September 15, 2014

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14-28

Dear Ms. Dortch,

The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School respectfully submits these reply comments and attached documents in the above-referenced docket.[1]

* * * * *

A Common Sense Understanding of the Net Neutrality Debate[2]

The Internet is many things – a borderless communications network unlike anything the world has ever seen; an unmatched enabler of innovation; a mighty leveler of playing fields between users of all kinds; a transformative tool for individuals and businesses – but it is not, despite the assertions of many, Utopia or a utopian medium. A diverse group of advocates, academics, and corporations, many of whom have commented in the instant proceeding, have long attempted to frame the Internet in just this way – as something more than just a "network of networks." For them and many others, the Internet is the digital realization of some undefinable, transcendent quality that has long been impossible in the analog world. But while the Internet has helped to facilitate innumerable positive outcomes for millions, if not billions, of users worldwide, it has

[1] The ACLP is an interdisciplinary program that focuses on identifying and analyzing key legal, regulatory, and public policy issues impacting stakeholders throughout the advanced communications market. For more information, please visit the ACLP's website.

[2] The following discussion builds upon analyses included in the attached documents. Reference to specific resources will be made in the foundational principles section.

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done so not as an untarnished Eden, but as perhaps the most efficient – and potent – commercial vehicle in the history of the world. Indeed, for as much good as the Internet indisputably helps to accomplish – by enabling better healthcare and educational services; by improving the lives of vulnerable and at-risk users; by enhancing public engagement with government – it also generates significant economic opportunities and financial returns for every entity (from device manufacturers to content providers to network owners and others) involved in facilitating and shaping the online experience.

This might seem like a crass (yet obvious) point to make, but it is an incontrovertible truth of the Internet, and a basic tenet that seems to have gotten lost in the long debate over net neutrality. Moreover, it is a simple observation that, we respectfully submit, ought to be reflected in and respected by whatever rules that might emerge from the instant proceeding. Acknowledging this fundamental dynamic, and ensuring that any new rules further rather than impede it, will yield a regulatory framework that is grounded in reality, not the apocalyptic what-ifs of doomsayers or the collectivist yearnings of some intellectuals and technology elitists.

E-Commerce is American Commerce

A leading argument in favor of far-reaching rules that has been made by many in this docket is that, in the absence of a framework that can preserve idealistic notions of the Internet and network neutrality, innovation at the edge of the Internet will cease (i.e., the "next Google" or "next Facebook" will never emerge). Though a seemingly powerful argument, it nevertheless overlooks certain basic truths about how commerce – of the digital and analog kind – works in the United States. It also omits the fact that the vast majority of major Internet firms in the U.S. – content firms, hardware manufacturers, ISPs, etc. – emerged in a market that lacked enforceable network neutrality rules.

Those who argue for a rigid regulatory regime oftentimes have powerful incentives to keep their costs as low as possible. Major online firms seek to gain market share by offering free services – be it a search product, a social media platform, or a streaming media site. These firms are able to provide "free" services by (1) keeping their operating costs low (many edge firms employ only a few dozen employees) and (2) offsetting costs and generating profits by monetizing the personal data that stem from customers' use of their service. Advocating for a framework that eliminates the ability of partner firms to impose new or added costs is certainly a rational response by any entity that seeks to make a profit and remain competitive, yet it is a perspective that is rarely voiced by those arguing in favor of robust net neutrality rules.

Another strain of argument seeks to further idealized notions of fairness and "fair play" by noting that the absence of broad network neutrality rules would make it possible for larger content firms to carve out special deals with ISPs or other entities, which would in turn provide them with a competitive advantage over other, smaller firms (e.g., by paying for priority delivery to end-users). The implication here is that smaller firms – e.g., the new start-up that might unseat Netflix – would find it extremely difficult, if not impossible, to get started and forge a viable position in the market. But for anybody who has ever tried to launch a small business, be it a

lemonade stand or a restaurant, this has long been the reality of doing business in a market-based economy. Owing to the fact that few business operate in isolation, in *every* market, analog and digital, larger, more established companies have many advantages over smaller firms, especially when it comes to leveraging relationships with partners. Indeed, larger firms can and do leverage their scale to realize a range of benefits, including the ability to easily acquire volume discounts or priority service with any number of vendors. For example, a small retailer will likely have to pay significantly higher postage rates on a per package basis than Amazon. A mom-and-pop eatery may have higher food costs than chain restaurants. A solo practitioner (e.g., a doctor or a lawyer) may have much higher per capita overhead costs than those who are part of a larger network of service providers.

The result of this dynamic – in both the real world and the online world – has not been the death of innovation, but rather the blossoming of competition among firms of all sizes. Indeed, a unique characteristic of American capitalism is that it not only tolerates but encourages and thrives on the development of niche markets and niche service providers. So long as there is sufficient demand on the consumer side and rational business models on the retail side, companies of nearly every size can coexist in a particular market segment. The mom-and-pop restaurant can compete with McDonald's on a range of factors – higher quality meals, lower prices, being a local business, etc. – and if the local eatery thrives, there is nothing stopping it from growing larger, a dynamic that has catapulted many small companies (including McDonald's) into becoming regional, national, and international conglomerates.

Success in any business is never a given. Such indifference and viciousness is another critical characteristic of American commerce. Anybody can launch a business so long as they possess the requisite resources and have the will to compete. Established competitors will try to snuff out new entrants by engaging in any number of legal business practices, all in the spirit of preserving their standing in the eyes of consumers. Those that fail will see their businesses suffer. Some will go bankrupt or close up shop. Some might respond and compete more vigorously. That the outcome is not preordained and that there are many paths that can lead to success or failure is essential to our economy. Indeed, this cycle of business creation and destruction evokes a spirit of enterprise, creativity, and competitiveness that has long defined commerce in this country.

This same dynamic has long prevailed online. Content companies like Google, Netflix, and Facebook; device manufacturers like Apple; and ISPs like AT&T and Comcast have all benefited immensely from their pursuit of scale. They have sought every kind of advantage over would-be rivals and have become market leaders as a result. Yet when they began competing in their relevant market, they were not assured dominance or even the ability to generate a profit. Their success was never guaranteed. Indeed, in the dustbin of Internet history, there are many firms that tried, and failed, to unseat these firms, or that were unseated by them. Those that have survived have done so because of their ability to continue experimenting and tweaking their services and business models. They have never stood still because to do so would be to invite competitors to speed past them. And as in any American market, no position is safe. New challenges are always possible because the gateway to the market is open to anyone with capital to invest and expertise to apply. Indeed, such ubiquity of opportunity, coupled with targeted rules

(e.g., antitrust laws) and flexible regulatory frameworks, has ensured that the U.S. economy is not dominated by monopolists. Rather, most sectors, including many throughout the broadband ecosystem, are characterized by a relatively large number of firms – some big, some small, some new and some old – that fuel competition and push the market toward efficient outcomes.

Learning About the Open Internet from Consumers

From a consumer perspective, this ongoing cycle has yielded a rich array of choices for going online and participating in the emergent ecosystem of content, devices, and networks. Looking back over the last 14 years provides essential perspective regarding the many benefits that have flowed, and continue to flow, from the Internet business cycle. Whereas wireline broadband and mobile data services were in their infancy at the turn of the 21st century, today consumers in nearly every part of the country have multiple options for going online via a high-speed connection. Such robust capacity has prodded a growing universe of firms to develop cutting-edge content and devices in an effort to meet consumer demand for more immersive, relevant, and real-time digital services. Although some firms attempt to mask their real motives, the primary driving force behind these many gains has been a desire to grow market share, increase revenues, and generate returns for investors, a vital dynamic that provides companies with the ability to continue investing in new services and fanning consumer demand.

Consumers also tolerate and benefit from many business practices that some in this proceeding argue are anti-consumer. A leading example here is the idea of prioritization, a notion that rankles many because it seems inherently contradictory to the ethos of the Internet. Much like in the real world, the online experience has long been a managed one. Content is curated and filtered by algorithms carefully developed by firms seeking to provide end-users with better services (e.g., more relevant search results) and to support business models built around such highly targeted content (e.g., ads for products that reflect a user's online habits and preferences). Customers generally appreciate these kinds of services (privacy concerns aside) because it echoes long-standing practices that support a range of services at different prices. For example, those who wish to skip airport security lines can do so for a fee via TSA Pre. Those who wish to receive a package faster from a retailer can pay more for overnight shipping. Online, freemium models have thrived. These provide free access for all consumers, while also allowing more active users to purchase premium add-on services. Similarly, tiered pricing packages for broadband service are also popular, allowing users of all kinds to purchase plans that meet their distinct needs (e.g., high bandwidth plans for gamers).

From a social policy perspective, support for prioritized services of both the analog and digital variety makes practical sense. Consumers have a high tolerance for these kinds of outcomes, reflecting an acknowledgement of a simple fact: certain things are more important than others. In other words, not every good or service is equal. For example, drivers who are snarled in gridlock nevertheless tolerate giving ambulances prioritized access through traffic during emergencies. Similarly, in the aftermath of major natural disasters, residents of impacted areas tend to support emergency response efforts that prioritize critical institutions over other needs (e.g., prioritizing efforts to restore electricity to hospitals over households). As such, there is no reason why firms

should be prevented from engaging in this type of behavior online. *Although some might be loath to admit it, not all Internet content has the same social value.* The brief history of the Internet teaches that, regardless of how much capacity might be available, there will always be some level of congestion. Accordingly, there is significant evidence to support allowing firms to prioritize certain kinds of socially important content (e.g., a telemedicine application) over others (e.g., streaming a movie) if the conditions warrant such an outcome.

Foundational Principles to Guide the FCC's Efforts

As the Commission moves forward with formalizing rules in this proceeding, the undersigned respectfully offer the following foundational principles to guide its efforts.[3]

1. **The regulatory framework that has prevailed in this space for the last decade has yielded enormous consumer welfare gains and produced an intensely competitive, vibrantly innovative, and closely interconnected ecosystem.** There is ample data to suggest a causal relationship between the minimalist regulatory framework for broadband and the many consumer welfare gains evident throughout this space.[4] As such, the Commission must demonstrate, with clear and convincing evidence and objective data, that its proposed rules are in fact necessary to address actual harms.[5]

2. **The Internet is an extension of American commerce.** As discussed at length above, the Internet, despite assertions to the contrary, is primarily an engine for business creation and economic growth. However, some commenters in this proceeding have sought to disguise the financial interests of certain firms beneath a veneer of platitudes describing idyllic aspects of the Internet. Accordingly, the Commission should avoid crafting rules that, intentionally or unintentionally, favor one set of firms or another, or that have the practical impact of limiting particular kinds of business models.[6] Incorporating notions of regulatory parity and competitive neutrality into the rules would provide much-needed certainty to firms competing in this space and support continued investment in networks, services, and devices of all kinds.[7] A core feature of this approach would be crafting rules that recognize and reflect key technical differences between wireline and wireless networks.[8]

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[3] These principles stem from the preceding analysis and the array of documents that are attached to these comments, an overview of which is included at the end of this letter. We respectfully request that the Commission review the attached documents in their entirety in order to ensure that they are read and understood in proper context.

[4] Please see Attachments #2, 5, 6, 8, 9, 10, 11, and 12.

[5] Please see Attachments #1, 3, and 5.

[6] Please see Attachments #1, 3, and 5.

[7] Please see Attachments #2, 4, 6, 8, 9, 10, and 11.

[8] For an in-depth discussion, please see Attachment #4.

3. **Consumers are generally accepting of the very business practices that the Commission is seeking to nullify or modify in this proceeding.** Because the Internet is just another means of buying goods and consuming services, consumers are generally accepting of business practices and commercial notions – like prioritization, tiered service, having "cost-causers" pay their own way, etc. – that the Commission has labeled as troubling in the instant proceeding.[9] Rather than undermine consumer choice, the Commission should craft rules that encourage unfettered experimentation with service delivery. Moreover, the Commission should avoid using the relatively large number of commenters in this proceeding as cover for implementing far-reaching and aggressive net neutrality rules (i.e., those built on Title II). Though impressive, the large number of commenters in this proceeding evidences only enthusiastic participation by a highly engaged but tiny minority of Internet users and Americans.

4. **Not all online content is created equal from a social welfare perspective.** As discussed above, there is a compelling case to be made for prioritizing certain kinds of socially valuable content over others during times of network congestion. Similarly, there appears to be at least some support for a related notion – customers should be free to choose to have particular Internet services delivered in a prioritized manner. These notions were discussed at length and endorsed in a joint filing to the FCC by an *ad hoc* coalition of some two dozen stakeholders – doctors working with telemedicine; elected officials; state regulators; disabilities advocates; and digital literacy experts working with senior citizens – that was submitted in April 2010, and remain relevant in the instant proceeding.[10]

5. **Regulatory restraint will yield the strongest and most enduring set of open Internet rules.** In the instant proceeding, the Commission has explored two distinct paths for implementing legally enforceable rules. The first path revolves around a broad reading of section 706 of the Telecommunications Act of 1996; the second would necessitate reclassifying broadband as a public utility service subject to common carrier regulation under Title II of the Communications Act. As discussed at length in several of the attachments, the Title II path is both untenable from a legal perspective and troubling from a policy perspective.[11] Consequently, of the two options, the one based on section 706 is far preferable. But even that approach raises some tough questions with regard to the scope of Commission authority over broadband and broadband-enabled services.[12] As such, the FCC should exercise regulatory restraint when building open Internet rules around section 706. In particular, the Commission should be humble in its application of this provision by acknowledging that it does not, in fact, possess unfettered regulatory

[9] Please see Attachments #2 and 12.

[10] Please see Attachment #7.

[11] Please see attachments #1, 2, 3, and 5.

[12] Please see Attachments #1, 3 and 5.

> authority over the broadband ecosystem and by imposing limits on the reach of its perceived authority.[13]

Taken together, these principles, the preceding analysis, and the attached materials underscore the profound importance of assuring sufficient regulatory certainty in whatever outcome might result from the instant proceeding. Moreover, these resources echo critical findings and arguments included in an array of filings in this proceeding, namely that the U.S. broadband ecosystem has thrived under a specific kind of regulatory framework, one that is minimalist in nature and flexible enough to accommodate the breakneck pace of business model experimentation and technological innovation that has come to characterize this critical segment of the country's economy. Accordingly, the FCC has a duty to ensure that any rules that might emerge from this proceeding do not unduly disrupt the organic market forces that have shaped, and continue to shape, this vital sector and that have long undergirded American commerce.

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The undersigned appreciate the opportunity to contribute to this discussion and look forward to working with the Commission and other stakeholders on these vital issues going forward.

Respectfully submitted,

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/s/ Michael J. Santorelli
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Submitted: September 15, 2014

[13] Please see Attachments #1 and 3.

OVERVIEW OF ATTACHMENTS

Attachment #	Description
1	*ACLP Comments to House Commerce Committee in Response to White Paper re Competition Policy* (June 2014)
2	*Understanding the Debate Over Government-Owned Broadband Networks: Context, Lessons Learned, and a Way Forward for Policymakers*, ACLP Report (June 2014)
3	*ACLP Comments to House Commerce Committee in Response to White Paper re Modernizing the Communications Act* (Jan. 2014)
4	*Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century*, CommLaw Conspectus (Dec. 2010)
5	*Net Neutrality, Investment & Jobs: Assessing the Potential Impacts of the FCC's Proposed Net Neutrality Rules on the Broadband Ecosystem*, ACLP Report (June 2010)
6	*The Impact of Broadband on Education*, ACLP Report to the U.S. Chamber of Commerce (Dec. 2010)
7	*ACLP Joint Filing to the FCC re "Preserving the Open Internet,"* GN Docket No. 09-191 (April 26, 2010)
8	*The Impact of Broadband on People with Disabilities*, ACLP Report to the U.S. Chamber of Commerce (Dec. 2009)
9	*The Impact of Broadband on Telemedicine*, ACLP Report to the U.S. Chamber of Commerce (April 2009)
10	*The Impact of Broadband on Senior Citizens*, ACLP Report to the U.S. Chamber of Commerce (Dec. 2008)
11	*Network Effects: An Introduction to Broadband Technology & Regulation*, ACLP Report to the U.S. Chamber of Commerce (Dec. 2008)
12	*ACLP Filing to the FCC re "Broadband Industry Practices,"* WC Docket No. 07-52 (Feb. 27, 2008)

Attachment #1

June 13, 2014

The Honorable Fred Upton
2183 Rayburn House Office Building
Washington, DC 20515

The Honorable Greg Walden
2182 Rayburn House Office Building
Washington, DC 20515

Re: Competition Policy and the Role of the Federal Communications Commission – Response to White Paper #3

Dear Chairman Upton and Chairman Walden,

The Advanced Communications Law & Policy Institute (ACLP) at New York Law School respectfully submits the following comments in response to the Committee's white paper titled, "Competition Policy and the Role of the Federal Communications Commission." We appreciate the opportunity to make this submission and commend the Committee for continuing forward with its inquiry into updating the nation's telecommunications laws.

Should you or your staff have any questions, please do not hesitate to contact us.

Respectfully submitted,

/s/ Charles M. Davidson
CHARLES M. DAVIDSON, DIRECTOR

/s/ Michael J. Santorelli
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To: The Honorable Chairman Upton and the Honorable Chairman Walden, Energy & Commerce Committee, U.S. House of Representatives

From: Charles M. Davidson & Michael J. Santorelli, ACLP at New York Law School

Re: Foundational Principles for Modernizing Competition Policy and Recalibrating the Role of the Federal Communications Commission

Date: June 13, 2014

The House Energy & Commerce Committee is to be commended for its continuing efforts to update the nation's communications laws. The present inquiry is critical to these efforts. As the white paper correctly notes, "regulatory policy should reflect the competitive conditions of the market it is addressing."[1] An important corollary to this maxim is that regulation is best seen as a last resort for bolstering underperforming markets. In other words, where competition is healthy and viable, regulation should be minimized. Creating the parameters for objectively determining whether competition exists is at the heart of U.S. competition policy. As discussed in more detail below, there is ample opportunity, and increasing need, for Congress to (a) reformulate the parameters of competition policy and analysis in the communications space and (b) recast the role of the FCC vis-à-vis implementing new policy imperatives – all in an effort to better align the regulatory apparatus with the realities of the emergent and vibrantly competitive broadband ecosystem.

To these ends, we respectfully submit the following set of foundational principles, which we hope will inform the Committee's efforts:

1. To better inform efforts around modernizing competition policy and recalibrating the FCC's role, Congress should embrace an expansive, non-silo view of the relevant marketplace to which new policies will be applied. (p. 2)

2. Reform efforts should be informed by the successes of minimalist regulatory policies in the modern communications space. (p. 5)

3. Precision in relevant federal statutes is essential to clearly articulating goals for new competition policies and analytical frameworks and for minimizing unintended consequences like regulatory creep or broad interpretations of vague grants of authority. (p. 10)

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[1] *See Competition Policy and the Role of the Federal Communications Commission*, at 2, May 19, 2014, Energy & Commerce Committee, U.S. House of Representatives, *available at* http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/20140519WhitePaper-Competition.pdf ("*Competition Policy White Paper*").

4. Congress should make clear that modern competition policy, and the oversight and enforcement that might stem from it, will be driven by objective data and analytical frameworks. (p. 12)

5. In order to make the regulatory process more efficient and responsive to market developments, Congress should provide clearer delegations of authority to all relevant regulatory entities in this space, recalibrate roles around these entities' core competencies, eliminate overlapping authority, and experiment with alternative regulatory approaches. (p. 15)

Each principle is expanded upon below.

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PRINCIPLE #1

To better inform efforts around modernizing competition policy and recalibrating the FCC's role, Congress should embrace an expansive, non-silo view of the relevant marketplace to which new policies will be applied.

The white paper accurately notes that, "[b]y dividing the overall regulatory scheme into separate titles based on specific network technologies and services, the Communications Act fails to contemplate or address the convergence and evolution of services in the modern digital era and the impact on the state of competition in the communications ecosystem."[2] Consequently, a critical first step toward modernizing competition policy will be to adopt a more modern view of the market to which new laws and policies might be applied.

A similar effort was undertaken in the late 1990s and early 2000s, when commercial broadband services were gaining in popularity and when federal regulators were considering how to shape new regulatory frameworks. The schematic that emerged was a "layered" model for the Internet.[3] This model was developed in reaction to widespread acknowledgement that the horizontal "siloes" around which communications law and regulatory policy had been developed was no longer applicable to a service that defied such easy categorization.[4] In the context of modernizing communications regulation, the

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[2] *Id.* at 2.

[3] *See, e.g.*, Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. Telecomm. & High Tech. L. 37 (2002) (summarizing the evolution and contours of this model) ("*Layered Model for Internet Policy*"); LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD 23-25 (2002) (same) ("FUTURE OF IDEAS").

[4] Although the general notion of discrete layers in the delivery of Internet services was evident for years, many attribute its application in the Internet regulation context to Yochai Benkler. *See* Yochai Benkler, *From*

primary virtue of the layered model was that it separated the various vertical components of Internet service – physical or transport layer; logical layer; services layer; content layer – into discrete elements, which was framed as an optimal way for identifying those aspects that were amenable to formal regulation.[5] To that end, the layered model isolated the physical layer as the one in which regulation was thought most essential in order to preserve certain transport ideals (*i.e.*, those that undergird modern calls for network neutrality rules).[6]

Although a step in the right direction, the "layered" model has become outdated and unworkable because of the rigidities inherent in its hierarchy and its inability to contemplate a blurring of the bright lines that separate the components of the broadband user experience. As such, the continued use of this model as a touchstone for recalibrating competition policy, revisiting FCC jurisdiction, and engaging in regulatory decision-making is problematic for several reasons.[7] First and foremost, the market conditions that initially informed the "layered" model have shifted profoundly over the last decade. At the time of its development, there was much uncertainty about the extent to which new broadband platforms – *i.e.*, DSL and cable – would be capable of sustaining notions of "openness," owing largely to disparate regulatory regimes and the potential for ISPs to exert "control" over other layers.[8] Over time, however, intermodal competition among an array of firms and platforms has emerged, challenging these core notions.[9]

In addition, the ideological underpinnings of the layered model supported the development of an asymmetric regulatory model in the modern broadband space.[10] Indeed, the primary

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Consumers to Users: Shifting the Deeper Structures of Regulation, 52 Fed. Comm. L. J. 561 (2000) ("*From Consumers to Users*").

[5] *Layered Model for Internet Policy* at 57-59 (identifying these four layers). The "right" number of layers has ranged from three to as many as seven. *See*, *e.g.*, FUTURE OF IDEAS at 25, n. 13 (identifying three layers and citing to four and seven layer models); Yochai Benkler, *From Consumers to Users: Shifting the Deeper Structures of Regulation*, 52 Fed. Comm. L. J. 561 (2000) (identifying three layers).

[6] *See*, *e.g.*, *Layered Model for Internet Policy* at 60 ("A vertically-layered communications policy would focus on these issues as they apply to all physical infra- structures, starting with the concept that where a physical network owner has market power, regulation may be the only way to ensure an open platform that fosters the beneficial dynamics of competitive markets.").

[7] The layered model has been the subject of much debate. *See*, *e.g.*, Douglas C. Sicker & Lisa Blumensaadt, *Misunderstanding the Layered Model(s)*, 4 J. Telecomm. & High Tech. L. 299, 300, n. 1 (2006) (collecting citations to critiques and counter-proposals).

[8] FUTURE OF IDEAS at 25.

[9] *See*, *e.g.*, Charles M. Davidson & Michael J. Santorelli, *Response to Congressional White Paper #1*, at 3-6, ACLP at New York Law School (Jan. 31, 2014), *available at* http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/WP1_Responses_1-20.pdf (providing relevant data and analysis). *See also* Daniel F. Suplber & Christopher S. Yoo, *Rethinking Broadband Internet Access*, 22 Harv. J. L. & Tech. 1 (2008) (discussing this evolution and its policy implications).

[10] *Cf.* Lawrence B. Solum & Minn Chung, *The Layers Principle: Internet Architecture and the Law*, 79 Notre Dame L. Rev. 815, 866-868 (2004) (arguing that the "layers principle is grounded on arguments that transcend particular ideologies and interests.").

focus of the regulatory responses emanating from this model was trained from the beginning on the physical/transport layer, *i.e.*, Internet access services provided by ISPs.[11] Consequently, this particular element of the broadband user experience has long been framed as a conduit for passively channeling content; efforts to undermine this ideal (*e.g.*, via network management) were seen as presumptively contrary to the ideals underlying the layered model.[12] The result has been a very narrow focus on regulating ISPs, which means that this "layer" is the only one potentially subject to any type of active regulation.[13] Conversely, while firms in other "layers," like content and device firms, are subject to a number of legal regimes – including relevant intellectual property, antitrust, and general consumer protection laws – these generally operate in an *ex post* manner; potential new rules for ISPs would be *ex ante* and "prophylactic" in nature.[14] Some have argued that such a myopic focus on ISPs has encouraged conduct in other segments of the market that has actually undermined consumer welfare.[15]

In light of new market contours, it is respectfully submitted that policy should no longer be informed, explicitly or implicitly, by the antiquated "layered" model of the Internet.[16] As the asymmetry of regulatory outcomes that flowed from this particular model demonstrates, metaphors matter in communications policymaking. Accordingly, policymakers should embrace more expansive and inclusive conceptions of the modern marketplace in order to reflect the realities of the user experience and not theoretical notions of Internet architecture. Such an approach could yield a more neutral approach to regulation, one that applies evenly to firms across the space regardless of what layer they might operate on or segment of the market in which they compete. Ultimately, such a model is essential in recognition of continued technological convergence and the many efforts by firms to compete across sectors.

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[11] *See, e.g.*, Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 Minn. L. Rev. 917, 1005 (2005) (noting that "As the structure of [the layered] model implies, the physical and logical infrastructure are the foundational layers upon which the Internet environment we experience has been built."

[12] *See, e.g.*, YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 393 (2006) (discussing the need for a "core common infrastructure" to preserve the "networked information economy.").

[13] *See, e.g.*, *In the Matter of Protecting and Promoting the Open Internet*, Notice of Proposed Rulemaking, para. 6-10, GN Docket No. 14-28, FCC 14-61 (May 15, 2014) (explaining how ISPs have a variety of economic incentives for limiting Internet openness) ("*Protecting and Promoting the Open Internet*"). *But see Verizon v. FCC*, 740 F.3d 623 (D.C. Cir. 2014) (suggesting that a provision of the Communications Act – section 706 – could be used to regulate other firms in the ecosystem).

[14] *Protecting and Promoting the Open Internet.*

[15] *See, e.g.*, Christopher S. Yoo, *Protocol Layering and Internet Policy*, 161 U. Pa. L. Rev. 1707, 1752-1755 (2013).

[16] Although the FCC rarely cites specifically to the layered model, its general framework has informed many of the recent efforts around network neutrality regulation, especially vis-à-vis the Commission's reluctance to extend regulation to non-ISPs. *See generally Protecting and Promoting the Open Internet.*

The "ecosystem" concept that has been in vogue in recent years offers a useful starting point for developing this new model.[17] "Ecosystem" connotes intimate interconnectivity among the full array of players in a given space. Positive and negative events in one sub-segment reverberate throughout the entire ecosystem. This inverts the hierarchical nature of the layered model and eschews subjective norms about Internet architecture and presumptions about certain kinds of behaviors by firms based on their place in the hierarchy, all of which supports more holistic assessments of real, as opposed to theoretical, outcomes in the marketplace. Embracing this type of mindset would thus orient competition policy and resulting regulatory actions around *actual* harmful practices regardless of the segment in which they occur.

PRINCIPLE #2

Reform efforts should be informed by the successes of minimalist regulatory policies in the modern communications space.

Reforming competition policy in the advanced communications arena should embrace and further principles of regulatory minimalism, a bipartisan approach that has played a critically important role in supporting robust competition and innovation throughout the modern broadband space. The following provides a brief overview of: (1) the evolution of this light-touch approach; (2) its impact on the communications market; and (3) its viability going forward.

Evolution. The development and implementation of minimalist regulatory policies in the communications space had its genesis in the responses of federal policymakers to the emergence of an array of new telecommunications and computing technologies in the 1960s and 1970s. Over the course of the following decades, continued innovation and competition in the provision of long-distance and data computing services, along with the rise of new communications platforms like mobile telephony and high-speed Internet access, made clear that fresh regulatory approaches were needed to foster growth in these nascent markets.[18] The contours of this new framework encompassed more than just a

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[17] The FCC popularized this concept in its National Broadband Plan. More specifically, it observed:

> Networks, devices and applications drive each other in a virtuous cycle. If networks are fast, reliable and widely available, companies produce more powerful, more capable devices to connect to those networks. These devices, in turn, encourage innovators and entrepreneurs to develop exciting applications and content. These new applications draw interest among end users, bring new users online and increase use among those who already subscribe to broadband services. This growth in the broadband ecosystem reinforces the cycle, encouraging service providers to boost the speed, functionality and reach of their networks.

See Connecting America: The National Broadband Plan, at 15-16, FCC (2010).

[18] These efforts dovetailed with broader efforts by policymakers to reassess traditional regulatory approaches in sectors like the trucking, airline, and railroad industries, which were undertaken in an effort to introduce competition into what some observed to be a stagnant U.S. economy. *See, e.g.*, PAUL A. LONDON, THE COMPETITION SOLUTION 78-81 (AEI Press 2005) (explaining that "after [World War II] ended people began to complain that limits on competition involved a lot of red tape and some obvious waste. By the 1960s, the idea began to take root…that cheaper and better service might be available if regulation could be streamlined and, perhaps in some areas, replaced by competition").

"hands off" approach to emerging services – they also highlighted a clear policy choice by policymakers to begin shifting away from the rigidities of the common carrier regulatory model for communications services.

In the first half of the 20th century, policymakers were more likely to defer to the monopoly provider of telephone service and maintain barriers to entry in an effort to preserve the market structure that undergirded the common carriage approach to universal telephony.[19] However, beginning in the 1950s, policymakers acknowledged that competition was possible in certain segments of the communications market.[20] Over time, this became increasingly evident as start-up firms worked to circumvent the monopoly market for basic telephony by harnessing new technologies and new methods for delivering familiar services.[21] Consequently, regulators in the latter part of the 20th century realized that it was increasingly futile and contrary to the interests of consumers to keep new entrants out.[22] Thus, Congress, the FCC, and other federal policymakers worked on two fronts to promote even the faintest signs of competition in the provision of long-distance service and data processing via communications networks: they began the complex process of divesting the AT&T monopoly, while on a parallel track they developed new, more minimalist regulatory approaches for competitive services.[23]

Although the FCC, via its Computer Inquiries, demonstrated an ability to think beyond the strictures of common carriage for communications services, the conditions that resulted in a full embrace of regulatory minimalism are best seen in how Congress and the FCC reacted to the rise of new platforms in the 1990s and early 2000s. In general, the regulatory paradigm for these and other competitive new services has tended to move quickly from a modified version of common carriage (or some other historical model that tended to be more maximalist in nature) to a more minimalist approach. Two examples from the recent past illustrate how this paradigm evolved and how it has succeeded in fostering the growth of cross-platform competition.

First, in the context of mobile communications services, the FCC had initially taken a very hands-on approach to apportioning spectrum and otherwise guiding early development of the wireless marketplace.[24] Similarly, a number of state utility commissions extended, as a

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[19] *See, e.g.*, Harry M. Trebing, *Common Carrier Regulation – The Silent Crisis*, 34 Law & Contemporary Problems 299 (1969) (discussing efforts by firms like MCI to enter protected markets like long-distance) ("*Common Carrier Regulation – The Silent Crisis*").

[20] *See, e.g.*, GERALD W. BROCK, THE SECOND INFORMATION REVOLUTION (2003) (providing an overview of technological advancements made in the middle part of the 20th century).

[21] *Common Carrier Regulation – The Silent Crisis*.

[22] *Id.*

[23] *See, e.g.*, Charles M. Davidson & Michael J. Santorelli, *Federalism in Transition: Recalibrating the Federal-State Regulatory Balance for an All-IP World*, 29 Berkeley Tech. L. J. (forthcoming, summer 2014) ("*Federalism in Transition*").

[24] Charles M. Davidson & Michael J. Santorelli, *Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century*, 19 CommLaw Conspectus 1, 29-31 (2011) (discussing this early "command and control" approach) ("*Seizing the Mobile Moment*").

matter of course, common carrier rules to new wireless telephone service providers, reasoning that intrastate voice communications of any kind naturally fell within their regulatory ambit.[25] However, once it became evident that these new services were viable – both from a technological and a consumer standpoint – and that the piecemeal state-federal approach to regulating the service, a hallmark of the traditional regulatory model for basic telephony, was harmful to continued growth, a bipartisan Congress in the early 1990s acted to clarify what the framework should look like. This entailed the development of a national model that freed service providers from the "dual . . . regulatory jurisdictional system designed to regulate the monopol[istic]" telephone industry.[26] Many aspects of state regulatory authority over wireless were significantly curtailed by the resulting federal statute.[27] Congress's explicit embrace of regulatory minimalism, coupled with concomitant changes to federal spectrum allocation policy, provided carriers with substantial regulatory certainty and facilitated the rapid deployment of competitive nationwide wireless services.[28]

Second, in the context of high-speed Internet access services, the initial regulatory response tilted towards maximalism for certain providers. More specifically, when offered by incumbent telephone companies, high-speed Internet access like DSL fell under the regulatory regime for data services that grew out of the Computer Inquiries, which required these providers to make available the underlying basic transmission component on a nondiscriminatory basis to competitors.[29] However, firms operating outside the common carrier market for telephony – notably cable companies – were not subject to these rules for their cable modem service.[30] Such a bifurcated regulatory approach raised concerns among some, who argued that, in the absence of uniform maximalist policies, cable companies and other firms not subject to strictures like "open access" rules would be free to "impose whatever conditions they desire[d] on their customers" and exert too much control over the content flowing through their networks.[31] Others, however, voiced

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[25] *See, e.g.*, Babette E.L. Boliek, *Wireless Net Neutrality Regulation and the Problem with Pricing: An Empirical, Cautionary Tale*, 16 Mich. Telecomm. & Tech. L. Rev. 1, 28–32 (2010) ("[T]wenty-nine states had not banned regulation, either by law or by de facto bans on [wireless] regulation promulgated by their public utility commissions").

[26] *See* Leonard J. Kennedy & Heather A. Purcell, *Section 332 of the Communications Act of 1934: A Federal Framework That is "Hog Tight, Horse High, and Bull Strong,"* 50 Fed. Comm. L.J. 547, 550 (1998).

[27] According to the statute, "no State or local government shall have any authority to regulate the entry of or the rates charged by any commercial mobile service or any private mobile service, except that this paragraph shall not prohibit a State from regulating the other terms and conditions of commercial mobile services." *See Omnibus Budget Reconciliation Act of 1993*, Pub. L. No. 103-66, § 6002(b), 107 Stat. 312, 392, 394 (codified in relevant part at 47 U.S.C. § 332(c)(3)(A) (20012)).

[28] *Seizing the Mobile Moment* at 31–40.

[29] *See, e.g.*, James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms*, 17 Yale J. on Reg. 40, 61-69 (2000) (discussing the regulatory treatment of these access services).

[30] *Id.*

[31] *See* Mark A. Lemley and Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. Rev. 925, 927 (2001) ("*End of End-to-End*").

concerns around the need for achieving regulatory parity and fostering a competitive environment in what was at that time a rapidly growing market.[32]

Regulators were thus presented with a clear policy choice: impose maximalist "open access" requirements on all broadband providers in an effort to assure parity that mirrored common carrier regulation, or implement minimalist policies along the lines of those first espoused decades prior when the FCC acknowledged that certain "enhanced" services required such an approach. The FCC ultimately opted for the latter approach, and between 2002 and 2007, it developed and successfully defended in court a minimalist light-touch regulatory framework for every type of broadband Internet access service.[33]

Impact. The impact of regulatory minimalism on advanced communications services, including mobile communications services, broadband, and IP-enabled services like VoIP, has been remarkable. As has been documented extensively elsewhere, there is significant evidence to demonstrate a causal relationship between the implementation of a deregulatory model in each of these segments and increases in investment, competition, and innovation.[34]

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[32] *See, e.g.*, William Kennard, Chairman, FCC, *Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at IX-2 (1999), *available at* http://www.fcc.gov/connectglobe/regguide.pdf (observing that "Government policy can have a profound impact on Internet development; it can either foster it or hinder it. To date, the Internet has flourished in large part due to the absence of regulation. A "hands-off" approach allows the Internet to develop free from the burdens of traditional regulatory mechanisms."); Michael K. Powell, Chairman, FCC, *The Great Digital Broadband Migration*, Remarks before the Progress & Freedom Foundation (Dec. 8, 2000), *available at* http://transition.fcc.gov/Speeches/Powell/2000/spmkp003.html ("Convergence is radically altering economic assumptions and underlying cost structures. It is changing the game of capital formation and altering business models. The culmination of these changes is what I am referring to by the Broadband Digital Migration. The challenge for us is to make a similar leap from analog-rooted regulations to ones that are applicable and relevant to the digital environment.").

[33] *See Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, 17 F.C.C.R 4798 (2002), *aff'd Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv.*, 545 U.S. 967 (2005); *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, 20 F.C.C.R. 14,853 (2005); *Classification of Broadband Over Power Line Internet Access Service as an Information Service*, 21 F.C.C.R. 13281 (2006); *In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, 22 F.C.C.R. 5901 (2007).

[34] *See, e.g.*, James Speta, *Deregulating Telecommunications in Internet Time*, 61 Wash. & Lee L. Rev. 1063, 1147 (2004) (assessing the pro-competitive impacts of preventing municipalities from entering communications markets); Thomas Hazlett et al., *Sending the Right Signals: Promoting Competition through Telecommunications Reform*, a Report to the U.S. Chamber of Commerce (Sept. 2004), *available at* http://www.uschamber.com/sites/default/files/reports/0410_telecommstudy.pdf (comparing and contrasting the regulatory frameworks for telephone and broadband services and finding that the exacting regulatory approach for the former would hinder, rather than advance, competition and innovation in the market for the latter) ("*Sending the Right Signals*"); Robert Crandall & Hal Singer, *The Economic Impact of Broadband Investment*, Broadband for America (Feb. 2010), *available at* http://www.broadbandforamerica.com/sites/default/themes/broadband/images/mail/broadbandforamerica_crandall_singer_final.docx (finding that "In a largely deregulatory climate, broadband penetration skyrocketed to nearly 65 percent penetration by the end of the decade as absolute and quality-adjusted prices fell, and first-generation technologies—cable modem, DSL, and 3G wireless—individually covered approximately 90 percent of all U.S. households and collectively covered even more." *Id.* at 1)

Another indicator of the success of regulatory minimalism in the broader communications space is the critical role that this framework has played in fostering the creation of an ecosystem of firms that spans discrete but related segments (*i.e.*, ISPs, content providers, device manufacturers). Unlike under common carriage, which for many years focused on preserving a narrow set of market conditions (*i.e.*, regulated monopolies) to the ultimate detriment of would-be competitors and collaborators, deregulation created the conditions under which such cross-sector partnerships have thrived. In short, the bright lines that once separated discrete segments of the communications space – and that were once enforced by maximalist rules – have begun to disappear as a result of regulatory minimalism. This dynamic is best illustrated by the rapid evolution of the modern wireless space.

Cross-sector partnerships in the wireless space have long existed (*e.g.*, between handset developers and service providers), but, for the most part, firms tended to focus mostly on competing within their immediate market.[35] Over the last few years, however, these lines have begun to blur, and are increasingly disappearing. The rapid rise of smartphones powered by operating systems that enable a universe of cutting-edge add-ons, the use of which can be monetized in numerous ways, along with the deployment of next-generation mobile broadband networks, which support faster and more reliable Internet connectivity, has fundamentally altered the nature of competition and innovation in what is now an interconnected ecosystem.[36] Numerous firms now compete across sectors for the attention – and dollars – of consumers as they seek to position themselves as the primary facilitator of the mobile experience.

This dynamic, which is evident throughout the broadband space, did not stem from a particular set of regulatory provisions, legal obligations or prescriptive competition policy. Rather, it evolved organically out of the conditions created and fostered by the minimalist approach to regulation enshrined by Congress in federal statutes and implemented by the FCC.[37] Those who argue in favor of a policy reversal and call for a return to more maximalist policies oftentimes fail to account for these kinds of positive spillovers from regulatory minimalism.[38] The practical result of such convergence is that effective policymaking in this space has by necessity become less insular than it once was under common carriage and the general "siloes" approach to regulation.

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[35] *See*, *e.g.*, Thomas Hazlett, *Modular Confines of Mobile Networks: Are iPhones iPhony?*, 19 Sup. Ct. Econ. Rev. 67 (2011) (providing an overview of how the ecosystem has developed).

[36] *See*, *e.g.*, Thomas Hazlett, David Teece and Leonard Waverman, *Walled Garden Rivalry: The Creation of Mobile Network Ecosystems*, George Mason University Law and Economics Research Paper Series 11-50 (Nov. 2011), *available at* http://www.law.gmu.edu/assets/files/publications/working_papers/1150WalledGardenRivalry.pdf.

[37] *See*, *e.g.*, *Seizing the Mobile Moment* (discussing this dynamic in the wireless space).

[38] Many make these arguments by asserting that broadband platforms should only be seen – and thus regulated – as vehicles for transporting information to and from end-users. This notion stems from early advocacy around the notion of a "stupid" network. *See*, *e.g.*, *End of End-to-End.*

Viability. Congress on several occasions over the last few decades has made clear that regulators should follow a minimalist path for new services like wireless and broadband. These actions recognize that the regulation of markets requires a delicate balancing act by policymakers since their actions send crucial signals to market participants. How stakeholders interpret these signals is principally impacted by the rationale underlying regulations, how those regulations are implemented, and whether the policies are consistently applied by regulators.[39] In the context of developing sustainable regulatory policies in the modern communications space, the many positive impacts of regulatory minimalism provide powerful evidence about the continued viability of this approach. More specifically, its inherent flexibility and adaptability has accommodated growth and innovation in ways that maximalism could never allow.[40] This augurs well for what many expect will be even more rapid and more disruptive change in the coming years.[41] As such, the minimalist model should inform any effort to modernize competition policy and otherwise reform the nation's communications laws.

PRINCIPLE #3

Precision in relevant federal statutes is essential to clearly articulating goals for new competition policies and analytical frameworks and for minimizing unintended consequences like regulatory creep or broad interpretations of vague grants of authority.

Legislative reform efforts should seek to be as precise as possible in new or revised statutory grants of authority in order to assure desired outcomes vis-à-vis the implementation of new competition policies and analytical frameworks. There are several

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[39] Shane Greenstein has noted that "private firms benefit from knowing how to anticipate the norms and standards employed by regulators to recognize the signs of health and unhealthy behavior in a situation that is changing so much [*i.e.*, the broadband ecosystem]." This interplay between innovator and regulator is essential to encouraging "innovative health." *See* Shane Greenstein, *Glimmers and Signs of Innovative Health in the Commercial Internet*, 8 J. on Telecomm. & High Tech. L. 25, 34 (2010).

[40] *See, e.g.*, LARRY DOWNES & PAUL NUNES, BIG BANG DISRUPTION: STRATEGY IN THE AGE OF DEVASTATING INNOVATION 72 (2014) ("…industries regulated as public utilities…must first obtain permission just to experiment with new technologies. They also need approval to pass the cost of research and development projects along to ratepayers…The degree of government oversight often translates to limits on the methods regulated industries employ to pursue disruptive innovation.") ("BIG BANG DISRUPTION"); Charles M. Davidson & Michael J. Santorelli, *Realizing the Smart Grid Imperative: A Framework for Enhancing Collaboration Between Energy Utilities and Broadband Service Providers* (2011), *available at* http://www.twcresearchprogram.com/pdf/TWC_Davidson.pdf (comparing and contrasting the capacity of firms to innovate in the heavily regulated utility sector with that of firms in the broadband space).

[41] *See, e.g.*, BIG BANG DISRUPTION (discussing major trends and noting the potential for profound disruption in many sectors via the use new and emerging technologies); ERIK BRYNJOLFSSON & ANDREW MCAFEE, THE SECOND MACHINE AGE: WORK, PROGRESS, AND PROSPERITY IN A TIME OF BRILLIANT TECHNOLOGIES (2014) (discussing how technology will likely disrupt nearly every facet of the economy). *See also* Howard A. Shelanski, *Adjusting Regulation to Competition: Toward a New Model for U.S. Telecommunications Policy*, 24 Yale J. on Reg. 55 (2007) (discussing the relative merits of minimalism in the context of accommodating growth in the broadband space).

possible routes for achieving such precision in the interpretation and implementation of new delegated authority while also providing sufficient flexibility and adaptability.

First, it is respectfully submitted that Congress should more precisely define the contours of FCC authority in this highly dynamic sector. Specificity in the statute, of course, does not automatically assure regulatory certainty (see, for example, the extended legal and regulatory battles that emerged in the aftermath of the 1996 Act, especially in the context of FCC implementation of Congressional mandates regarding telephone network access by competitive providers). Even so, precision in statutory grants of authority is increasingly essential in a highly dynamic marketplace because broad "catchall" provisions could eventually be used in ways that contravene Congressional intent. The recent kerfuffle over the legality of the FCC's network neutrality rules offers an illustrative example of how vague or seemingly innocuous provisions could blossom into broad regulatory power.

The Commission's latest attempt to justify imposition of network neutrality rules hinges on a broad reading of section 706 of the Telecommunications Act.[42] Although an appeals court vacated parts of an initial set of rules, it also interpreted section 706 as possibly authorizing nearly limitless authority by the FCC to regulate broadband services.[43] Key to this reading was a controversial determination by the FCC that broadband was not being deployed in a "reasonable and timely" manner.[44] According to the court, this conclusion is likely sufficient to support broad interventions into the marketplace, so long as those interventions constitute "immediate action to accelerate deployment of [broadband] capability."[45] Previously, the FCC had rarely invoked section 706 except as the basis for issuing reports on the deployment status of "advanced telecommunications services." The current interpretation – first advanced by the FCC and subsequently accepted by the appeals court – not only broadens significantly the prevailing understanding of the meaning of this provision, it is also contrary to well over a decade of regulatory restraint by an agency that, for many years, grounded its approach in what it interpreted as a clear call by Congress to exercise caution in the regulation of dynamic services.[46]

At a time when the courts are increasingly deferential to agency interpretations of the outer bounds of their jurisdiction,[47] precision in any Congressional grant of authority to an

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[42] A previous attempt by the FCC to implement similar rules was struck down by a federal court because the Commission failed to justify that the Communications Act granted it authority to carry out its proposed censure of a broadband service provider. *See Comcast v. FCC*, 600 F.3d 642 (D.C. Cir. 2010).

[43] *Verizon v. FCC.*

[44] *Id.*

[45] *Id.* (citing 47 U.S.C. § 1302 (b)).

[46] *See, e.g., Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, 17 FCC Rcd 4798 (2002), *aff'd Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv.*, 545 U.S. 967 (2005). *See also supra*, Principle #2.

[47] In *City of Arlington v. FCC*, 133 S. Ct. 1863 (2013), the Supreme Court held that courts should defer to an agency's interpretation of its own jurisdiction so long as that interpretation is reasonable. This adds to a long line of case law around judicial deference to agencies when interpreting their enabling statutes. The landmark case here was *Chevron v. Natural Resources Defense Council*, 467 U.S. 837 (1984).

entity, including the FCC, which operates in a sector undergoing constant creative destruction, is critical. To the extent possible, Congress should thus specify the FCC's reach on key issues like regulating broadband and IP-enabled services. As discussed above, an optimal path forward would be formalizing the regulatory framework that fostered such incredible growth in this space over the last decade.

Second, more precise and narrower statutory grants of authority should be supplemented with greater reliance on laws of general applicability (e.g., antitrust). A key component of this undertaking will be an examination of the efficacy of continuing to locate primary oversight authority for broadband and IP-enabled services at the FCC. Some have argued in favor of eliminating or sharply reducing FCC authority in this space and replacing it with antitrust enforcement by federal authorities like the FTC.[48] Others have called for systemic deregulation in light of current market forces and dynamics in the broadband ecosystem.[49] A middle ground approach would be to narrow FCC authority along the lines discussed above, focus it on core competencies like spectrum allocation,[50] and supplement it with laws of general applicability (*e.g.*, antitrust principles and consumer protection laws) that are enforced in appropriate venues (*e.g.*, the FTC).

Third, Congress should also explore the feasibility of using more sunset clauses in certain parts of a revised Communications Act. Doing so would encourage policymakers to reevaluate provisions on a rolling basis, providing them with built-in opportunities for amending policies to better reflect new market dynamics. Congress should also explore the efficacy of integrating "triggers" into new statutes in certain well-defined instances. These kinds of provisions could lead to self-executing changes (*e.g.*, the grant or removal of certain regulatory powers based on criteria being met or unmet), or they could help to speed up the process by which Congress is required to reauthorize particular sections of the Communications Act. Properly framed, such an approach could serve as both a "carrot" and a "stick" for guiding regulatory entities towards realizing specific Congressional imperatives around broadband and other IP-enabled services.

PRINCIPLE #4

> *Congress should make clear that modern competition policy, and the oversight and enforcement that might stem from it, will be driven by objective data and analytical frameworks.*

To the extent possible, data should inform efforts by Congress to modernize competition policy and undergird any effort by regulatory entities to implement and enforce new

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[48] *See, e.g.*, Jonathan E. Nuechterlein, *Antitrust Oversight of an Antitrust Dispute: An Institutional Perspective on the Net Neutrality Debate*, 7 J. on Telecomm. & High Tech. L. 19 (2009) (discussing the need for antitrust enforcement in the context of net neutrality disputes).

[49] *See, e.g.*, Christopher S. Yoo, *Deregulation vs. Reregulation of Telecommunications: A Clash of Regulatory Paradigms*, 36 J. Corp. L. 847, 866-867 (2011).

[50] For additional discussion, *see infra*, Principle #5.

policies. Data should be objective and evaluated in an impartial manner in order to assure integrity throughout analytical and rulemaking processes.

Currently, the communications laws empower the FCC to collect a range of data and require it to produce an array of reports on discrete topics. In addition, the statute grants the Commission significant authority to interpret the means (*i.e.*, analyses of the data) and ends (*i.e.*, interpretation of the analyses) of these inquiries. Without additional guidance, there may be incentives to subordinate data and the resulting analyses and reports as just another set of tools for realizing particular regulatory outcomes. Two examples from recent years illustrate how such vagueness in the statute supports subjective outcomes that are nominally grounded in data.[51]

First, as noted above, there has been much recent discussion about the scope and application of section 706 of the Telecommunications Act of 1996. In reviewing the FCC's most recent set of network neutrality rules, the D.C. Circuit opined that the Commission has potentially sweeping authority to regulate broadband under this provision, especially if the agency finds that advanced telecommunications services (*i.e.*, broadband) are not being deployed in a "reasonable and timely" manner.[52] That such broad regulatory authority can simply be unlocked by a new interpretation of data regarding broadband availability in the U.S. raises important questions about data gathering and analytical techniques at the FCC – questions that are ripe for examination during the present Congressional inquiry. Indeed, in the absence of specific guidance regarding the parameters of its ability to collect, analyze, and interpret relevant data in this context, the FCC, in theory, is free to adopt its own performance benchmarks that would support an even more dire assessment of the U.S. broadband space.[53] This, in turn, could provide a sturdier foundation for new rules meant to accelerate broadband deployment.[54] Checks and balances are available under

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[51] Of course, this is not a new dynamic. Indeed, numerous FCC rulings have been challenged in court as being arbitrary and capricious and not supported by substantial evidence. Another illustrative example is the FCC's ongoing struggles around updating and reforming its media ownership rules. Beginning in the early 2000s, the Commission has attempted numerous times to use data to justify a range of changes to these rules. On several occasions, however, federal courts have remanded the rules back to the agency for further analysis. For an overview, *see In the Matter of 2014 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, Further Notice of Proposed Rulemaking and Report and Order, at para. 9-14, MB Docket No. 14-50, FCC 14-28 (rel. April 15, 2014).

[52] *Verizon v. FCC*, 740 F.3d at 640-643.

[53] *See, e.g.*, Daniel Frankel, *FCC Looks to Redefine Broadband, Raise Speed Threshold Above 10 Mbps*, June 2, 2014, Fierce Cable, *available at* http://www.fiercecable.com/story/fcc-looks-redefine-broadband-raise-speed-threshold-above-10-mbps/2014-06-02 ("A higher standard would also significantly impact policy debates and how the FCC regulates Internet service providers. With the greater benchmark, the commission could argue more stridently that ISPs aren't offering consumers a true broadband experience.").

[54] *Verizon v. FCC* 740 F.3d at 641 ("We think it quite reasonable to believe that Congress contemplated that the Commission would regulate this industry, as the agency had in the past, and the scope of any authority granted to it by section 706(b)—limited, as it is, both by the boundaries of the Commission's subject matter jurisdiction and the requirement that any regulation be tailored to the specific statutory goal of accelerating broadband deployment—is not so broad that we might hesitate to think that Congress could have intended such a delegation.").

other statutes (*i.e.*., administrative procedure rules), but more precise Congressional guidance would help to avoid protracted rulemakings and litigation on these issues.

The second "vagueness" example stems from recent FCC efforts to determine whether there is "effective competition" in the U.S. mobile marketplace. In 2010, the Commission, for the first time in six years, found that data did not support a finding of effective competition in the market for mobile services.[55] It reached a similar conclusion in two subsequent reports.[56] Criticism of this reversal has focused on the policy implications that such a sudden change in measuring competition could have on firms throughout the marketplace. Some interpreted this development as further evidence that the Commission remains ill-equipped to fully comprehend the mountains of "direct market evidence" evincing a new competitive landscape in the wireless ecosystem.[57] Others have criticized the FCC for a sloppy and confused analysis – one that put forward a large amount of compelling evidence that seemingly indicated the presence of at least "effective" levels of competition, but that ultimately failed to adopt that label.[58] Critics have also faulted the FCC's current rubric for assessing competition on an array of other, more technical grounds, including an inability to identify the relevant market and thus properly contextualize the analysis.[59]

The FCC has defended its new approach to assessing wireless competition as a direct consequence of undertaking a more "expansive and detailed analysis of the entire mobile wireless industry," including voice, messaging, and broadband.[60] As a result, it is wary of attaching a label of "effectively competitive" to this space "because such an assessment would be incomplete and possibly misleading in light of the variations and complexities [it] observe[s]."[61] This reasoning seems specious, though, especially considering the large

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[55] *See In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fourteenth Report, 25 FCC Rcd 11407, 11411 (2010).

[56] *See In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fifteenth Report, 26 FCC Rcd 9664, 9691 (2011) ("*15th CMRS Report*"); Sixteenth Report, 28 FCC Rcd 3700, 3704 (2013).

[57] *See, e.g.*, Gerald R. Faulhaber, Robert W. Hahn, and Hal J. Singer, *Assessing Competition in U.S. Wireless Markets: Review of the FCC's Competition Reports*, 64 Fed. Comm. L. J. 320, 321 (2012) (hereinafter "*Assessing Competition*").

[58] *See, e.g.*, Thomas W. Hazlett, *The Federal Communications Commission's Excellent Mobile Competition Adventure*, George Mason University Mercatus Center Working Paper No. 11-46 (Nov. 2011), *available at* http://mercatus.org/sites/default/files/publication/FCC_Hazlett.pdf.

[59] *See, e.g.*, Harold Furchtgott-Roth, *Searching for Competition in the FCC's Mobile Competition Report*, May 30, 2012, Fierce Wireless, *available at* http://www.fiercewireless.com/story/furchtgott-roth-searching-competition-fccs-wireless-competition-report/2012-05-30 ("Even more troubling, the wireless competition reports never address whether wireless and wireline services might be part of a larger communications market.").

[60] *15th CMRS Report* at 9687.

[61] *Id.* at 9691-9692.

amount of data suggesting high levels of intense cross-sector competition in the wireless space.

Both examples demonstrate a compelling need for additional Congressional guidance around data collection, analysis, and interpretation.[62] While it would be a tedious and ultimately counterproductive task for Congress to attempt to spell out in detail the exact data and analytical techniques that the FCC – or any administrative agency – should use, there are many ways Congress could be more precise in its delegations around data collection and the production of reports. For example, Congress could temporarily relieve the FCC of its many data collection and reporting obligations until a more expert entity developed objective standards to guide the Commission's efforts. This could happen via a formal standard-setting process (*e.g.*, one led by NIST), a separate expert entity convened by the FCC for these purposes (*e.g.*, something similar to its Technical Advisory Council), or a collaborative multi-stakeholder forum.

PRINCIPLE #5

In order to make the regulatory process more efficient and responsive to market developments, Congress should provide clearer delegations of authority to all relevant regulatory entities in this space, recalibrate roles around these entities' core competencies, eliminate overlapping authority, and experiment with alternative regulatory approaches.

In an effort to promote continued growth of the broadband ecosystem and preserve consumer welfare gains and protections, it will be essential for Congress to not only modernize competition policy, but also recalibrate the roles of the regulatory entities that will be charged with implementing any new policies that might result. This will entail a wholesale reexamination of the underpinnings of federal legislative frameworks and resulting delegated authority to the array of regulatory entities at the federal, state, and local levels.[63] Recalibration of this magnitude is already occurring in a piecemeal manner – the FCC is addressing key aspects of regulatory federalism in the context of the IP transition and universal service reform, among other proceedings. These efforts are essential and long overdue, but in the absence of a more comprehensive undertaking led by Congress, the result will be continued tension between regulatory entities that share – or think they share – jurisdiction over certain services and segments of the communications space.[64]

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[62] The portion of the statute that guides FCC efforts in the mobile context has not been updated since 1993; section 706 hasn't been updated since being adopted in 1996. Most other sections of the Act that require data collection and/or require the submission of a report to Congress interpreting this data have also not been revisited in many years.

[63] Over the last decade, there have been numerous similar undertakings by Congress and other stakeholders in the communications space to overhaul federal law. *See, e.g.*, Kyle D. Dixon & Philip J. Weiser, *A Digital Age Communications Act Paradigm for Federal-State Relations*, 4 J. Telcomm. & High. Tech. L. 321 (2004) (discussing several of these types of initiatives).

[64] *See, e.g.*, *Federalism in Transition. See also* Michael J. Santorelli, *Regulatory Federalism in the Age of Broadband: A U.S. Perspective*, 2 Policy & Internet 99 (2010) (discussing the need for federal-state

Effective reapportionment of regulatory authority will hinge on a number of factors. Foremost among these will be the extent to which Congress can provide clearer legislative guidance about the reach of federal and state law vis-à-vis broadband and IP-enabled services. Although Congress has long empowered the FCC with the authority to classify these services for regulatory purposes, the Commission has demonstrated a tendency to prevaricate in these determinations. The unresolved question of the proper regulatory classification of VoIP, which has been pending before the FCC for more than a decade, is illustrative of this dynamic.[65] In the absence of clear guidance, numerous states have attempted to impose traditional telecommunications regulation on this borderless service.[66] In short, while administrative law recognizes that expert agencies are well positioned to fill in any gaps that might emerge when fulfilling their delegated duties,[67] the many gaps in the communications laws have been widened further by the disruptive and ceaseless nature of innovation throughout the ecosystem, further underscoring the need for Congress to update and clarify its mandates.[68]

Another major factor impacting recalibration will be the extent to which the FCC and other relevant regulatory agencies embrace a new model for conceptualizing the Internet and the reach and structure of possible regulatory responses. A broader conception, along the lines of the one proposed above (in Principle #1), would likely necessitate more vigorous application of laws of general applicability, including antirust and consumer protection rules. Accordingly, other expert agencies (*e.g.*, the FTC), along with the federal courts,

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recalibration to facilitate continued use of broadband in key sectors like healthcare, education, and energy) ("*Regulatory Federalism in the Age of Broadband*").

[65] *See In the Matter of IP-Enabled Services*, Notice of Proposed Rulemaking, 19 FCC Rcd. 4863 (2004). This official rulemaking proceeding grew out of an array of earlier inquiries made by the Commission into the proper regulatory approach to VoIP service. *see*, *e.g.*, *See The Provision of Interstate and International Interexchange Telecommunications Service via the "Internet" by Non-Tariffed, Uncertified Entities, America's Carriers Telecommunications Association ("ACTA") Petition for Declaratory Ruling, Special Relief, and Institution of Rulemaking Against VocalTec, Inc.; Internet Telephone Company; Third Planet Publishing Inc.; Camelot Corporation; Quarterdeck Corporation; and Other Providers of Non-tariffed, and Uncertified Interexchange Telecommunications Services*, RM No. 8775 (Mar. 4, 1996) (asking for clarification of the regulatory treatment of VoIP); *In the Matter of Federal-State Joint Board on Universal Service*, Report to Congress, 13 FCC Rcd. 11501 (1998) (exploring the array of different kinds of Internet telephony and identifying possible regulatory treatments).

[66] *Federalism in Transition* (discussing various attempts and responses by the FCC).

[67] *See*, *e.g.*, *Chevron U.S.A. v. Natural Resources Defense Council*, 467 U.S. 837 (1984).

[68] The Supreme Court in 1999 observed that: "It would be a gross understatement to say that the 1996 Act is note a model of clarity. It is in many important respects a model of ambiguity or indeed even self-contradiction. That is most unfortunate for a piece of legislation that profoundly affects a crucial segment of the economy worth tens of billions of dollars." *AT&T Corp. v. Iowa Utils. Bd.*, 525 U.S. 366, 397 (1999). *But see* Randy J. Kozel & Jeffrey A. Pojanowski, *Administrative Change*, 59 U.C.L.A. L. Rev. 112, 118-122 (2011) (discussing the mechanics of judicial review of agency interpretations and noting the willingness of courts to provide agencies with broad discretion to interpret their enabling statutes).

would likely see their roles expand in the context of policing the behavior of firms throughout the broadband ecosystem in an *ex post* manner.[69]

Yet another factor influencing recalibration will be the extent to which policymakers opt for designing new regulatory roles that can effectively harness and leverage core competencies. Indeed, a key part of any legislative update should be a bolstering of authority over issues that are seen as remaining within the reasonable purview of the entity. For example, there is little debate that the FCC should retain exclusive authority over the management of spectrum resources for commercial mobile services.[70] Indeed, in recent years there have been efforts to *expand* this authority in an effort to facilitate the allocation of additional spectrum for mobile broadband purposes.[71] Further expanding this authority will be essential to accommodating continued growth of the mobile broadband space. However, there is much less agreement that the FCC should retain a major role in merger review, for example, highlighting yet another opportunity for Congress to more clearly express its intent vis-à-vis the contours of FCC actions in this and similar contexts. At other levels of government, recalibration efforts will likely result in much narrower regulatory authority for state PUCs and municipalities.[72] Even so, these entities would remain uniquely positioned to play key roles in enhancing broadband connectivity at the state and local levels.[73]

These efforts could be supplemented by alternative regulatory and governance platforms. Exploring the feasibility of these types of approaches will be a valuable exercise by policymakers. An animating force of these efforts would be a desire to streamline regulatory processes and make them more responsive to rapid changes in the marketplace. Indeed, new market dynamics require platforms that can reduce, rather than heighten, complexity and bureaucracy in the resolution of time-sensitive matters. To these ends, policymakers should explore whether and to what extent they might require regulatory agencies to adapt alternative dispute resolution (ADR) techniques for use in resolving commercial disputes. The virtues of well-designed ADR platforms are many and include: the ability to centralize complex, multi-jurisdictional matters in a single forum; ensuring that dispute resolution is driven largely by the parties, which helps to insulate proceedings from larger policy or political discussions; empowering parties to select impartial expert

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[69] The literature on the viability of more expansive application of antitrust in the communications space has grown significantly in recent years. For a representative sampling of these works *see, e.g.*, *Antitrust Oversight of an Antitrust Dispute; Information, Innovation, and Competition Policy for the Internet*; Geoffrey A. Manne & Joshua D. Wright, *Innovation and the Limits of Antitrust*, 6 J. Competition L. & Econ. 153 (2010); Salil K. Mehra, *Paradise is a Walled Garden? Trust, Antitrust, and User Dynamism*, 18 Geo. Mason L. Rev. 889 (2011); Babette E.L. Boliek, *FCC Regulation Versus Antitrust: How Net Neutrality is Defining the Boundaries*, 52 B.C. L. Rev. 1627 (2011).

[70] *See, e.g.*, *Seizing the Mobile Moment* at 28-50 (detailing the history of FCC spectrum policy).

[71] *See, e.g.*, *See Middle Class Tax Relief and Job Creation Act of 2012*, Pub. L. No. 112-96, 126 Stat. 156 (2012) (empowering the FCC with the authority to engage in incentive auctions).

[72] *See, e.g.*, *Federalism in Transition* (detailing the range of antiquated regulatory activities that will likely be preempted during the IP transition).

[73] *Id. See also Regulatory Federalism in the Age of Broadband.*

mediators; creating a dynamic where resolution of a particular dispute is final, thus reducing lengthy appeals processes; and the ability to assure adequate levels of transparency and confidentiality depending on the matter at issue.[74]

Forums that embody ADR principles already exist at the FCC for settling disputes involving program carriage arrangements.[75] Something similar has been proposed in the context of addressing violations of possible new network neutrality rules.[76] Going forward, federal policymakers should continue exploring the efficacy of such multi-stakeholder processes and platforms so long as they prove to be effective in hastening the fair resolution of commercial disputes. To this end, policymakers might support small-scale pilot programs to test the effectiveness of various models in resolving discrete business-to-business matters throughout the ecosystem.[77] Over the long term, successful models could be adapted for use in any number of other contexts.

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[74] *See, e.g.*, *Efficient ADR for Intellectual Property Disputes*, World Intellectual Property Organization, *available at* http://www.wipo.int/export/sites/www/amc/en/docs/euro.pdf (excerpting from THE HANDBOOK OF EUROPEAN INTELLECTUAL PROPERTY MANAGEMENT, 2nd ed. (Adam Jolly & Jeremy Philpott, eds.) (2009)).

[75] *See, e.g.*, *Time Warner Cable v. FCC*, 729 F.3d 137, 145-149 (2d Cir. 2013) (discussing this framework).

[76] *Protecting and Promoting the Open Internet* at para. 170-176.

[77] Initial issues to explore in this manner might include disputes regarding: interconnection; patent enforcement; copyright infringement claims; and digital privacy.

Attachment #2

JUNE 2014

UNDERSTANDING THE DEBATE OVER GOVERNMENT-OWNED BROADBAND NETWORKS:

Context, Lessons Learned, and a Way Forward for Policy Makers

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NEW YORK LAW SCHOOL

NEW YORK LAW SCHOOL

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Founded in 1891, New York Law School is the second oldest independent law school in the United States. Drawing on its location near the centers of law, government, and finance in New York City, its faculty of noted and prolific scholars has built the school's curricular strength in such areas as tax law, labor and employment law, civil and human rights law, telecommunications and information law, corporate and commercial law, and interdisciplinary fields such as legal history and legal ethics.

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About The Advanced Communications Law & Policy Institute

The Advanced Communications Law & Policy Institute (ACLP) at New York Law School is an interdisciplinary public policy program that focuses on identifying and analyzing key legal, regulatory, and public policy issues facing stakeholders throughout the advanced communications sector. ACLP's mission is to promote data-driven and solution-focused dialogues amongst local, state and federal policy makers, academe, consumers, service providers, and the financial community concerning changes to the regulatory regimes governing wireline, wireless, broadband, and IP platforms. Recent research has focused on modernizing communications regulations at the federal, state, and local levels, identifying barriers to more robust broadband adoption in key demographics and sectors, and public policy strategies to spur innovation and investment in broadband.

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UNDERSTANDING THE DEBATE OVER GOVERNMENT-OWNED BROADBAND NETWORKS:

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New York Law School Foreword

As a law school based in the heart of the largest and most dynamic city in the country, New York Law School strives to create an environment in which to train the next generation of advocates and government leaders. To do so, we foster a diverse and collaborative atmosphere that draws on the myriad strengths of our faculty, our academic programs, and our proximity to major institutions like state and federal courts, as well as New York's City Hall and its City Council. What emerges is a unique kind of thought leadership, one that is grounded in the realities of litigation, policy making, and on-the-ground advocacy. These are among the many singular traits that make NYLS New York's law school. The following paper is written very much in this spirit. It tackles head-on a controversial topic and offers a very straightforward and practical analysis that will be useful and accessible to a wide range of policy makers.

Nothing is more fundamental to effective governance than understanding the parameters of government action and knowing how to effectively work within those limits to realize core social and public policy goals. No matter what the issue under consideration, there will inevitably be debate, dialogue, and disagreement over the proper reach of government. That is certainly the case in the context of municipal broadband, and such is to be expected. The real test for officials is how they respond. In an environment of limited resources and multiple, pressing public policy priorities, this paper offers guidance for policy makers grappling with the many complex questions associated with ensuring that residents, businesses, and institutions have ready access to what has fast become the foundation of modern commerce: broadband Internet connectivity.

Having had the privilege to work in New York City government for more than two decades, including a decade as counsel to former Mayor Michael Bloomberg, I certainly appreciate the contours and challenges associated with improving broadband access at the city level. Without robust broadband access, the city's burgeoning start-up sector might have struggled to get off the ground. Similarly, without widespread opportunities for getting online—in school, at home, in our city's many parks—many residents and small businesses would have been deprived of the chance to benefit from the transformative power of high-speed Internet connectivity. For these many reasons, Mayor Bloomberg—working with key appointees in his administration like Carole Post, who, before joining NYLS as its Executive Vice President and Chief Strategy Officer, led the city's Department of Information Technology and Telecommunications and served as the city's Chief Information Officer—sought to maximize broadband coverage by engaging experts and working with them to enhance what they do best—build networks, increase capacity, support high-tech businesses, and increase digital literacy. The model that resulted was a partnership model, one that positioned city government as a vehicle for facilitating and expediting beneficial outcomes for all involved (some of these partnerships are discussed at length in **section 6**).

These types of challenges and opportunities remain in cities and states throughout the country. The following paper identifies a reasonable path forward and, perhaps most importantly, provides policy makers with an array of resources to reach the decisions that make the most sense for their municipalities. It is essential to approach these types of issues in as reasoned and forward-looking a manner as possible. This paper will help to do just that.

Anthony W. Crowell
Dean and President
New York Law School

Authors' Foreword

Over the last nine years, the Advanced Communications Law & Policy Institute at New York Law School has explored nearly every major facet of the U.S. broadband market. Through an array of articles, white papers, reports, primers, and interdisciplinary events, we have examined a wide range of policy and regulatory matters—from more esoteric topics like intercarrier compensation to the "big" issues like how to spur more robust adoption and use of broadband in key sectors (e.g., education, energy, and health care) and in major demographic groups (e.g., seniors, people with disabilities). Our wide-ranging curiosity stems in large part from previous experiences working in and around state and local government during the birth and adolescence of broadband in the United States.

This is our fifth paper on government-owned broadband networks (GONs) .Our current study holistically examines the topic of GONs in the context of statistics and data, case studies and real world experiences, and consensus-based policy objectives (e.g., spurring broadband adoption and use).

Beyond disagreements about the competitive and innovative health of the U.S. broadband space—a topic we explore at length in this report—the debate over whether or not GONs are appropriate often comes down to a fundamental disagreement over the proper role of government in private markets. This debate is not unique to the GONs space. Indeed, it is a debate that has been ongoing for decades, if not centuries, and it has spilled over into nearly every sector of the economy.

At their core, these disagreements are animated by competing worldviews that, more often than not, fail to align. The debates that such competing views stimulate, however, can be enormously productive. Throughout history, they have inspired creative solutions to profound problems. Unfortunately, in the broadband context, debates tend to unravel into unproductive shouting matches. Instead of meeting on common ground to arrive at sound policy outcomes, debates in the broadband space tend to spiral out of control, draining all of the life and productive mental energy from the room. Stakeholders often move further apart; arguments are attacked regardless of their merits; cynicism reigns supreme.

In an effort to break through what at times appears to be a manufactured stalemate, the following report is offered as a conversation starter. It has been developed first and foremost with policy makers in mind. For many at the state and local levels, the issue of GONs can be arcane, especially in light of the dozens of more pressing day-to-day priorities, like improving schools, keeping the streets paved, and fighting crime. Nevertheless, there is increasing enthusiasm around the potential for municipally owned and operated networks to serve as a means for municipalities to seize control of their economic destiny. With so many issues of foundational importance already challenging decision-makers—from rising economic inequality to structural shifts in employment that have forced millions out of the workforce, to crumbling roads, bridges, and other basic public infrastructure—calls for GONs, which typically require substantial investments of already scarce public resources, warrant increased scrutiny.

We don't purport to have the "right" answers to the many questions raised by GONs. What's right for a particular community will differ from city to city and from state to state. Nevertheless, the following report offers critical context for these discussions and proposes a possible path forward for policy makers. To the extent that someone disagrees with our analyses, observations, or recommendations, we invite constructive feedback. Our hope is that this report will spur solution-focused dialogues among a diverse array of stakeholders

and encourage creative ideas for developing and implementing rational policies that bolster broadband connectivity throughout the United States.

We would remiss if we didn't acknowledge the many sources that were influential throughout the drafting and editing of this report. Over the last few years, we have benefited immensely from conversations with stakeholders across the broadband ecosystem on the many issues discussed herein. Our dialogues with policy makers and their staffs have been immensely informative. Through conversations with state legislators, federal and state regulators, and local elected officials, as well as policy experts and members of major national policy-focused organizations like the National Conference of State Legislatures, the American Legislative Exchange Council, the National Association of Regulatory Utility Commissioners, the National Association of Counties, the National League of Cities, the National Association of Telecommunications Officers and Advisors, and Women in Government, we have learned much. Closer to home, we have appreciated our many discussions on a range of broadband issues with the New York State Broadband Program Office, the New York State Broadband Task Force, the New York State Business Council, and the Partnership for New York City, as well as a number of local elected officials, including Manhattan Borough President Gale Brewer.

We are indebted to New York Law School for supporting our work on this project. The law school is supported by a wide range of organizations—alumni, trustees, corporations, and philanthropies—that, collectively, hold a range of views on the issues discussed in and implicated by the following report. We note that everything included herein, unless otherwise noted, represents the views of the authors only and does not necessarily reflect the views of New York Law School or any of its supporters. We are incredibly thankful for the continued support of New York Law School, including the wisdom shared with us by its many resident experts. Foremost among this cadre are Dean Anthony Crowell and Executive Vice President Carole Post, two veterans of the administration of former New York City Mayor Michael Bloomberg.

We look forward to discussing these critical issues with all stakeholders going forward and hope that our report contributes to productive dialogues around harnessing the transformative power of broadband in every sector and every community across the United States.

Charles M. Davidson
Michael J. Santorelli
ACLP at New York Law School

Executive Summary

Policy makers have debated the efficacy and viability of government-owned broadband networks (GONs) in the United States for many years. At their core, these debates reflect fundamental disagreement over the broadband market's competitive and innovative health, as well as the appropriate role of government in this space. This report seeks to inform the debate by grounding it in data and relevant context. The report offers a number of resources and tools for use by policy makers when evaluating the efficacy of GONs and developing targeted and cost-effective approaches to bolster broadband connectivity from both the supply side and demand side.

Report Overview and Summary of Findings

Historical Analysis of GONs and GONs Advocacy. The report begins by tracing the historical evolution of arguments for government broadband ownership in the United States. Understanding how these arguments evolved and how they have fared in the real world is essential to understanding the contours and drivers of current GONs advocacy.

> **Key point:** Many current rationales for GONs are variations of themes and advocacy about broadband regulation in the early and mid-2000s. These themes informed much of the municipal Wi-Fi advocacy in the late 2000s and now inform the current debate over GONs.

> **Key point:** Despite a number of failed municipal Wi-Fi projects in the mid-2000s, advocacy for GONs persisted. Many blamed the failures on too little government involvement and began to embrace broadband deployment models that were exclusively public in nature and built around particular technologies (e.g., fiber) and subjective speed benchmarks. These efforts ultimately sought to "future-proof" advocacy by asserting what the "end-state" of broadband in the United States should be and then advocating for that outcome.

Contextualizing the Modern GONs Debate. The report then sets forth the relevant context in which to evaluate GONs proposals. This analysis encompasses two categories of issues.

First, the report examines the state of the U.S. broadband market. Critics argue that broadband is too expensive, too slow, and offered by too few providers, and that GONs offer viable redress. A comprehensive, data-driven and historical analysis of both the supply side (i.e., availability) and demand side (i.e., adoption and use) yields more optimistic findings regarding the broadband market's competitive and innovative health.

> **Key point:** Throughout the evolution of the GONs debate, diagnoses of failing or failed broadband have proven inaccurate. The data make clear that the U.S. broadband market is robust in terms of speed, affordability, and choice, and well-positioned to keep improving in response to evolving consumer demand.

> **Key point:** Ample data demonstrate that, by nearly every metric, broadband availability and performance have greatly improved—and continue to improve—across the entire country. Over the last 15 years, consumers have been getting increasingly more value for their money; average speeds have increased and the number of service options has multiplied.

Challenges nevertheless remain. On the supply side, some remote parts of the country remain unserved. The Federal Communications Commission (FCC) and state governments, in partnership with service providers, are helping to plug these gaps. But on the demand side, data highlight a number of important challenges that require concerted, collaborative action by public, private, and nonprofit stakeholders.

> **Key point:** Some of the most pressing public and social policy challenges remain on the demand side. Adoption rates in key user groups—senior citizens, people with disabilities, low-income households, and certain minority communities—remain below the national average. This is due in large part to an array of community-specific barriers that impede more robust adoption and use of broadband-enabled services.

The second set of issues involves the ability of municipalities, and, by implication, states, to construct and maintain these networks—and the opportunity costs of doing so. Foremost among the many factors that influence municipal action of any kind are the volatile state of public finances and the immediate need to invest more resources in shoring up basic public infrastructure like roads, bridges, dams, the electric grid, and water systems.

> **Key point:** The Great Recession exposed a number of critical weaknesses in local finances that, taken together, create an inhospitable environment for taking on the risks and making the massive new investments associated with redundant long-term construction projects like GONs.

> **Key point:** By nearly every measure, basic public infrastructure in the United States is crumbling and in need of trillions of dollars of investment. To the extent that new funding is available for investment in towns, cities, and states, data indicate that those dollars should be allocated in support of repairing existing infrastructure. Calls to prioritize public spending for the purposes of deploying a GON should be carefully examined in light of these many existing and future obligations.

Case Studies of Major GONs. To better understand the real-world issues of municipal broadband projects, the report profiles the GONs that have been built in Chattanooga, Tennessee; Bristol, Virginia; Lafayette, Louisiana; Monticello, Minnesota; Cedar Falls, Iowa; Danville, Virginia; UTOPIA, Utah (a consortium of 16 cities); Groton, Connecticut; Provo, Utah; and Wilson, North Carolina. These networks represent a broad spectrum of municipal broadband efforts undertaken across the country in recent years. While the networks share many traits—notably, volatile business models, significant debt, and uncertain financial futures—the story of each individual GON highlights why the network should be seen as a cautionary endeavor rather than a replicable model.

Findings about GONs' Efficacy in the United States. The data included in the case studies, along with analyses from other sections of the report, support an array of findings regarding GONs.

> **Finding One**: Failed and failing GONs offer much-needed perspective about the complexities and challenges associated with building and deploying advanced communications networks. Overly optimistic assumptions about costs and take-rates often doom networks before they are even launched. In addition, moderately successful municipal networks generally had their genesis in unique circumstances that are extremely difficult, if not impossible, to replicate. Oftentimes, these unique factors include the availability of one-time grant funding that offsets the significant costs associated with building a broadband network. And many "successes" offered by GONs proponents have not, in fact, endured over the long term, raising key concerns about the viability of any kind of municipal broadband network.

> **Finding Two**: GONs, especially those deployed by municipal utilities, raise fundamental concerns regarding sustainability, fair competition, and consumer welfare. As regulated monopolies, municipal utilities operate according to a distinct set of rules, regulations, and

incentives relative to private firms. These incentives are not primarily focused on spurring innovation or engaging in competitive markets.

Finding Three: Calls for achieving subjective speed benchmarks should not supplant actual consumer demand as the primary driving force shaping the broadband ecosystem. Data indicate that the vast majority of consumers are satisfied with their broadband connections and that, in general, the supply of bandwidth and the speeds of Internet connections are being shaped, in fact, by consumer demand and actual usage patterns.

Finding Four: The direct economic impact of GONs, especially in job creation, can be difficult to attribute. Data do not indicate that GONs actually serve as the nucleus of renewed economic activity in cities and towns where they have been deployed. On the contrary, they appear to be playing minor roles in creating relatively few new jobs as companies continue to respond more favorably to other, more tangible incentives (e.g., tax breaks).

Finding Five: Governments are not well-equipped to compete in dynamic markets. In general, municipal governments do not have a strong record of keeping pace with technological advances or in shaping policies that reflect rapidly evolving consumer preferences for new services. Moreover, because of the various interests represented in government policy- and decision-making, and because of other factors like institutional inertia, government is ill-equipped to act quickly or drive the type of creative destruction evident throughout the broadband ecosystem. Finally, increasing use of public-private partnerships (PPPs) and privatization of many municipal functions evince a growing recognition by government entities that there are viable alternatives to "going it alone."

Finding Six: The substantial costs of building, maintaining, and operating GONs outweigh real benefits. The asserted benefits are often attributable to other factors. And there are important opportunity costs associated with a decision to pursue a GON instead of spending money on other infrastructure (e.g., water and wastewater systems) or public policy needs (e.g., education).

Finding Seven: Pursuit of a GON often diverts scarce public resources from more pressing priorities. Many states have laws limiting the amount of debt a municipality can accrue. Cities contemplating a municipal system will have to determine whether debt assumed as a result of a GON may limit additional bond issuances in support of other projects. Pursuit of a GON often necessitates real trade-offs that may negatively impact core aspects of local governance.

Finding Eight: A GON will not spawn the next Silicon Valley. Numerous cities have successfully nurtured vibrant information sectors, high-tech clusters, and start-up communities by using public resources to create or enhance the economic and innovative conditions necessary to foster an environment conducive to these industries. But this outcome is the result of many factors and policies having nothing to do with a GON.

Finding Nine: GONs are not remedies for perceived or actual broadband connectivity challenges. Positioning a municipal network as a vehicle for spurring competition in a local broadband market could ultimately undermine market forces and harm consumers.

Finding Ten: State-level policy makers have important roles to play in the GONs context. The costs associated with building and maintaining a GON are significant, which raises the risk of financial default by local government, the diversion of resources from other priorities, or other negative outcomes (e.g., credit downgrades). States, which maintain ultimate responsibility for the financial health of the cities and towns in their borders, have strong interests in overseeing the process by which GONs proposals are vetted and

approved. Well-established legal precedent supports such a close relationship between states and their political subdivisions.

Roles for State and Local Policy Makers in Enhancing Broadband Connectivity. The final substantive section of the report examines the wide array of roles that policy makers can and should play in bolstering broadband connectivity from both the supply side and demand side.

> **Key point:** The most effective public efforts in the broadband space are well defined and narrowly tailored to address actual problems. Often, public-private partnerships, which leverage the expertise, resources, and economic incentives of stakeholders in the private and nonprofit sectors, can reduce public risk and optimize outcomes on both the supply side and demand side. Numerous examples of PPPs are provided for consideration by policy makers.
>
> **Key point:** In general, the most successful PPPs tend to be those that position government as a conduit for channeling available funding to support the efforts of expert firms in the private and nonprofit spaces, and as hubs for facilitating collaboration and frank discussions about workable, impactful solutions in a given community.

Additional Resources for Policy Makers:

The Policy Maker Toolkit presented in **section 1** provides a step-by-step guide for evaluating proposals for a government-owned broadband network. Because these networks typically require long-term commitments of limited public resources and entail the assumption of substantial risk, decision-making processes should be as informed and comprehensive as possible.

Additional Perspectives on GONs are included in **section 7** in an effort to provide further insight into the efficacy of government-owned broadband networks. These brief essays have been authored by a range of subject-matter experts who have firsthand experience with GONs or who have examined the contours of municipal broadband.

Part I

Introduction and Context

1 Introduction

This paper seeks to provide policy makers and regulators at every level of government with:

- Relevant historical and modern context to inform discussion about government-owned broadband networks (GONs);
- A data-based, fact-driven examination of ten GONs deployed in the United States over the last decade;
- Findings regarding the efficacy of GONs in the United States; and
- A list of feasible, efficient options for municipalities and states interested in increasing broadband connectivity.

1.1 Broadband Policy Making in the United States and its Critics

Policies and arguments impacting U.S. Internet access have long been driven by a desire to plan for and achieve "what's next." For example, work around the National Information Infrastructure[1] in the early 1990s gave way to the Next Generation Internet initiative a few years later. This initiative was launched to improve a congested online experience that was a result of robust consumer use and rapid growth in online services.[2] In 2010, the *National Broadband Plan*, prepared and released by the Federal Communications Commission (FCC), articulated a bold vision for high-speed Internet connectivity, including a wide availability of next-generation communication networks and more informed use of broadband-enabled services.[3]

The common thread of these initiatives is a desire to ensure U.S. consumers and businesses can access progressively better Internet connections. The nation's strategy for achieving this goal has been the implementation of a minimalist regulatory framework to encourage investment in the deployment, maintenance, and improvement of commercial broadband networks.[4] This approach can be traced back to the Telecommunications Act of 1996, in which Congress stated:

> It is the policy of the United States … to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation.[5]

1 *See, e.g., The National Information Infrastructure: Agenda for Action*, Information Infrastructure Task Force (Sept. 1993), *available at* http://www.eric.ed.gov/PDFS/ED364215.pdf. This initiative was launched to "ensure that [new] information resources [were] available to all at affordable prices." *Id*. at p. 5.

2 *See, e.g., Concept Paper*, Next Generation Internet Initiative, Networking and Information Technology Research and Development (July 1997), *available at* http://www.nitrd.gov/ngi/pubs/concept-Jul97/pdf/ngi-cp.pdf ("Today's Internet suffers from its own success. Technology designed for a network of thousands is laboring to serve millions. Fortunately, scientists and engineers believe that new technologies, protocols, and standards can be developed to meet tomorrow's demands. These advances will start to put us on track to a next generation Internet offering reliable, affordable, secure information delivery at rates thousands of times faster than today. Achieving this goal will require several years of generic, pre-competitive research and testing." *Id*. at 1).

3 *See generally Connecting America: The National Broadband Plan*, Federal Communications Commission (March 2010) ("*National Broadband Plan*").

4 *See, e.g.,* William Kennard, Chairman, FCC, *Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at p. IX-2 (1999), *available at* http://www.fcc.gov/connectglobe/regguide.pdf (observing that "Government policy can have a profound impact on Internet development; it can either foster it or hinder it. To date, the Internet has flourished in large part due to the absence of regulation. A "hands-off" approach allows the Internet to develop free from the burdens of traditional regulatory mechanisms.").

5 47 U.S.C. §230 (b) (2) (emphasis added).

What is a GON?

A government-owned broadband network (GON) is any high-speed Internet system that is built and operated by a municipality, a consortium of municipalities, or a subsidiary of state or local government (e.g., a wholly-owned municipal electric utility or a state-level authority), and that is offered on a commercial basis to residents.

The resulting "light touch" approach from this bipartisan Congressional mandate enshrined a deliberate choice to equip service providers with the latitude necessary to experiment with business models and compete in what quickly became a vibrant, interdependent broadband ecosystem.[6]

Notwithstanding this national policy framework's success in spurring broadband access across virtually the entire country,[7] questions have emerged about the private sector's ability to balance profit maximization against preserving certain core aspects of the Internet.[8] Since the commercial Internet reached a tipping point of mass appeal around the turn of the 21st century, some have argued that fundamental flaws exist in the market for Internet access and those flaws call for certain government interventions.[9] This dynamic was evident in debates over "open access" rules in the early 2000s,[10] in regulatory proceedings focused on whether to impose common carrier obligations on broadband service providers in the mid-2000s,[11] and in ongoing discussions about whether "network neutrality" rules are necessary to mediate interactions between network owners and content providers.[12]

The resulting "light touch" approach from this bipartisan Congressional mandate enshrined a deliberate choice … in what quickly became a vibrant, interdependent broadband ecosystem.

6 *See, e.g., National Broadband Plan* at p. 5 (noting that "While we must build on our strengths in innovation and inclusion, we need to recognize that government cannot predict the future. Many uncertainties will shape the evolution of broadband, including the behavior of private companies and consumers, the economic environment and technological advances. As a result, the role of government is and should remain limited.").

7 *See infra*, section 3.1, for discussion and analysis.

8 *See, e.g., Upgrading the Internet*, The Economist, Technology Quarterly, March 22, 2001 (observing that since "the Internet has gone from being an academic network populated by geeks and boffins to an artery of commerce, a disjunction is emerging between what is best from a purely engineering point of view and what makes sense commercially.").

9 *See, e.g.,* Brett Frischmann, *Privatization and Commercialization of the Internet Infrastructure*, 2 Colum. Sci. & Tech. L. Rev. 1 (2001) (highlighting several roles for the government in the provision of "Internet interconnection infrastructure").

10 *See, e.g.,* Mark A. Lemley and Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. Rev. 925 (2001) (arguing that the dynamics of the emerging market for broadband Internet access services imperiled the end-to-end principle, a nondiscrimination norm that was built into the architecture of the Internet at its founding) ("*End of End-to-End*").

11 *See, e.g.,* Barbara A. Cherry, *Maintaining Critical Rules to Enable Sustainable Communications Infrastructures*, 24 Georg. St. U. L. Rev. 947 (2007) (arguing in favor of regulating broadband as a common carrier and public utility).

12 *See, e.g.,* Tim Wu, *Network Neutrality, Broadband Discrimination,* 2 J. on Telecomm. & High Tec. L. 141 (2003) (identifying the contours, and arguing in favor, of a network neutrality regulatory regime). These conversations have taken on renewed primacy in the aftermath of Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014), wherein the Court of Appeals for the D.C. Circuit found that, even though the FCC had overreached in adopting certain proposed "open Internet" rules, the Commission does have broad authority under the Communications Act to implement some form of regulatory framework for Internet access services. In response to the court's ruling, the FCC appears like to pursue a narrower set of network neutrality rules. *See* Tom Wheeler, FCC Chairman, *Setting the Record Straight on the FCC's Open Internet Rules,* April 24, 2014, FCC Blog, *available at* http://www.fcc.gov/blog/setting-record-straight-fcc-s-open-internet-rules (explaining that the FCC's new proposed rules will encompass the following requirements: "(1) That all ISPs must transparently disclose to their subscribers and users all relevant information as to the policies that govern their network; (2) That no legal content may be blocked; and (3) That ISPs may not act in a commercially unreasonable manner to harm the Internet, including favoring the traffic from an affiliated entity."); Guatham Nagesh, *FCC to Propose New 'Net Neutrality' Rules,* April 23, 2014, Wall St. J. (noting that "The proposal marks the FCC's third attempt at enforcing "net neutrality"—the concept that all Internet traffic should be treated equally.")

Despite substantial data,[13] calls for increased government involvement continue, based on various perspectives about whether market forces can guide the broadband space toward their preferred outcomes.[14]

1.2 The Debate over Government-Owned Broadband Networks

Advocates of government-owned broadband networks (GONs) argue that the United States lacks adequate broadband service in terms of speeds, prices, and availability.[15] This position is based on the argument that a lack of competition among service providers slows innovation at the network level and deprives consumers of ultra-high-speed access to the Internet.[16] GONs proponents assert that the most expedient remedy[17] is for cities and towns to deploy "future-proof" networks capable of gigabit transmission speeds (equivalent to 1,000 megabits per second).[18]

This approach appears to align with general policy imperatives to realize "what's next" for broadband networks, inject competition into markets, and jumpstart local economic development.[19] Framed in this manner, arguments in favor of GONs, which promise faster speeds at lower prices, are very attractive.[20]

This report will discuss these complex issues and provide a new framework in which to assess the arguments and controversy surrounding GONs. The report points out that substantial public resources to deploy GONs come at the expense of other major challenges facing many cities and states, the majority of which are already served by multiple wireline and wireless broadband providers. Many cities and states teeter on the edge of

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13 These data are discussed at length in section 3, *infra*.

14 *See, e.g.,* Lawrence Lessig, *Why Your Broadband Sucks*, Wired, March 2005 (observing that the "private market has failed the U.S. so far"); Paul Waldman, *Highway Robbery for High-Speed Internet*, June 24, 2013, American Prospect, *available at* http://prospect.org/article/highway-robbery-high-speed-internet#13721714498071&action=collapse_widget&id=1469977 (making many of the same points). *Cf.* Richard Bennett et al., *The Whole Picture: Where America's Broadband Networks Really Stand*, Information Technology & Innovation Foundation (Feb. 2013), *available at* http://www2.itif.org/2013-whole-picture-america-broadband-networks.pdf (refuting arguments that broadband in the U.S. is inferior).

15 *See, e.g.,* Blair Levin, *Global Leadership in the Broadband Economy and 10th Amendment Values,* April 4, 2013, Gig.U*, available at* http://www.gig-u.org/blog/blair-levins-remarks-to-wisconsin-broadband-summit (arguing that, for the first time in two decades, "no national carrier in the United States [has] plans to roll-out a better network than the current best network." *Id.* at p. 8); Hibah Hussain et al., *The Cost of Connectivity 2012*, New America Foundation (July 2012), *available at* http://newamerica.net/publications/policy/the_cost_of_connectivity (arguing that American consumers "tend to pay higher prices for slower [broadband] speeds compared to consumers abroad" and recommending that policy makers reevaluate our current policy approaches to increase competition and encourage more affordable high-speed Internet service in the U.S." *Id.* at 1); Hibah Hussain et al., *The Cost of Connectivity 2013*, New America Foundation (Oct. 2013), *available at* http://www.newamerica.net/publications/policy/the_cost_of_connectivity_2013 (echoing many of the observations in its 2012 report and concluding that "2013 data shows little progress, reflecting remarkably similar trends to what we observed in 2012.").

16 *See, e.g.,* Christopher Mitchell, *Publicly Owned Broadband Networks: Averting the Looming Broadband Monopoly*, Institute for Local Self-Reliance (March 2011), *available at* http://www.newrules.org/sites/newrules.org/files/cmty-bb-map.pdf ("*Averting the Looming Broadband Monopoly*").

17 Proposals to "fix" the failing broadband market abound and include an array of policy reforms that seek to, among other things, impose common carrier-like obligations on broadband service providers and mandate that all networks be open to competitors. *See, e.g.,* Lee L. Selwyn & Helen E. Golding, *Revisiting the Regulatory Status of Broadband Internet Access: A Policy Framework for Net Neutrality and an Open and Competitive Internet*, 63 Fed. Comm. L. J. 91 (2010) (calling for the reclassification of broadband Internet access service as a "telecommunications service," which would result in the application of common carrier rules); Yochai Benkler, *Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World*, The Berkman Center for Internet and Society at Harvard University (Feb. 2010), *available at* http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/Berkman_Center_Broadband_Final_Report_15Feb2010.pdf (supporting the adoption of open access policies for broadband networks in the U.S.).

18 On the notion of "future-proofing" and the many benefits of deploying fiber-optic networks, *see generally What Fiber Broadband Can do for Your Community,* Fiber-to-the-Home Council (summer 2012), *available at* www.ftthcouncil.org/FiberPrimer.

19 *See, e.g.,* Joanne Hovis, *The Business Case for Government Fiber Networks*, Broadband Communities (March/April 2013), *available at* http://www.bbpmag.com/MuniPortal/EditorsChoice/0313editorschoice.php ("*Business Case for Government Fiber*").

20 For past criticisms of the overly optimistic attitude of many pro-GONs advocates, *see, e.g.,* Patrick Ross, *Municipal Broadband and Net Neutrality,* Feb. 14, 2006, Progress & Freedom Foundation Blog, *available at* http://blog.pff.org/archives/2006/02/print/002560.html (comparing one advocate to the smooth-talking con man Harold Hill in "The Music Man"); John Hood, *Flashback: Monorails of the Decade,* July 3, 2008, Carolina Journal*, available at* http://www.carolinajournal.com/articles/display_story.html?id=4855 (noting comparisons of GONs to monorails, which were widely seen as overly hyped transportation systems that failed to generate expected returns on significant municipal investments).

financial insolvency[21] and need to repair crumbling roads, bridges, dams, and other public infrastructure.[22] In addition, there is considerable evidence that many GONs eventually fail. More generally, the current debate over whether GONs are a viable strategy for bolstering broadband connectivity has not adequately examined new ideas that may provide more impactful methods of using local resources to strengthen every segment of the ecosystem in more holistic and sustainable ways.

In many ways, the current debate over GONs distracts from the many policy imperatives for broadband and has the potential of driving parties apart at a time when it is essential they come together. Collaboration—among policy makers across every level of government, private firms throughout and beyond the broadband ecosystem, community leaders, consumer advocates and consumers themselves—is essential to addressing the many barriers to more robust broadband adoption and use.[23]

There are numerous examples of communities benefiting from more collaborative local leadership on these issues. Public-private partnerships (PPPs), for example, are bringing broadband networks to unserved areas, while direct engagement with service providers is yielding creative approaches to bolstering existing services.[24] Similar efforts are also proving successful on the demand side, where communities are leveraging local social infrastructures to promote adoption and more informed use of broadband services.[25] Such approaches allow local policy makers to take a more organic, data-driven assessment of broadband connectivity in their municipality and design strategies to address actual needs. As discussed here, embracing this model could yield enormous community benefits.

1.3 Report Overview

Section 2 traces the historical evolution of arguments for government broadband ownership in the United States. Understanding how these arguments evolved and how they have fared in the real world is essential to understanding the contours and drivers of current GONs advocacy.

In **section 3**, the report then sets forth the relevant context in which to evaluate GONs proposals. This analysis encompasses two categories of issues. First, in **section 3.1**, the report examines the state of U.S. broadband. Critics argue that broadband is too expensive, too slow, and offered by too few providers, and that GONs are the only answer. A comprehensive, data-driven and historical analysis of both the supply side (i.e., availability) and demand side (i.e., adoption and use) yields more optimistic findings regarding the broadband market's competitive and innovative health.

The second set of issues, which are examined in **section 3.2**, involves the ability of municipalities, and, by implication, states, to construct and maintain these networks—and the opportunity costs of doing so. Foremost among the many factors that influence municipal action of any kind are the volatile state of local finances and the immediate need to invest more resources in shoring up basic public infrastructure like roads, bridges, dams, the electric grid, and water systems.

To better understand the real-world issues of municipal broadband projects, **section 4** includes profiles of the GONs that have been built in Chattanooga, Tennessee; Bristol, Virginia; Lafayette, Louisiana; Monticello, Minnesota; Cedar Falls, Iowa; Danville, Virginia; UTOPIA, Utah (a consortium of 16 cities); Groton, Connecticut; Provo, Utah; and Wilson, North Carolina. These networks represent a broad spectrum of

21 *See, e.g.,* Mary Williams Walsh, *Cost of Public Projects is Rising, and Pain will be Felt for Years*, June 27, 2013, N.Y. Times (describing the negative impacts of volatility in the municipal bond market on cities and states). For additional discussion and analysis, *see infra,* section 3.2.1.

22 *See, e.g.,* John Schwartz, *Small Infrastructure Gains are Observed in Engineering Report*, March 19, 2013, N.Y. Times (discussing data regarding the state of U.S. infrastructure). For additional discussion and analysis, *see infra,* section 3.2.2.

23 *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Evaluating the Rationales for Government-Owned Broadband Networks*, at p. 17-18, a Report by the ACLP at New York Law School (March 2013), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Davidson%20&%20Santorelli%20-%20Evaluating%20the%20Rationales%20for%20GONs%20-%20March%202013.pdf ("*Evaluating the Rationales for Government-Owned Broadband Networks*"). For additional discussion, *see infra,* section 3.1.

24 For examples and discussion, *see infra,* section 5.

25 For examples and discussion, *see infra,* section 5.

municipal broadband efforts undertaken across the country in recent years. While the networks share many traits—notably, volatile business models, significant debt, and uncertain financial futures—the story of each individual GON highlights why the network should be seen as a cautionary endeavor rather than a replicable model.

The data included in the case studies, along with analyses from other sections of the report, support an array of findings regarding GONs, which are articulated in **section 5**.

The report concludes in **section 6** with an examination of the wide array of roles that policy makers can and should play in bolstering broadband connectivity from both the supply side and demand side. The most effective public efforts in the broadband space are well defined and narrowly tailored to address actual problems. Often, public-private partnerships, which leverage the expertise, resources, and economic incentives of stakeholders in the private and nonprofit sectors, can reduce public risk and optimize outcomes on both the supply side and demand side. Numerous examples of PPPs are provided for consideration by policy makers.

Policy Maker Toolkit

The following checklist of questions is offered to state and local policy makers as a resource for evaluating proposals for government-owned broadband networks. Because these networks typically require long-term commitments of limited public resources and entail the assumption of substantial risk, decision-making processes should be as informed and comprehensive as possible.

Questions to Ask When Deciding Whether to Undertake a Government-Owned Broadband Network

When considering a GON, understanding the contours and mechanics of local broadband markets is essential. The following checklist of questions identifies key issues to examine on both the supply side and demand side.

Assessing the Local Broadband Market	Questions To be Asked
Have local officials comprehensively examined the local broadband market? Such examinations should encompass both the supply side and the demand side.	☐
On the supply side: • What is the nature of local broadband competition? How many total broadband options—wireline, wireless, satellite, etc.—do consumers have access to? • Are there barriers to further deployment by incumbent Internet Service Providers (ISPs)? New entrants? • Has the municipality analyzed how it could leverage its resources to facilitate additional network deployment by private ISPs? Examples include reevaluating existing rights-of-way administration, tower siting approvals, antiquated zoning laws, and franchising processes. • Has the municipality engaged ISPs in dialogues around meeting clear goals on the supply side? • Has the municipality clearly articulated its supply side goals for broadband via RFPs/RFIs and/or other such means of public communication? • Are there opportunities to use public-private partnerships (PPPs) to address supply side challenges? Pilot programs? Other experimental approaches?	☐
On the demand side: • Are there data available on the nature of local broadband demand and use? Are there data regarding adoption rates across the municipality? Are there cost-effective ways of gathering such data (e.g., via existing survey tools, anchor institutions, etc.)? • Has the municipality engaged experts in the private and nonprofit sectors to identify barriers to more robust adoption and utilization? Has the municipality begun work to remove those barriers? • Has the municipality inventoried and examined existing resources on the demand side—e.g., training programs, anchor institutions, digital literacy initiatives? • Has the municipality attempted to work with and through local social infrastructures to address real demand side needs? • Has the municipality attempted to forge PPPs with partners in the private and nonprofit sectors? Have these partners attempted to leverage existing funding opportunities at the state and/or federal levels to support these efforts? • In unserved and underserved areas, have partners in the public, private, and nonprofit sectors engaged in sufficient demand aggregation activities to create favorable environments for new network deployment?	☐

Evaluating Related Municipal Factors	
Has the municipality evaluated basic infrastructure needs and weighed them against perceived and real broadband needs? These include developing plans to maintain roads, bridges, dams, electric grid components, water system elements, ports, and other basic public infrastructure for which state and local governments are responsible.	☐
Has the municipality identified the full range of economic, social, and infrastructural opportunity costs associated with building a GON? Are there opportunities to achieve core public goals for broadband and new technologies generally without endeavoring to build a municipal network or otherwise interfere with organic market forces?	☐
Does the municipality have a balanced budget? A surplus? A deficit? Is it financially solvent? Are there competing priorities for funding? Is the municipality assuming additional debt (e.g., under-funded pensions)?	☐

Questions to Ask When Reviewing a GONs Proposal

When evaluating whether to invest in or approve a proposal for a GON, an array of variables should guide decision-making. Numerous non-GONs options may be available to address broadband issues on both the supply and demand sides. As such, state and local policy makers should carefully consider the myriad costs, risks, and complexities associated with owning and operating a commercial broadband network. The following questions are offered as a guide for policy makers to use during these intricate undertakings.

Initial Review of GONs Proposals	
Have policy makers exhausted other options for bolstering broadband from both the supply side and demand side? (Discussed at length in **section 6**.)	☐
What is driving consideration of a GON in a particular municipality? Are there actual problems or issues that policy makers are seeking to address with a municipal network? Are policy makers looking to generate income? Spur the local economy? Make the local broadband market more competitive? Are they responding to unsolicited proposals?	☐
Have policy makers and planners consulted and involved constituents in the process? Have policy makers created opportunities and a process for informative dialogue amongst citizens and stakeholders during review and planning stages?	☐
With regard to reviewing specific GONs proposals: • Does the network plan consider and address the range of possible negative outcomes—e.g., low consumer demand, reaction by private ISPs, legal challenges, state preemption, etc.? • Are performance and outcome expectations—among policy makers, the public, etc.—for the network grounded in solid data and analysis? Are assumptions and predictions about costs, take rates, and competitive impacts supported? • Have policy makers and planners addressed the challenges associated with network construction and maintenance? Factors include population density, geographic considerations, and recurring network costs. • Does the network plan have one or more "end games" or exit strategies? • Does the plan adequately consider (and contain strategies regarding) the market strengths and possible responses of private sector providers? • Does the plan create competitive or regulatory advantages for the proposed municipal provider compared to non-municipal providers?	☐

Cost, Financing & Business Model Review	
With regard to costs: • What is the estimated cost of the GON? Does this estimate encompass all aspects of maintenance, operation, and technology upgrades? • What is the expected cost of hiring experienced management and expert staff—necessary inputs for operating a network in a competitive market? • What is the expected cost for marketing and consumer outreach? Have these and other related costs been factored into cost projections? • Have policy makers contemplated the costs associated with unwinding the network in the event of failure? • Have policy makers considered the risk and additional costs of a negative credit action (e.g., a credit downgrade) against the locality or parent utility as a result of a GON's financial or operational difficulties?	☐
With regard to financing: • How will the network be financed? Will this entail the assumption of debt by the municipality or by a quasi-public entity (e.g., a public utility)? • How much debt will planning, construction, operation, maintenance, and technology upgrades require upfront? Over the long term? How long will it take to repay these debts in the best case scenario? How long in the worst case scenario? Have policy makers quantified these scenarios? • Who bears the financial risk of network failure? Bond default? Are taxpayers shielded from these obligations? • Does the business model use alternative funding mechanisms that would limit taxpayer exposure to the costs of failure? • To what extent does the financing plan revolve around government grants or other public assistance? Are these funds guaranteed? Provided in lump-sum upfront or an installment basis? Is this aid conditional (e.g., tied to certain performance metrics)? • Has the municipality explored the feasibility of indemnification of public outlays if a network fails? This might be appropriate in instances where GONs proposals are offered unsolicited to municipalities.	☐
With regard to proposed business models: • Is the proposed business plan reasonable when measured against actual consumer demand for broadband services and when measured in light of competitive conditions in local markets? • To what extent does the business model hinge on cross-subsidies (e.g., by a parent electric utility)? Are these cross-subsidies legal? Sustainable? Do they provide the municipal network with a competitive advantage over providers? • Does the proposed business plan include contingency planning to address under-adoption, pricing adjustments by competitors, and/or outright failure? • Does the business model allocate any potential profits to the local government (e.g., payments in lieu of taxes)? • Does the business model factor in debt servicing generally? In the event that subscriber forecasts are off? • To what extent does the business plan include supplemental borrowing or allocation of additional funds/resources by local government?	☐
Legal, Regulatory & Public Policy Considerations	
Are there state and/or local statutes to guide the GON review process?	☐
Are there related utility laws that might impact core aspects of the proposal (e.g., prohibitions or limitations on utility cross-subsidies)?	☐
Are there limitations on the extent to which municipalities can leverage public resources (e.g., rights-of-way) to provide a commercial service in direct competition with private providers?	☐
Is the municipality empowered under state law to engage in activities that amount to industrial planning?	☐
In the absence of formal state or local rules regarding GONs, has the municipality considered a public referendum or other means of public engagement?	☐

2 The Evolution of the Debate over Government-Owned Broadband Networks in the United States

This section traces the historical evolution of arguments for U.S. government ownership of broadband networks. Many current rationales for GONs are variations of themes and theories in the early to mid-2000s that were at the heart of broadband regulation advocacy. These later informed much of the advocacy around municipal Wi-Fi and the current debate over GONs. Understanding how these arguments evolved and how they have fared in the real world is essential to understanding current GONs advocacy.

2.1 GONs Beta: The Ideological Origins of GONs Advocacy

There has always been a hint of revolution in GONs advocacy. Arguments for municipal entry into broadband markets reflect, to varying degrees, a desire to circumvent or replace the competitive, market-based Internet access model.[26] According to this argument, market forces cannot adequately discipline Internet service providers (ISPs), nor should they try given perceived faults in the Internet's structure and commercial nature. This necessitates government intervention to ensure widespread, unmediated Internet access.[27] Others base GONs advocacy on local self-reliance—that municipalities should be the primary providers of a service that, in their view, should be considered a public utility (like electricity and water) that serves as a basic input of local economic activity.[28]

Ultimately, rationales in favor of government-owned broadband networks revolve around a concept of the Internet as a medium that should be insulated from the marketplace.[29] This formulation views the Internet as a vast commons, something antithetical to traditional notions of private property and contrary to the economic incentives undergirding the market forces shaping the U.S. broadband space.[30]

There has always been a hint of revolution in GONs advocacy. Arguments for municipal entry into broadband markets reflect, to varying degrees, a desire to circumvent or replace the competitive, market-based Internet access model.

26 The irony, of course, is that the U.S. has long favored commercial provision of Internet access services over public provision. This was demonstrated most dramatically in the early 1990s when the federal government privatized – and thus commercialized – the Internet backbone in an effort to bolster innovation and encourage more widespread use of the service. For an overview, *see A Brief History of NSF and the Internet*, Office of Legislative and Public Affairs, National Science Foundation (Aug. 2003), *available at* http://www.nsf.gov/od/lpa/news/03/fsnsf_internet.htm.

27 *See, e.g.,* Thomas Bleha, *Down to the Wire,* Foreign Affairs (May/June 2005) (arguing that market forces, in the absence of active government involvement, steered the U.S. broadband market toward subpar results when measured against international counterparts).

28 *See, e.g.,* Sam Gustin, *Is Broadband Internet Access a Public Utility?*, Jan. 9, 2013, Time.com, *available at* http://business.time.com/2013/01/09/is-broadband-internet-access-a-public-utility/ (noting the many arguments that have been made in favor of the idea that broadband is or should be treated as a public utility).

29 For additional discussion and analysis of these various rationales, *see Evaluating the Rationales for Government-Owned Broadband Networks.*

30 *See, e.g.,* Lawrence Lessig, *The Internet Under Siege*, Foreign Policy, Nov. 1, 2001 ("…the Internet took off precisely because core resources were not "divided among private owners." Instead, the core resources of the Internet were left in a "commons." It was this commons that engendered the extraordinary innovation that the Internet has seen. It is the enclosure of this commons that will bring about the Internet's demise.").

Section 2 Highlights

This section traces the historical evolution of arguments in favor of government intervention into the U.S. broadband space. Understanding how such arguments evolved and how they have fared in the real world is essential to understanding the contours and drivers of current GONs advocacy.

- Many of the current rationales in favor of GONs are variations of themes and advocacy around related issues impacting the regulation of broadband in the early and mid-2000s. These themes later informed much of the advocacy around municipal Wi-Fi in the late 2000s and the current debate over GONs.
- Despite a number of failed municipal Wi-Fi projects in the mid-2000s, advocacy in favor of GONs persisted. Many blamed the failures on too little government involvement and began to embrace broadband deployment models that were exclusively public in nature and built around technologies (e.g., fiber) that sought to "future-proof" advocacy by asserting what the "end-state" of broadband in the United States should be and then advocating for that outcome.

For some, Internet access should occur via "dumb" networks—networks that do nothing more than passively transmit data to and from end users.[31] In this view, the commercial and operational aspects of serving as an ISP—investing risk capital in networks, maintaining the infrastructure, and experimenting with service models in response to changes in consumer preferences and to generate revenue for network expansion—ought to be subordinated to theoretical notions of "dumb" pipes built, owned, and operated outside the private sector. Governments are thus seen as natural owners of ISPs because they lack a profit motive that might distort these ideals.[32]

The rise of cable broadband Internet access in the late 1990s and early 2000s, however, presented a regulatory and technological challenge to this view.[33] The regulatory treatment of dial-up and DSL service, the other major Internet access platforms in the late 1990s, was relatively straightforward: when offered by incumbent telephone companies, these services fell under the so-called Computer Inquiry regime, which required service providers to make available the underlying basic transmission component on a nondiscriminatory basis to competitors.[34] Some viewed this approach as optimal from the standpoint of protecting the theoretical architecture of the Internet.[35] However, cable operators were not subject to these rules.[36] Because cable modems were the dominant form of broadband Internet access at the time, some worried that if cable companies were not required to facilitate competitive entry, these firms could "impose whatever conditions they desire[d] on their customers" and ultimately undermine the notion of a "dumb" network.[37]

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31 For one of the earliest descriptions of and arguments in favor of the "dumb network," *see* David Isenberg, *Rise of the Dumb Network*, Computer Telephony (Aug. 1997). *See also End of End-to-End* at 930-931 (noting that the founding principles of the Internet "counsel[] that the "intelligence" in a network should be located at the top of a layered system – its "ends," where users put information and applications onto the network. The communications protocols themselves (the "pipes" through which information flows) should be as simple and as general as possible."); Susan Crawford, *Transporting Communications*, 89 Boston Univ. L. R. 871, 937 (2009) ("We need to return to the basic notion of a non-discriminatory network underlying communications. The legal idea that companies providing transport services for general-purpose communications networks are burdened with an express obligation not to discriminate with respect to the content or source of those communications is ready for a revival."); Adam Thierer, *Are "Dumb Pipe Mandates" Smart Public Policy? Vertical Integration, Net Neutrality, and the Network Layers Model,* 3 J. on Telecomm. & High Tec. L. 275, 279-287 (2005) (providing additional background and discussion regarding the notion of a "dumb" pipe).

32 *See, e.g.,* Harold Feld, Gregory Rose, Mark Cooper & Ben Scott, *Connecting the Public: The Truth about Municipal Broadband*, A Report by Free Press et al. (April 2005) ("Private companies operate solely on the basis of profit motives. They have fiduciary obligations to stockholders to maximize their profits. While the profit motive often produces competition and innovation that benefits consumers, it provides no guarantee that private companies will fulfill vital public needs. The decisions of private companies may be economically rational in terms of the advantages accruing to the firm and its stockholders, but there are equally important economic and social needs and benefits completely absent from their calculations." *Id.* at p. 6) ("*Connecting the Public*").

33 *See, e.g., End of End-to-End.*

34 *See, e.g.,* James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms*, 17 Yale J. on Reg. 40, 61-69 (2000) (discussing the regulatory treatment of these access services) ("*Handicapping the Race*").

35 *See, e.g.,* Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 Minn. L. Rev. 917 (2005).

36 *Handicapping the Race* at p. 71-75 (discussing the rationales supporting this approach).

37 *End of End-to-End* at p. 927.

This initial debate over the proper regulatory treatment of broadband platforms reached a critical turning point when the city of Portland, Oregon, attempted to impose through its local franchising authority open access requirements on a local cable broadband provider.[38] The major motivation was to manufacture competition among broadband service providers, which would have positioned the municipality as the primary local market facilitator.[39] This act was ultimately deemed unlawful by a federal appeals court, which ruled that municipalities were prohibited from regulating cable broadband service.[40] The immediate result was a rebuke of municipal authority to impose open access requirements on cable broadband providers.[41] More importantly, the case spurred the FCC to formalize and rationalize its regulatory approach to new and emerging broadband platforms.[42]

Over the next several years, the open access debate mushroomed into broader discussions about whether and to what extent regulation was needed to:

- Preserve the founding ideals of the Internet;
- Promote continued investment in network deployment; and
- Foster innovation throughout a burgeoning broadband environment.[43]

The stakes of this debate were high, as the resulting regulatory framework would embody a clear choice between two competing narratives about the nature of U.S. Internet access.

An aggressive regulatory approach would signal agreement that the marketplace was failing due to lack of competition,[44] while a deregulatory approach would explicitly endorse the principle that the broadband market's intermodal nature, combined with increasing demand for high-speed Internet access, would ensure continued consumer and social welfare gains.[45] The FCC ultimately agreed with the latter approach, and between 2002 and 2007 it developed and successfully defended in court a light-touch regulatory framework for every type of broadband Internet access service.[46] The FCC also acted to "preserve the freedom of use broadband consumers [had] come to expect" by clarifying the extent to which ISPs could manage their networks, tacitly acknowledging that broadband networks were in fact "smart," complex infrastructures, and not just "dumb" pipes.[47]

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38 *AT&T v. City of Portland*, 216 F.3d 871 (9th Cir. 2000).

39 *AT&T v. City of Portland,* 43 F.Supp.2d 1146, 1150 (U.S.D.C. Or. 1999), *rev'd AT&T v. City of Portland*, 216 F.3d 871 (9th Cir. 2000).

40 *AT&T v. City of Portland*, 216 F.3d at 881 ("We hold that subsection 541(b)(3) prohibits a franchising authority from regulating cable broadband Internet access, because the transmission of Internet service to subscribers over cable broadband facilities is a telecommunications service under the Communications Act.").

41 *Id.* at 878-879.

42 Up until that point in time, the FCC had addressed these issues only tangentially. Critical groundwork for eventual decisions regarding the regulatory treatment of broadband was developed in proceedings stretching back to the 1970s. Several other inquiries, notably a major investigation into the regulatory impacts of new communications services in the wake of the 1996 Telecommunications Act, also proved consequential to the ultimate design of the framework for broadband services. For an overview of the earlier initiatives, *see* Robert Cannon, *The Legacy of the Federal Communications Commission's Computer Inquiries*, 55 Fed. Comm. L. J. 167 (2003). *See also Federal-State Joint Board on Universal Service,* Report to Congress, 13 FCC Rcd 11501 (1998) (examining possible regulatory impacts of new and emerging communications technologies).

43 *See, e.g.,* Tim Wu, *The Broadband Debate, A User's Guide,* 3 J. on Telecomm. & High Tech. L. 63, 71-79 (2004) (providing an overview of the two sides in the debate over the proper regulatory framework for broadband networks).

44 *Id.*

45 *See, e.g.,* Daniel F. Spulber & Christopher S. Yoo, *Rethinking Broadband Internet Access*, 22 Harv. J. Law & Tech. 1 (2008) (discussing the development of the regulatory framework for broadband).

46 *See Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, 17 F.C.C.R 4798 (2002), *aff'd Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv*., 545 U.S. 967 (2005); *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, 20 F.C.C.R. 14,853 (2005); *Classification of Broadband Over Power Line Internet Access Service as an Information Service*, 21 F.C.C.R. 13281 (2006); *In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, 22 F.C.C.R. 5901 (2007).

47 *See* Michael Powell, Chairman, FCC, *Preserving Internet Freedom: Guiding Principles for the Industry,* at p. 5, Remarks at the Silicon Flatirons Symposium on "The Digital Broadband Migration: Toward a Regulatory Regime for the Internet Age," University of Colorado School of Law, Boulder, Colorado, Feb, 8, 2004, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-243556A1.pdf. These principles were eventually adopted by the FCC in a non-binding Policy Statement issued in 2005. *See Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, Policy Statement, 20 F.C.C.R. 14986 (2005).

Those advocating government intervention did not see how such a light-touch approach could preserve their long-term vision for the Internet.[48] The open access policies at the heart of alternative regulatory schemes were considered the best way to synthesize and maintain a type of competition that would keep communications networks as passive conduits.[49] Around this time, there was also a rising sentiment that local governments were especially well-positioned to enter the market as service providers and serve as ballast against private ISPs.[50] Taken together, this line of advocacy stressed that the only metric that mattered from a consumer welfare perspective was the number of providers in a particular market.[51] But several states acted to preempt their municipalities from becoming service providers for fear that they would have an unfair competitive advantage and ultimately undermine, rather than promote, competition among providers.[52] After an array of legal challenges and FCC proceedings, the Supreme Court found that federal communications law did not preclude states from controlling their municipalities by prohibiting them from providing service.[53]

These interrelated actions provided stakeholders in the broadband space with significant clarity about the scope of possible government interventions.[54] The FCC framework formalized Congress's call for a mostly hands-off approach to the Internet,[55] while the legal cases made clear that non-federal (i.e., state and local) entities had little, if any, basis for regulating such inherently borderless services.[56] And to the extent that data regarding levels of investment, innovation, network availability and improvements in service quality are indicators, these policies succeeded in spurring broadband service competition.[57]

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48 *See, e.g., Connecting the Public* at p. 1 ("Absent federal regulation requiring network neutrality or open access, municipal systems remain the last line of defense against [allegedly anticompetitive] practices."); Rob Frieden, *Lessons from Broadband Development in Canada, Japan, Korea, and the United States*, 29 Telecommunications Policy 595 (2005) (embracing a more interventionist approach in the United States vis-à-vis broadband deployment); S. Derek Turner, *Dismantling Digital Deregulation: Toward a National Broadband Strategy,* Free Press (May 2009), *available at* http://www.freepress.net/sites/default/files/fp-legacy/Dismantling_Digital_Deregulation.pdf ("The FCC, in its blind pursuit of deregulation, abandoned line sharing and other open access policies in the hopes that this "regulatory relief" would inspire incumbents to make massive investments in broadband infrastructure. But this hope, based in part on the promises made by the incumbents to get favorable FCC treatment, turned out to be completely false." *Id.* at p. 9) ("*Dismantling Digital Deregulation*").

49 *See* Douglas H. Ginsburg, *Synthetic Competition*, 16 Media L. & Pol'y 1, 11-15 (2006) (explaining that "synthetic competition" describes "a market subject to a regulatory regime designed to assure there are multiple sellers regardless whether fewer sellers, perhaps only one, would be more efficient," and arguing that, "in synthetic competition, the preferences of regulators – not consumers – are paramount").

50 *See, e.g., In the Matter of the Missouri Municipal League, et al.,* Memorandum Opinion and Order, Separate Statement of Chairman William Kennard and Commissioner Gloria Tristani, 16 FCC Rcd. 1157, 1172 (rel. Jan. 12, 2001) ("The right policy for consumers is to have as many providers of telecommunications from which to choose-barring entry by municipally-owned utilities does not give consumers that choice.") ("*In the Matter of the Missouri Municipal League*").

51 *See generally* Barak Orbach and Grace Campbell Rebling, *The Antitrust Curse of Bigness*, 85 S. Cal. L. Rev. 605 (2012) (describing the historical evolution of this "simplistic" approach to evaluating competition).

52 The first two states to do this were Texas and Missouri. *In the Matter of the Missouri Municipal League* at 1158.

53 *Nixon v. Mo. Mun. League*, 541 U.S. 125 (2004) (rejecting municipalities' argument that the Telecom Act's prohibition on state barriers to entry applied to protect municipalities' provision of service from state superintendence).

54 *See, e.g.,* James Speta, *Deregulating Telecommunications in Internet Time,* 61 Wash. & Lee L. Rev. 1063, 1147 (2004) (assessing the pro-competitive impacts of preventing municipalities from entering communications markets); Thomas Hazlett et al., *Sending the Right Signals: Promoting Competition through Telecommunications Reform*, a Report to the U.S. Chamber of Commerce (Sept. 2004), *available at* http://www.uschamber.com/sites/default/files/reports/0410_telecommstudy.pdf (comparing and contrasting the regulatory frameworks for telephone and broadband services and finding that the exacting regulatory approach for the former would hinder, rather than advance, competition and innovation in the market for the latter).

55 Section 230(b)(2) of the Communications Act, as amended by the Telecommunications Act of 1996, states that it is "the policy of the United States…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation."

56 In addition to the *City of Portland* and *Nixon* cases, there is a growing body of legal precedent suggesting that states lack authority over borderless services like VoIP, which travel over high-speed Internet networks. *See, e.g., Minn. Pub. Utils. Comm'n. v. FCC*, 483 F. 3d 570 (8th Cir. 2007) (upholding FCC preemption of the PUC's attempt to levy traditional telecommunications regulation on a VoIP provider, finding that it is impossible to separate interstate and intrastate elements of the service for regulatory purposes). *But see generally Verizon v. FCC,* 740 F.3d 623 (D.C. Cir. 2014) (providing a reading of the Communications Act that suggests that states, along with the FCC, might have authority to implement regulations impacting broadband networks).

57 For a comprehensive analysis, *see infra,* section 3.1.

2.2 GONs 1.0: The Rise and Fall of Municipal Wi-Fi

During development of the federal policy framework for broadband, the notion of GONs became the preferred option for those who argued against a minimalist regulatory regime.[58] GONs advocates proposed positioning municipal networks as a means of closing the "digital divide" and achieving universal access to the Internet.[59]

Disagreement over the proper role of policy in closing the digital divide existed along familiar lines.

- Some saw virtue in continuing to focus government attention on "clear[ing] away regulatory obstacles to the investment that fuels development and deployment of new technologies."[60] Between 2000 and 2005, these efforts yielded impressive improvements in the availability and adoption of broadband throughout the country.[61]
- Others saw these policies and the resulting evolution of the broadband market as major contributors to a broadening, rather than shrinking, digital divide. Evidence in support of this claim focused on two issues: low adoption rates and prices for broadband service.[62] According to this point of view, widespread deployment of GONs was an optimal solution.

Although a number of municipalities had previously experimented with providing commercial communications service, the first major wave of government-owned broadband was driven largely by the emergence of Wi-Fi.[63] This wireless technology was viewed as a game-changer for several reasons:

- It was relatively cheap to deploy;
- It was amenable to mesh networking strategies, which could, in theory, bolster coverage; and
- It was built on freely available unlicensed portions of the wireless spectrum.[64]

To some, Wi-Fi held the promise of "turn[ing] the airwaves into a commons without tragedy, and turn[ing] the economics of wireless [and broadband provision generally] on its head."[65]

The municipal Wi-Fi movement blossomed with Philadelphia's announcement, in 2005, that it was planning to deploy a citywide Wi-Fi network.[66] This initiative was hailed by proponents as a way for the GONs movement to gain credibility and underscore what they asserted as a foundational principle of Internet access: that

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58 It should be noted that municipal entry into other segments of the communications space — in particular, telephony and cable — was not a new phenomenon in the early 2000s. Indeed, some municipalities began offering local telephone service as early as the 1890s and early 1900s. *See, e.g.,* Richard R. John, Network Nation: Inventing American Telecommunications 264-267 (Belknap Press: Cambridge, MA 2010) (discussing early attempts by municipalities to offer telephone service). There is also a long history of municipal participation in the market for cable services. For an overview, *see generally* Kathryn A. Tongue, *Municipal Entry into the Cable Broadband Market: Recognizing the Inequities Inherent in Allowing Publicly Owned Cable Systems to Compete Directly Against Private Providers*, 95 Nw. U. L. Rev. 1099 (2001) ("*Municipal Entry into the Cable Broadband Market*").

59 The notion of a digital divide was not new in the mid-2000s. The term had been coined in the 1990s to describe a growing gulf between households in the U.S. that were purchasing and using new communications tools like desktop computers and dial-up Internet access, and those that were not. The emergence of broadband networks as high-speed on-ramps to the Internet, however, changed the calculus around the digital divide, shifting the policy emphasis to ensuring that as many people as possible were adopting and using this transformative technology. For a brief overview of the evolution of digital divide analysis and policy making, *see* Charles M. Davidson, Michael J. Santorelli and Thomas Kamber, *Toward a More Inclusive Definition of Broadband Adoption,* 6 Int'l. J. of Comm. 2255, 2556-2558 (2012). For additional analysis and discussion of the digital divide, *see infra*, section 3.1.2.

60 *See Networked Nation: Broadband in America 2007,* at p. 8, National Telecommunications & Information Administration, U.S. Dept. of Commerce (Jan. 2008), *available at* http://www.ntia.doc.gov/files/ntia/publications/networkednationbroadbandinamerica2007_0.pdf.

61 *See infra,* section 3.1, for discussion and analysis.

62 *See, e.g.,* Hannibal Travis, *Wi-Fi Everywhere: Universal Broadband Access as Antitrust and Telecommunications Policy*, 55 Am. U. Law. Rev. 1697, 1702 (2006) (arguing that "The provision of high-speed Internet access by private industry alone is leaving behind most of the poor, vast numbers of racial and ethnic minorities, and many residents of rural and inner-city communities.") ("*Wi-Fi Everywhere*"); Ben Scott and Frannie Wellings, *Telco Lies and the Truth about Municipal Broadband Networks*, Free Press (April 2005) ("The telecom and cable kings of the broadband industry have failed to bridge the digital divide and opted to serve the most lucrative markets at the expense of universal, affordable access." *Id.* at p. 2).

63 For examples of these early efforts, *see id.; Municipal Entry into the Cable Broadband Market.*

64 For additional discussion regarding the virtues and drawbacks of using Wi-Fi for broadband, *see* Michael J. Santorelli, *Rationalizing the Municipal Broadband Debate*, 3 ISJLP 43, 55-57 (2007) ("*Rationalizing Municipal Broadband*").

65 *See* Chris Anderson, *The Wi-Fi Revolution*, Wired, May 2003.

66 *See* Arshad Mohammed, *Philadelphia to be City of Wireless Web*, Wash. Post, Oct. 5, 2005.

it was best treated "as a basic municipal service like water, electricity, and trash collection."[67] The rapid rise in Wi-Fi's popularity coupled with the announcement in Philadelphia encouraged a number of other cities to deploy or consider deploying wireless GONs.[68] Indeed, many saw the exponential growth of municipal Wi-Fi as proof the commercial broadband market failed and GONs were the most viable means of providing all citizens with "free and low-cost … broadband."[69]

This initial wave of enthusiasm diminished almost as quickly as it began because of the many problems Philadelphia encountered in deploying its network. After several years of negotiating over rights-of-way access and experimentation with business models, the project collapsed under the weight of soaring budgets and tepid demand.[70] The mesh networking technology was incapable of covering the city's 135 square miles with reliable service.[71] In addition, the initial budget of $10 million eventually tripled.[72] As a result, project viability depended on a large number of residential subscriptions. Low quality of service, coupled with significantly better and cheaper service options offered by incumbent ISPs, resulted in fewer than 6,000 total subscriptions; fewer than 1,000 were new Internet users.[73]

The fallout from Philadelphia had consequences for other municipalities. Between 2005 and 2008, a number of large cities terminated their municipal wireless plans. Examples included Orlando, which, in 2005, "pulled the plug on its free downtown Wi-Fi service because only 27 people a day were accessing it."[74] Chicago, Houston, San Francisco, St. Louis, and Cincinnati, among many others, also opted to put their wireless plans on hold.[75]

These failures occurred for two primary reasons.

- First, there was a lack of demand for free or low-cost municipal Wi-Fi due mostly to the increasing availability of higher quality and lower-priced wired—and, eventually wireless—broadband connections. Between June 2005 and June 2007, the number of broadband subscribers in the United States more than doubled, from 42.5 million to nearly 101 million.[76] Broadband prices also fell during this period,[77] and mobile broadband, enabled by new third-generation (3G) wireless networks, emerged as a viable, affordable, and extremely popular alternative to traditional wired connections.[78]
- Second, no city succeeded in developing a viable business model to support its Wi-Fi efforts.[79] Beyond the Philadelphia failure, many other business models for large-scale municipal wireless projects proved unsuccessful. Perhaps the most notorious was an attempt to offset the costs associated with providing free or very low cost wireless Internet access with revenue derived from the sale of location-based advertising.[80] This model, initially championed by Google in San Francisco, quickly drew the ire of residents who feared for

67 *Id.*

68 *See, e.g.,* Sharon Gillett, *Municipal Wireless Broadband: Hype or Harbinger?*, 79 S. Cal. L. Rev. 561, 579-581 (2006) (providing an overview of planned deployments in 2004-2006).

69 *Wi-Fi Everywhere* at 1704.

70 *See* Dan P. Lee, *Power: Whiffing on Wi-Fi,* Sept. 24, 2008, Philadelphia Magazine*, available at* http://www.phillymag.com/articles/power_whiffing_on_wi_fi.

71 *Id.* (noting that the Wi-Fi technology "couldn't penetrate thick walls, or heights, or other obstructions.").

72 *Id.*

73 *Id.*

74 *See* Mark Williams, *Golden Gate Lark*, Technology Review, Sept. 2006 ("*Golden Gate Lark*").

75 *See* Judy Keen, *Cities Turning Off Plans for Wi-Fi*, Sept. 20, 2007, USA Today.

76 *See High-Speed Services for Internet Access: Status as of December 31, 2008*, at Table 1, FCC (Feb. 2010) ("*High-Speed Services for Internet Access: Status as of December 31, 2008*").

77 *See* John Horrigan, *Home Broadband Adoption 2009,* at p. 25, Pew Internet & American Life Project (June 2009), *available at* http://www.pewinternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf ("*Home Broadband Adoption 2009*").

78 Between 2005 and 2007, the number of mobile broadband connections in the United States increased from just 380,000 to over 35 million. *High-Speed Services for Internet Access: Status as of December 31, 2008* at Table 1. For additional discussion, *see infra,* section 3.1.

79 *See, e.g.,* Bryan Gardiner, *What's Behind the Epidemic of Municipal Wi-Fi Failures?*, Sept. 4, 2007, Wired.com*, available at* http://www.wired.com/techbiz/it/news/2007/09/muni_wifi?currentPage=all.

80 *Rationalizing Municipal Broadband* at 72-73.

their privacy.[81] Even though the main reason for the unraveling of the San Francisco project was economic, privacy concerns played a major role in pushing up projected costs.[82]

A comprehensive study of failed GONs projects summed up the entire debate by stating, "Regardless of the reason given for establishing municipal networks, the results are always the same: a dangerous government market grab that fails to perform as projected."[83] There was growing evidence that the economics of GONs rarely, if ever, worked.[84] In response to these failed projects, a number of states passed laws, or considered legislation, to prohibit or restrict the use of public resources to support municipal broadband.[85]

Policy makers at every level of government sought to draw lessons from these failures and incorporate them into a clearer decision-making process in order to leverage their resources in the most efficient and cost-effective manner.[86] These responses revealed a common desire to reduce or eliminate the risk of squandering public resources.

2.3 GONs 2.0: From Wi-Fi to Fiber

By some estimates, the failed experiment with municipal Wi-Fi contributed significantly to an estimated $800 million in public spending on GONs.[87] Notwithstanding the many failures, GONs proponents continued to encourage cities and towns to deploy broadband networks. One argument was municipal Wi-Fi systems failed because of too *little* government involvement. Some faulted local governments like Philadelphia for attempting to use a public-private model in the deployment of municipal broadband networks. The crux of this argument was that these local governments would have been better off shouldering the entire burden themselves:

> The basic idea of offering Internet access as a public service is sound. The problem is that cities haven't thought of the Internet as a form of public infrastructure that—like subway lines, sewers, or roads—must be paid for. Instead, cities have labored under the illusion that, somehow, everything could be built easily and for free by private parties.[88]

To support this position, proponents framed their case around a cadre of smaller cities where government-owned Wi-Fi seemed successful in the early and mid-2000s. Examples included St. Cloud, Florida, which had

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81 *See, e.g.,* Elinor Mills, *Google in San Francisco: Wireless Overlord?*, Oct. 1, 2005, CNET News.com, *available at* http://news.cnet.com/Google-in-San-Francisco-Wireless-overlord/2100-1039_3-5886968.html (discussing initial privacy concerns regarding Google's proposal); Verne Kopytoff, *Wi-Fi Plan Stirs Big Brother Concerns*, April 8, 2006, S.F. Chronicle, *available at* http://articles.sfgate.com/2006-04-08/business/17288637_1_google-wi-fi-privacy-advocates-google-inc-s-plans (noting that "Privacy advocates are raising concerns about Google Inc.'s plans to cover San Francisco with free wireless Internet access, calling the company's proposal to track users' locations a potential gold mine of information for law enforcement and private litigators.").

82 *See* Robert Selna, *S.F. Citywide Wi-Fi Plan Fizzles as Provider Backs Off*, Aug. 30, 2007, S.F. Chronicle, *available at* http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/08/30/MNEJRRO70.DTL&hw=earthlink&sn=001&sc=1000 (noting that city approval of the plan hinged on more robust privacy safeguards that would have undermined the original business model for the network).

83 *See* Sonia Arrison, Dr. Ronald Rizzuto, and Vince Vasquez, *Wi-Fi Waste: The Disaster of Municipal Communications Networks,* at p. 5, Pacific Research Institute (Feb. 2007) ("*Wi-Fi Waste*").

84 *Id.* For an economic analysis of GONs through 2005, *see* Michael Balhoff and Bob Rowe, *Municipal Broadband: Digging Beneath the Surface*, Balhoff & Rowe LLC (Sept. 2005), *available at* http://www.balhoffrowe.com/pdf/Municipal%20Broadband--Digging%20Beneath%20the%20Surface.pdf.

85 *See, e.g., Rationalizing Municipal Broadband* at p. 68 (noting that, by 2007, about half the states in the country had "enacted, or were considering, legislation that addresses the municipal broadband debate.").

86 *See, e.g., Municipal Provision of Wireless Internet*, at p. 41-48, Staff Report, Federal Trade Commission (Sept. 2006), *available at* http://ftc.gov/os/2006/10/V060021municipalprovwirelessinternet.pdf (articulating a number of guiding principles for policy makers and capturing them in a "decision-tree" that was meant to guide decision-making processes by state and local officials).

87 *Wi-Fi Waste* at p. 3.

88 *See* Tim Wu, *Where's my Free Wi-Fi?*, Sept. 27, 2007, Salon.com, *available at* http://www.slate.com/articles/technology/technology/2007/09/wheres_my_free_wifi.single.html. The irony here, of course, is that basic public infrastructure in the U.S. – sewers and roads included – has long been considered crumbling and inferior because of chronic under-investment by the public sector. *See, e.g., Report Card for America's Infrastructure: 2005,* American Society of Civil Engineers, *available* at https://apps.asce.org/reportcard/2005/index2005.cfm (assigning an overall grade of "D" to the country's basic infrastructure, down from a "D+" in 2001). For additional discussion and analysis on this point, *see infra,* section 3.2.

successfully deployed Wi-Fi systems because, according to the argument advanced by proponents, they were delivered as public services (i.e., solely by the municipality via public funding).[89] But by 2010, many of these systems had failed. St. Cloud ended its free Wi-Fi service in 2009 because of budget concerns and low usage rates.[90] Between 2007 and 2010 the total number of cities that had deployed or were considering deploying public Wi-Fi systems decreased from over 400 to fewer than 200.[91]

GONs proponents often argued that the private sector had "persuade[d] [municipalities] either to adopt ownership models that [were] more likely to fail, or to adopt less ambitious networks that [did] not pose significant threats to incumbents."[92] This critique echoed much of the rhetoric put forward during the open access debate and subsequent discussions regarding how regulation could be used to save a "failing" broadband market. Although the market for commercial broadband services was thriving in the late 2000s,[93] some still viewed the U.S. broadband market as insufficiently competitive and looked to GONs to inject competition into stagnant markets by providing "open access network[s] … open to all service providers."[94]

By 2008, GONs proponents began to shift their focus away from wireless and toward wireline broadband. Deployment of fiber-optic GONs became the favored option for those who thought the failure of municipal Wi-Fi might spell the end of the GONs movement. This shift in advocacy was subtle and necessitated a rethinking of how to frame new calls for municipal networks in the wake of major public Wi-Fi failures. A report commissioned by the mayors of Boston, Chicago, and San Francisco in 2008 hinted at this reframing by saying continued competitiveness and economic growth at the municipal level hinged on widespread access to fast, reliable, next-generation broadband networks.[95] Others amplified these themes by arguing fiber held the most promise for GONs because it "boast[ed] nearly unlimited capacity" to support economic development, job creation, and civic participation.[96]

Implicit in this reframing was a decision to place GONs far ahead of actual consumer demand[97] and attempt to "future-proof" advocacy by focusing on what a growing number of advocates considered the end-state

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89 *Id.*

90 *See* Etan Horowitz, *St. Cloud Pulls Plug on Free Citywide Wi-Fi*, Sept. 29, 2009, Orlando Sentinel, *available at* http://articles.orlandosentinel.com/2009-09-29/news/0909290002_1_free-wi-fi-city-council-free-internet-access (noting that, at its peak, less than a quarter of the population used the network and that, by shutting down the system, the city would save $370,000 in maintenance fees each year).

91 *Compare* Bert Latamore, *What's the Future of Municipal Wi-Fi?,* Nov. 24, 2007, PCWorld.com, *available at* http://www.pcworld.com/article/139845/article.html (quoting a report that found that "400 U.S. communities were in some stage of broadband service creation" by the end of 2007), *with* Esme Vos, *Updated list of US cities and counties with large scale WiFi networks*, June 7, 2010, Muniwireless.com, *available at* http://www.muniwireless.com/2010/06/07/updated-list-of-cities-and-counties-with-wifi/ (reporting that that number had decreased to less than 200 by mid-2010).

92 *See* John Blevins, *Death of the Revolution: The Legal War on Competitive Broadband Technologies*, 12 Yale J. on Law & Tech. 87, 107 (2010) ("*Death of the Revolution*").

93 For discussion and analysis, *see infra,* section 3.1.

94 *See* Becca Vargo Daggett, *Localizing the Internet: Five Ways Public Ownership Solves the U.S. Broadband Problem*, at p. 7, Institute for Local Self-Reliance (Jan. 2007), *available at* http://www.ilsr.org/wp-content/uploads/files/5ways.pdf.

95 *See The Future of Municipal Broadband: Business, Technology and Public Policy Implications for Major U.S. Cities,* A White Paper Prepared by Civitium LLC for the Mayors of Boston, Chicago, and San Francisco (spring 2008), *available at* http://www.cityofchicago.org/dam/city/depts/doit/supp_info/DEI/MunicipalBroadband.pdf.

96 *See* Craig Aaron, *The Promise of Municipal Broadband*, Aug. 2008, The Progressive, *available at* http://progressive.org/mag/aaron0808.html ("*The Promise of Municipal Broadband*"). *See also Municipal Fiber to the Home Deployments: Next Generation Broadband as a Municipal Utility*, FTTH Council (Oct. 2009), *available at* http://www.baller.com/pdfs/MuniFiberNetsOct09.pdf.

97 In 2009, the FCC estimated that the average broadband user was consuming 9 gigabytes of data each month. Streaming video via services like YouTube accounted for a significant portion of this data. However, the rise of smartphones and faster mobile networks resulted in exponential increases in wireless data use. Overall, customers reported that they were satisfied with their broadband offerings. Indeed, an FCC survey released in 2010 found that only 9% of customers were not satisfied with the speed of their broadband connection. *See Broadband Performance*, at 6, OBI Technical Paper No. 4, FCC (2010), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2010/db0813/DOC-300902A1.pdf (estimating average data consumption); *Press Release: comScore Releases First Comprehensive Review of Pan-European Online Activity*, comScore, June 4, 2007, *available at* http://www.comscore.com/press/release.asp?press=1459 (highlighting increasing usage of online video); *Broadband Satisfaction: What Consumers Report about their Broadband Internet Provider*, at p. 3, FCC (Dec. 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-303263A1.pdf (providing results of a nationwide customer satisfaction survey) ("*Broadband Satisfaction: What Consumers Report*").

of broadband in the United States: gigabit fiber-optic networks.[98] The primary justification was that these networks would serve as the foundation on which new businesses and the future economy would be built.[99] In short, geography would no longer matter if a city had a gigabit fiber network. This reframing seemingly made GONs a *fait accompli* because very few ISPs planned to offer gigabit speeds in the near future—as there was little, if any, demand for such high-speed connectivity.[100] In addition, this position allowed advocates to dismiss the continued incremental improvements in commercial broadband service as insufficient, thus resurrecting criticisms of competition and regulation that had long been advanced by those wary of market forces.[101]

A fiber-based GON often cited as a success in its early days was based in Burlington, Vermont.[102] In 2005, Burlington began offering residents and businesses a proprietary fiber-optic broadband network that had initially been deployed for the exclusive use of city agencies.[103] After securing tens of millions of dollars in financing, Burlington Telecom (BT), the operator, appeared to be on a path toward sustainability in 2007.[104] However, despite a positive cash flow and a slowly expanding subscriber base, by 2008 overall revenues were insufficient to cover its debt payments.[105] By 2009, BT had amassed a significant debt load, leading the city council to conclude that the system was "too deeply indebted to break even given the size of its customer base."[106] To this day, BT remains in debt and continues to struggle to expand its user base.[107]

The struggling Burlington fiber network reveals the enormous stakes involved in the GON debate. As a result of its failed GON, Burlington's credit rating was downgraded on several occasions over the last few years, leaving it on the brink of junk status.[108] And almost a decade after the fiber-based, open access broadband network was deployed, few promised benefits materialized. These dynamics and resulting impacts are not unique to Burlington and, consequently, argue for extensive evaluation and study prior to committing to GONs as a strategy for improving broadband connectivity.

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98 *See, e.g.,* Susan Crawford, Captive Audience: The Telecom Industry and Monopoly Power in the New Gilded Age (Yale University Press: New Haven, CT 2013) ("Captive Audience") (calling for universal deployment of gigabit networks); Reed Hundt & Blair Levin, The Politics of Abundance: How Technology can Fix the Budget, Revive the American Dream, and Establish Obama's Legacy (Odyssey: New York, NY 2012) (calling for more widespread deployment of gigabit hubs) ("The Politics of Abundance").

99 *See, e.g., Broadband as an Economic Development Tool*, NATOA (Nov. 2008), *available at* http://www.natoa.org/policy-advocacy/documents/NATOABroadbandEconStimulus.pdf.

100 *See generally* Robert C. Atkinson et al., *Broadband in America – 2nd Edition,* Columbia University (May 2011), *available at*, http://www4.gsb.columbia.edu/filemgr?file_id=738763 (providing an overview of actual and planned broadband offerings by ISPs).

101 As made abundantly clear in section 3, *infra,* these arguments are without merit.

102 *See, e.g.,* Christopher Mitchell, *Burlington Telecom Profits from Fiber*, Broadband Properties (Oct. 2007), *available at* http://www.broadbandproperties.com/2007issues/october07/Burlington.pdf ("*Burlington Telecom Profits from Fiber*"); Christopher Mitchell, *Burlington Telecom Case Study*, Institute for Local Self-Reliance (Aug. 2007), *available at* http://www.ilsr.org/wp-content/uploads/files/bt.pdf; *The Promise of Municipal Broadband.*

103 *See* Christopher Mitchell, *Learning From Burlington Telecom*, at p. 2, Institute for Local Self-Reliance (Aug. 2011), *available at* http://www.muninetworks.org/sites/www.muninetworks.org/files/bt-lessons-learned.pdf.

104 *Id.*

105 *Id.*

106 *Id.* at p. 4.

107 *See, e.g.,* John Briggs, *Debt Takes Toll; Burlington Telecom Treads Water*, May 13, 2012, Burlington Free Press, *available at* http://www.burlingtonfreepress.com/article/20120514/NEWS02/120513019/Debt-takes-toll-Burlington-Telecom-treads-water.

108 *See Moody's Downgrades Burlington's Bond Rating*, June 21, 2012, Vermont Biz, *available at* http://www.vermontbiz.com/news/june/moodys-downgrades-burlingtons-bond-rating. *See also Rating Action: Moody's assigns Baa3 rating to the City of Burlington's (VT) $9 million Taxable General Obligation Bonds, Series 2013A*, April 12, 2013, Moody's Investor Service, *available at* http://www.moodys.com/research/Moodys-assigns-Baa3-rating-to-the-City-of-Burlingtons-VT--PR_270766 (affirming its previous downgrade and maintaining a negative outlook for the city's finances). *See also* Annie Linskey, *Burlington's Quest for Fast Internet Slows Credit Rating,* June 16, 2013, Bloomberg, *available at* http://www.bloomberg.com/news/2013-06-17/burlington-s-quest-for-fast-internet-slows-credit-rating.html (noting that ongoing legal troubles with creditors, stemming from the struggling municipal broadband network, led Moody's to warn that it might downgrade the city's debt to junk status).

3 The Modern GONs Debate in Context

This section outlines the essential context for discussions about the efficacy of government-owned broadband networks. **Section 3.1** examines the current state of the U.S. broadband market. **Section 3.2** examines the nature of state and local finances and the condition of basic public infrastructure across the country. This section recommends policy makers focus on addressing critical priorities (e.g., stabilizing budgets and shoring up infrastructure) and working with, rather than around, service providers and other stakeholders in the private and nonprofit sectors to enhance meaningful broadband connectivity.

3.1 Broadband in the United States

The U.S. broadband space has made enormous progress over the last 15 years. The market for high-speed Internet access is in no danger of failing or being controlled by a monopoly.[109] Even so, some GONs proponents believe prices are too high, speeds are too slow, and that the promise of the Internet cannot be realized because ISPs focus on maximizing profits at the expense of consumer welfare.[110] This view describes the U.S. broadband market as inadequate measured against service offerings in countries as disparate as Japan, South Korea, France, and the Netherlands.[111] At the state and local level, the focus shifts to a discussion of ultra-high-speed broadband and the risks a municipality faces in relying on the private sector to ensure residents and businesses have access to "world class" Internet connections.[112]

This section presents a data-based quantitative and qualitative analysis of broadband in the United States. **Section 3.1.1** evaluates how the U.S. broadband space evolved over the last 15 years and analyzes a range of data from both the supply side *and* the equally important demand side. Examining both aspects reveals a vibrant market for broadband services on the supply side, but also key shortcomings on the demand side. These are assessed in **section 3.1.2.**

3.1.1 The Broadband Success Story

Many of the arguments and assertions put forward by municipal broadband advocates are ripe for debate when situated in the context of the U.S. broadband market's trajectory in the past 15 years. Throughout the evolution of the GONs debate, there has been disagreement about the diagnoses of failing or failed broadband in the country. Data indicate that the U.S. broadband market is robust and well positioned to continue improving in response to evolving consumer demand.

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109 One of the more extreme (and recent) versions of this tale can be found in Captive Audience. However, as discussed *supra,* in section 2, this type of criticism has been evident ever since commercial broadband networks first emerged in the late 1990s.

110 *See, e.g.,* S. Derek Turner, *Free American Broadband!*, Oct. 18, 2005, Salon.com, *available at* http://www.salon.com/2005/10/18/broadband_4/ (providing an example of the type of argument made by pro-GONs advocates in the early 2000s).

111 For examples, *see supra*, section 2.1.

112 This kind of rhetoric is informed by notions of local self-reliance and arguments that GONs are best because they "keep[] more money circulating in the local economy." *See* Christopher Mitchell and Sascha Meinrath, *Want to Pay Less and Get More?*, Aug. 1, 2012, Slate, *available at* http://www.slate.com/articles/technology/future_tense/2012/08/community_based_projects_ make_broadband_internet_access_high_speed_and_affordable_.html.

Section 3 Highlights

Two sets of issues provide essential context for evaluating GONs proposals. The first set focuses on the state of the broadband sector. The second set focuses on the capabilities of municipalities to fund and maintain major infrastructure projects.

State of Broadband. Assertions that the market is failing or underperforming have long been at the center of calls for local government intervention into the broadband space. Data-driven analyses of both the supply (i.e., availability) and demand sides (i.e., adoption and use) yield much more optimistic findings regarding the health of this space. In particular:

- Throughout the evolution of the GONs debate, diagnoses of failing U.S. broadband have proven factually inaccurate. Data make clear the U.S. broadband market is robust and well positioned to continue improving in response to evolving consumer demand.
- Ample data demonstrate that, by nearly every metric, broadband availability and performance continue to improve across the entire country. Over the last 15 years, prices have declined, average speeds have increased, and the number of service options has multiplied.

Challenges nevertheless remain. On the supply side, some remote parts of the country remain unserved. Efforts by the FCC, the Executive Branch, and state governments are succeeding in helping to plug these gaps. On the demand side, however, data highlight critical challenges that require concerted and collaborative action by stakeholders in the public, private, and nonprofit sectors.

- Some of the most immediate challenges remain on the demand side. Adoption rates in key user groups—senior citizens, people with disabilities, low-income households, and certain minority communities—remain below the national average. This is due in large part to an array of community-specific barriers that impede more robust adoption and utilization of broadband-enabled services.

Local Government Capability. The second set of context issues focuses on the ability of municipalities (and, by implication, states) to fund the construction and ongoing maintenance of these networks—and the opportunity costs of such funding. Among the many factors that influence municipal action of any kind are the volatile state of local finances and the pressing need to invest more resources in shoring up basic public infrastructure like roads, bridges, dams, the electric grid, and water systems.

- The Great Recession exposed a number of critical weaknesses in local finances that, taken together, create an inhospitable environment for massive new investments in or assuming the many risks associated with redundant long-term construction projects like GONs.
- By nearly every measure, basic public infrastructure in this country is literally crumbling and in need of trillions of dollars of investment. To the extent that new funding is available for investment in towns, cities, and states, data indicate that those dollars should be allocated in support of repairing existing infrastructure. In this context, calls to prioritize public spending for the purposes of deploying a GON should be carefully examined in light of these many existing and future obligations.

3.1.1.1 The First Decade (1998–2008)

The federal government began studying trends in computer and Internet usage in the early 1990s,[113] although the first official FCC survey of broadband availability was not released until 1999.[114] In it, the FCC reported that, by the end of 1998, there were about 375,000 residential broadband customers.[115] (The FCC defined broadband as an Internet connection capable of speeds in excess of 200 Kbps.[116]) This represented a residential

113 *See Falling Through the Net: A Survey of "Have Nots" in Rural and Urban America,* National Information and Telecommunications Administration, U.S. Dept. of Commerce (July 1995), *available at* http://www.ntia.doc.gov/ntiahome/fallingthru.html ("*Falling Through the Net I*").

114 *See In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to all Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, First Report, 14 FCC Rcd 2398, CC Docket No. 98-146 (rel. Feb. 2, 1999) ("*1st 706 Report*").

115 *Id.* at para. 88. This number included households and small businesses.

116 *Id.* at para. 20.

penetration rate of 0.4%, a figure the FCC observed to be well ahead of the penetration level for "the telephone, color television, and cellular service at the same stage in their deployment, and approximately the same penetration percentage as that of black-and-white television."[117] Overall, the FCC reported positively on the pace of broadband deployment and was especially encouraged by significant investment in modernizing every part of the communications infrastructure in the United States:

> [W]e are encouraged that deployment of advanced telecommunications generally appears, at present, reasonable and timely. We base this conclusion, in part, on the large investments in broadband technologies that numerous companies in the communications industry are making.[118]

Among its many observations in this first report, the FCC squarely addressed the "pessimis[m]" of predicting the nascent broadband market would quickly fall prey to the forces of natural monopoly.[119] In light of the frothy nature of the early broadband market, characterized by substantial investment and innovation in the delivery of high-speed Internet access services, the FCC concluded that "the preconditions for monopoly [were] absent" from the fledgling market and found that the data did "not indicate that the consumer market [for broadband was] inherently a natural monopoly."[120] Moreover, the FCC expressed its view that the market would continue to evolve and expand to include new competition from wireless service providers (e.g., satellite and mobile).[121]

Table 3.1 provides a snapshot of the U.S. broadband market, observed by the FCC, at the end of 1998.

Table 3.1: Broadband in the U.S. Circa 1998 (Major Platforms)

Service Provider/ Platform	Avg. Speed (download)	Monthly Cost (1998 $)	Monthly Cost (2013 $*)	Availability
Cable/Cable Modem	3 Mbps	$40	$57	Limited (some major cities, suburbs and rural areas)
Telco/ADSL	1.5 Mbps	$50-60	$71-85	Limited (some major cities, suburbs and rural areas)
Telco/ISDN	128 Kbps	$30-50	$43-71	Most Major Cities (mostly for business)
Satellite	400 Kbps	$30-50	$43-71	Nationwide

Source: *1st 706 Report, FCC (February 1999)*
*Adjusted for inflation using CPI Inflation Calculator, U.S. Bureau of Labor Statistics, http://www.bls.gov/data/inflation_calculator.htm

Although many data benchmarks and analytical techniques used in 1998 and 1999 would be refined over time, the FCC in this first assessment of the U.S. broadband market set forth an approach to thinking about and measuring competition that remained a touchstone for the next 15 years:

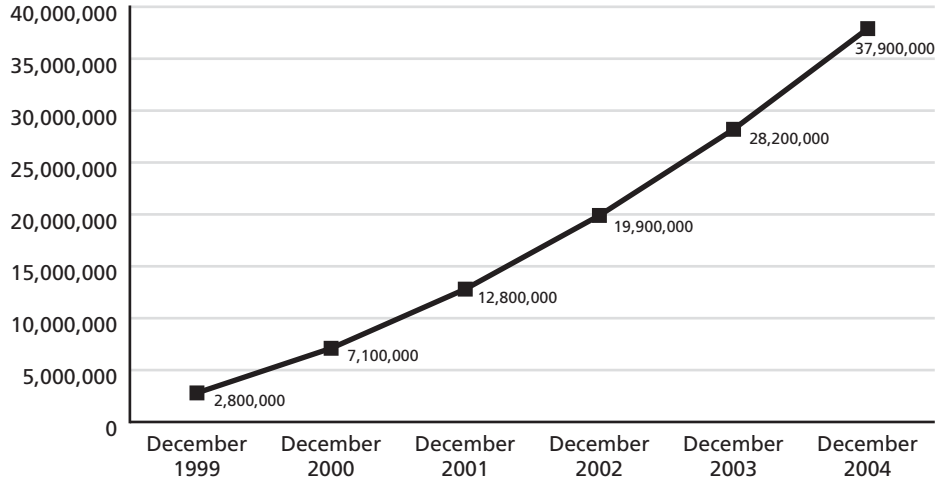
> The consumer market for broadband should be characterized by new products and services being offered and costs falling as a result of technological change. At the retail level, in addition, competition among providers of broadband service may occur on price (different

117 *Id.* at para 92.
118 *Id.* at para. 6. *See also id.* at para 36-61 (discussing investments in backbone, middle-mile and last-mile segments of broadband networks).
119 *Id.* at para 47.
120 *Id.* at para. 48.
121 *Id.* at para. 49.

prices and different rate structures (flat-rate and usage-sensitive)), quality of service (different volumes and speeds of transmission in one or both directions), warranties against outages, technical features (symmetrical and asymmetrical bandwidth, storage space), geography (one technology working best in one kind of topography), and user friendliness (some customers wanting just easy-to-use e-mail and fast web access and others wanting their own personal web pages and major multimedia applications).[122]

Over the next few years, the FCC observed continued exponential growth in the consumer market for broadband services. In the years before mobile broadband emerged as a viable competitor to wireline (in the mid-2000s), the U.S. market underwent significant change as firms sought to address growing consumer demand for faster and more ubiquitous connectivity. More specifically, during the period from 1999 to 2004, the market developed considerably in response to the minimalist, bipartisan regulatory approach that had been instituted in the late 1990s.[123] By nearly every measure, the reach and quality of broadband improved immensely during this initial phase of its evolution. For example, the total number of high-speed Internet connections grew almost 14 times larger between 1999 and 2004, increasing from 2.8 million to nearly 38 million (see Figure 3.1).

Figure 3.1: Total High-Speed Lines in Service, 1999–2004



Source: *High-Speed Services for Internet Access: Status as of Dec. 31, 2005, FCC (July 2006)*

Such robust growth stemmed from substantial investment by ISPs to improve the quality and geographic reach of their offerings. During this period, ISPs invested tens of billions of dollars in new and enhanced broadband infrastructure.[124] Thousands of miles of fiber-optic cabling was deployed in the backbone and middle-mile segments of these networks in the late 1990s and early 2000s, while ISPs continued to invest billions in the intricate, capital-intensive task of enhancing last-mile connections to these national networks.[125] Altogether, service providers invested in excess of $500 billion in broadband infrastructure between 1999 and 2004.[126]

122 *Id.* at para. 50.

123 *See supra,* section 2.1, for additional discussion.

124 *See, e.g.,* Patrick Brogan, *Updated Capital Spending Data Show Continued Significant Broadband Investment in Nation's Information Infrastructure,* at p. 2, chart 1, Research Brief, U.S. Telecom (April 2012), *available at* http://www.ustelecom.org/sites/default/files/documents/042012_Investment_2011_Research_Brief.pdf (charting ISP capital expenditures for 1996 to 2011) ("*Updated Capital Spending Data*").

125 *In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to all Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, Second Report, at para. 20-27, CC Docket No. 98-146 (rel. Aug. 21, 2000) ("*2nd 706 Report*") (describing investment and improvement in backbone and middle-mile segments as of 2000).

126 *Updated Capital Spending Data* at p. 2, chart 1.

The immediate result was more widespread access to multiple options for getting online. Between 1999 and 2003, the percentage of U.S. zip codes reporting at least one high-speed line increased from 59 to 93 percent.[127] During that same time period, the percentage of zip codes reporting more than one broadband service provider increased from about 33 to about 80 percent.[128] While the use of zip codes for these purposes was criticized as providing a somewhat skewed picture of broadband in the United States, the FCC noted that such data were nonetheless useful in demonstrating that "steady progress" was being made in the deployment of broadband throughout the country.[129]

Over the next few years, these positive trends in wireline broadband deployment would continue:

- Broadband networks expanded to more parts of the country;
- The variety and speed of broadband offerings increased; and
- Prices decreased.[130]

But the contours of competition in the U.S. broadband market changed dramatically when mobile broadband emerged as an alternative platform for accessing the Internet at high speeds.[131] This shift occurred around the same time that a growing number of critics were calling U.S. broadband uncompetitive, slow, and overpriced, and as advocates were looking to municipal Wi-Fi networks, which could only deliver maximum speeds of 1 Mbps to residents,[132] as a solution.[133]

The rise of mobile services was swift. By 2002, the wireless market had already reached several important milestones: in 2000, the subscriber base eclipsed 100 million,[134] and by 2002 consumers were using more minutes on their cellphones than on their landlines.[135] Between 1999 and 2002, significant progress was made in the development of mobile data offerings as a result of strong consumer demand for more advanced services (e.g., RIM released the first BlackBerry and proprietary wireless e-mail system in 1999).[136]

In an effort to satisfy growing consumer demand, most major carriers in the early 2000s announced plans to invest significant resources in deploying 3G networks, which would provide faster, more reliable Internet connections.[137] The rapid maturation and deployment of these services was impressive: in 2003, the FCC observed maximum mobile Internet speeds of about 144 Kbps;[138] by 2006, maximum download speeds had increased to over 2 Mbps, allowing users to engage in a wide array of online activities.[139] The FCC sought to further these gains and speed along deployment of 3G networks by auctioning off sizeable swaths of new spectrum in 2006.[140] Wireless carriers responded by investing over $24 billion in their networks to support

127 *See 2nd 706 Report* at para. 83; *In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to all Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, Fourth Report, at 30, GN Docket No. 04-54 (rel. Sept. 9, 2004) ("*4th 706 Report*"). At that point in time, broadband was defined as an Internet connection in excess of 200 Kbps.

128 *See High-Speed Services for Internet Access: Status as of June 30, 2005,* Table 5, FCC (April 2006).

129 *4th 706 Report* at p. 30.

130 *See Broadband Deployment is Extensive Throughout the United States, but it is Difficult to Assess the Extent of Deployment Gaps in Rural Areas,* U.S. Government Accountability Office, GAO-06-426 (May 2006), *available at* http://www.gao.gov/new.items/d06426.pdf.

131 For a comprehensive analysis of the evolution of the market for mobile services, *see* Charles M. Davidson & Michael J. Santorelli, *Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century*, 19 CommLaw Conspectus 1 (2010) ("*Seizing the Mobile Moment*").

132 *Rationalizing the Municipal Broadband Debate* at p. 70.

133 *See supra,* section 2.2., for additional discussion.

134 *See In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, Sixth Report, 16 F.C.C.R. 13350, Table 1 (2001) ("*6th CMRS Report*").

135 *Seizing the Mobile Moment* at 34-35.

136 *See* RIM, History, http://www.blackberry.com/select/get_the_facts/pdfs/rim/rim_history.pdf.

137 *6th CMRS Report* at 13397-13398.

138 *In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, Eighth Report,18 FCC Rcd 14783, 14793-14794 (2003).

139 *In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, Eleventh Report, 21 FCC Rcd 10947, 10991-10992 (2006).

140 *Seizing the Mobile Moment* at 39-40.

these many new uses.[141] Other firms throughout the mobile ecosystem responded by producing new devices (e.g., smartphones) and content (e.g., apps) that leveraged these faster, more reliable connections.[142]

In short, the United States broadband services market had changed completely in just one decade. Table 3.2 compares the U.S. broadband market at the end of 2008 with the market at the end of 1999. Table 3.3 provides a snapshot of the broadband market in 2008, similar to the one provided in Table 3.1, which depicted the broadband market in 1998.

Table 3.2: U.S. High-Speed Internet Connections (Total, by Platform): 1999 and 2008

	December 1999	December 2008
DSL & other Wireline*	979,701	31,148,000
Cable	1,414,183	40,251,000
Satellite and Fixed Wireless	50,404	1,423,000
FTTP	312,204	2,884,000
Mobile Wireless	0	26,532,000
Total Connections	2,756,492	102,238,000

Sources: *FCC data reports (2000 and 2012)*

*"Other wireline" includes broadband over power lines and other such services (for the 2008 data) and "traditional telephone company high-speed services and symmetric DSL services that provide equivalent functionality" for the 1999 data.

Table 3.3: Broadband in the U.S. Circa 2008 (Major Platforms)

Service Provider/ Platform	Avg. Speed (download)	Monthly Cost (2008 $)	Monthly Cost (2013 $*)	Availability	Market share**
Cable/Cable Modem	8.6 Mbps†	$43.27†	$46.82	Nationwide (multiple providers)	39%
Telco/DSL	3.5 Mbps†	$60†	$64.92	Nationwide (multiple providers)	31%***
Mobile/ Wireless (3G)	~1-2 Mbps	$30††	$32.46	Nationwide (multiple providers)	26%
Telco/FTTH	20 Mbps†††	$53	$57.34	Select areas (expanding)	3%

Sources: *FCC reports*

*Adjusted for inflation using CPI Inflation Calculator, U.S. Bureau of Labor Statistics, http://www.bls.gov/data/inflation_calculator.htm
**Using data from Figure 3.2
***Includes "other wireline" services (e.g., traditional telephone company high-speed services and symmetric DSL services that provide equivalent functionality)
† Average speed and cost[143]
†† Cost of a wireless plan offered by a major carrier in late 2008[144]
††† Speed and cost of a mid-tier service option offered by Verizon in 2008[145]

141 *See Annual Year-End 2012 Top Line Survey Results*, at p. 2, CTIA – The Wireless Association, *available at* http://files.ctia.org/pdf/CTIA_Survey_YE_2012_Graphics-FINAL.pdf.
142 *See, e.g., Seizing the Mobile Moment* at 35-45 (analyzing innovation in the wireless space between 2002 and 2008).
143 *See* Shane Greenstein & Ryan C. McDevitt, *Evidence of a Modest Price Decline in US Broadband Services*, National Bureau of Economic Research, NBER Working Paper 16166 (July 2010), *available at* http://www.nber.org/papers/w16166.pdf?new_window=1
144 *See, e.g.*, Kelly Hodgkins, *Verizon Wireless kills Pay as You Go data plans, data plans now mandatory*, Nov. 2, 2008, BGR.com, *available at* http://bgr.com/2008/11/02/verizon-wireless-kills-pay-as-you-go-data-plans-data-plans-now-mandatory/.
145 *See, e.g.,* Tamara Chuang, *Speed up your Verizon FiOS Internet for Free; Just Ask*, June 18, 2008, Orange County Register, *available at* http://gadgetress.freedomblogging.com/2008/06/18/verizon-offers-cheaper-faster-internet/2943/ (providing pricing plan information for Verizon's FiOS FTTH service).

3.1.1.2 2009 to the Present

Since 2009, the pace of change in the U.S. broadband space has shown little sign of faltering or reversing course. When placed in the long arc of evolution described above, data indicate the market is continuously evolving in response to organic forces that stem primarily from consumer demand.

Between 2009 and the present, the long-term positive trends identified above are still evident and continue to move in the right direction.

Users. The total number of high-speed lines[146] in service throughout the United States more than doubled, growing from 119,433,000 in June 2009 to 261,731,000 in December 2012 (see Table 3.4).

Table 3.4: U.S. High-Speed Internet Connections (Total, by Platform): 2009 and 2012

	June 2009	December 2012
DSL	30,848,000	31,142,000
Other Wireline*	689,000	822,000
Cable	41,434,000	51,649,000
Satellite	990,000	1,454,000
Fixed Wireless	488,000	771,000
FTTP	3,548,000	6,728,000
Mobile Wireless	41,436,000	169,165,000
Total Connections	119,433,000	261,731,000

Sources: *FCC data report (2013)*

*"Other wireline" includes broadband over power lines and other such services

Investment. Despite a prolonged recession, ISPs continued to invest tens of billions of dollars in their networks. Table 3.5 provides a summary.

Table 3.5: Annual Broadband Capital Expenditure: 2009–2012

Year	Total Broadband Capex
2009	$63 billion
2010	$66 billion
2011	$66 billion
2012	$68 billion

Sources: *U.S. Telecom data; CTIA data; NCTA data*

Competition. These investments are bringing broadband networks to more parts of the country. Intermodal competition continues to spread, and the number of areas unserved by a terrestrial ISP continues to shrink. For example, the percentage of Census tracts with one or fewer fixed (i.e., non-mobile) broadband providers

146 These are all connections in excess of 200 Kbps. Even though the FCC increased the "benchmark" for broadband speeds in 2010 – raising it to 4 Mbps downstream and 1 Mbps upstream – for data collection purposes the Commission still considers 200 Kbps to be the threshold for broadband. *See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Amended by the Broadband Data Improvement Act, Sixth Report,* 25 FCC Rcd 9556, para. 4 (2010) (defining the new "benchmark" for broadband); *Instructions for local telephone competition and broadband reporting (FCC Form 477)*, at p. 2, FCC (2013), *available at* http://transition.fcc.gov/Forms/Form477/477inst.pdf (defining broadband as any 200 Kbps connection).

decreased from 3.5 percent in June 2009 to 1.2 percent in December 2012.[147] Equally important, by December 2012 about 95 percent of U.S. households had access to at least three different mobile broadband providers.[148] Taken together, these data indicate the vast majority of U.S. households have access to multiple broadband service providers.

Speed. In tandem with sustained investment levels and innovation at the network level, average speeds continue to increase year after year.[149] In addition, a growing number of consumers report higher speeds at home, indicating they are taking advantage of a broad range of available service options. Table 3.6 tracks this migration.

Table 3.6: Broadband Connections by Download Speed (Total, All Platforms): 2009 and 2012

	June 2009	December 2012
Between 200 Kbps & 3 Mbps (% of total connections)	62,291,000 (55%)	119,869,000 (45.8%)
Between 3 Mbps & 6 Mbps (% of total connections)	14,926,000 (13.2%)	42,052,000 (16.1%)
Between 6 Mbps & 10 Mbps (% of total connections)	23,110,000 (20.4%)	40,016,000 (15.3%)
Between 10 Mbps & 25 Mbps (% of total connections)	12,835,000 (11.3%)	39,177,000 (15%)
Between 25 Mbps & 100 Mbps (% of total connections)	187,000* (0.2%)	20,418,000 (7.8%)
Over 100 Mbps (% of total connections)	N/A	201,000 (0.01%)

Sources: *FCC data reports (2009 and 2013)*

*Data for connections with download speeds of at least 25 Mbps

These data highlight several important trends related to broadband speeds. A similar percentage of users continues to prefer speeds in the 3—10 Mbps range despite the availability of faster connections. Data also demonstrate that, though growing exponentially year after year, average data consumption remains low across the user population, which means that download speeds in the 3–10 Mbps range remain adequate.[150] Nevertheless, there has been a significant migration toward connections with download speeds in excess of 10 Mbps. The data demonstrate such a trend toward even faster speeds. To this end, the FCC recently reported that the "average subscribed speed is now 15.6 Mbps, representing an average annualized speed increase of about 20 percent."[151] The data indicate supply is meeting demand.[152]

Prices. In response to competitive pressure and consumer demand, prices for broadband service have leveled off and, in many cases, decreased over the last few years. Moreover, there is ample evidence suggesting U.S.

147 *See Internet Access Services: Status as of June 30, 2009,* at p. 30, Table 13, FCC (Sept. 2010); *Internet Access Services: Status as of December 31, 2012,* at p. 54, Table 24, FCC (Dec. 2013) ("*Internet Access Services: Status as of Dec. 31, 2012*").

148 *See* National Broadband Map, Summarize: Nationwide, http://www.broadbandmap.gov/summarize/nationwide.

149 *See, e.g., The State of the Internet: 3rd Quarter, 2013 Report*, at p. 16, Akamai (Jan. 2014), *available at* http://www.akamai.com/dl/akamai/akamai-soti-q313.pdf?WT.mc_id=soti_Q313 (noting continued strong growth in U.S. Internet connection speeds).

150 *See, e.g.,* Scott Wallsten, *The Real Benefits of Gigabit Networks Have Nothing to Do with Speed,* Technology Policy Institute (May 2013), *available at* http://www.techpolicyinstitute.org/files/wallsten_the_real_benefits_of_gigabit_networks.pdf (providing additional context about the practical value of high-speed Internet connectivity) ("*Real Benefits of Gigabit Networks Have Nothing to Do with Speed*").

151 *See Measuring Broadband America – Feb. 2013*, FCC, *available at* http://www.fcc.gov/measuring-broadband-america/2013/February (providing a detailed analysis of the steady rise in broadband speeds across the U.S.).

152 For additional discussion regarding broadband speeds and consumer demand, *see infra,* section 5.3.

consumers are getting more broadband for their dollar when compared to offerings over time.[153] Table 3.7 provides a value comparison for broadband offerings in 1998, 2008, and 2013.

Table 3.7: Broadband Value Comparison ($/Mbps): 1998, 2008, and 2013

Service Provider/ Platform	1998 $/Mbps (2013 $)	2008 $/Mbps (2013 $)	2013 $/Mbps* (2013 $)
Cable/Cable Modem	$19/Mbps	$5.4/Mbps	$1.10/Mbps[154]
Telco/DSL	$52/Mbps	$18.55/Mbps	$3.32/Mbps[155]
Mobile/ Wireless	N/A	$20/Mbps (3G)	$3.08/Mbps[156] (4G)

Sources : *Figures 3.1 and 3.2*

*Representative offerings of major ISPs

3.1.1.3 Observations

The U.S. broadband market evolved from a fragmented space in 1998 to a thriving ecosystem characterized by multiple providers across multiple platforms competing for customers by offering a menu of different service offerings. Statements about the demise of broadband have been exaggerated. Prices have declined sharply, while average speeds have increased and the number of service options has multiplied. Further, intermodal competition is now widely evident across nearly every part of the country.

In sum, evaluating the U.S. broadband market in isolation or in a static manner necessarily yields incomplete and inaccurate results. Instead, assessing the growth of the market over an extended period of time allows for a more full-bodied assessment of market growth and dynamism. While there have been ongoing assertions of market failures by some, numerous metrics reveal the broadband market has consistently improved since its nascence. While progress in U.S. communications has long been punctuated by impressive leaps and creative destruction and while some supply side challenges remain, the broadband market, by and large, was and continues to be pushed inexorably forward by consumer demand.[157]

153 *See, e.g.,* Richard Bennett, Luke A. Stewart, and Robert D. Atkinson, *The Whole Story: Where America's Broadband Networks Really Stand*, at p. 53, Info. Tech. & Innov. Foundation (Feb. 2013), *available at* http://www2.itif.org/2013-whole-picture-america-broadband-networks.pdf.

154 Based on a package — Extreme 105 — offered by Comcast consisting of a 105 Mbps standalone connection for $115/month (as of February 2014). *See* Comcast, Xfinity Internet, Deal Finder, http://www.comcast.com/.

155 Based on a package — DSL Elite — offered by AT&T consisting of a 6 Mbps connection for $19.95/month (as of February 2014). *See* http://www.attonlineoffers.com/greatoffers/dsl?fbid=Julqt-8DxSb.

156 This figure was arrived at by dividing the average download speed for Verizon Wireless's LTE 4G network, as observed by PC Magazine (13 Mbps), by the monthly cost for a smartphone data plan on Verizon Wireless ($40/month with a 1 GB data cap) as of July 2013. *See* Sascha Segan, Fastest Mobile Networks 2013, June 17, 2013, PC Mag., *available at* http://www.pcmag.com/article2/0,2817,2420333,00.asp; Verizon Wireless, Share Everything Plan, http://www.verizonwireless.com/wcms/consumer/shop/share-everything.html.

157 For a discussion of the regulatory implications of this evolution, *see* Howard Shelanski, *Adjusting Regulation to Competition: Toward a New Model for U.S. Telecommunications Policy*, 24 Yale J. on Reg. 56 (2007) (arguing that the market for advanced communications services necessitated a new type of regulatory approach in order to facilitate continued growth and innovation).

Lingering Supply Side Challenges

Broadband is nearly universal but not quite; some rural areas remain unserved. Private and public resources to bring broadband to these areas are not unlimited, and as discussed in **section 3.2,** the public resources are certainly finite. A key policy focus going forward, at least on the supply side, is for public and private entities to work together and focus efforts and resources on bringing broadband to the few remaining parts of the country that actually remain unserved.

The FCC has begun attempting to shift federal universal service funds to support network deployment to these areas. Additional experimentation is ongoing at the state and local levels, as public entities explore opportunities to partner with the private sector in an effort to figure out the economics of serving these "uneconomic" areas. These and other methods provide municipalities with a wide array of options for bringing broadband to unserved areas and working with ISPs and others to bolster connectivity in areas that are already served.

3.1.2 Demand Side Challenges: Barriers to More Robust Use of Broadband

Much of the debate over broadband in the United States has revolved around the supply of high-speed Internet connectivity. Indeed, even as broadband and intermodal competition diffused across nearly every part of the United States over the last decade, the policy focus has remained largely on notions of universal service, notwithstanding the more systemic issue of disparities in adoption rates across a range of user communities.[158] Implicit in many supply side arguments is an assumption that demand side issues will resolve themselves once there is ample supply of cheap and ultra-fast broadband.[159] Though appealing, this reductive cause-and-effect has been questioned by social scientists, researchers, practitioners, and others who have worked to identify and better understand the complex mechanics associated with broadband adoption across key demographics and in key sectors. The following discussion details the evolution of these challenges and identifies their modern contours.

3.1.2.1 Measuring and Understanding Internet Use

The contours of the digital divide(s) in the United States have been evident since the mid-1990s, when the U.S. Department of Commerce first began to track trends in computer ownership and Internet usage. These early studies identified a number of factors, including age, race, income, and educational attainment, that seemed to predict whether a particular person or household would use these technologies.[160] Table 3.8 provides an overview of Internet use data from the late 1990s and early 2000s.

158 Despite an array of universal service obligations imposed by Federal and state law, basic telephone service never reached 100% penetration. For recent data, *see* Alexander Belinfante, *Telephone Subscribership in the United States (Data Through November 1999),* p. 5, Table 1, Common Carrier Bureau, FCC (Jan. 2000), *available at* http://transition.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/subs1199.pdf (providing telephone penetration data for 1983-1999); Stephen J. Blumberg and Julian V. Luke, *Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, January-June 2013*, CDC (Dec. 2013), *available at* http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201312.pdf (providing telephone penetration data for 2003-2013).

159 *See, e.g.,* Captive Audience.

160 *See Falling Through the Net I; Falling Through the Net II: New Data on the Digital Divide.* NTIA, U.S. Dept. of Commerce (July 1998), *available at* http://www.ntia.doc.gov/report/1998/falling-through-net-ii-new-data-digital-divide; *Falling Through the Net III: Defining the Digital Divide*, NTIA, U.S. Dept. of Commerce (July 1999), *available at* http://www.ntia.doc.gov/legacy/ntiahome/fttn99/FTTN.pdf; *Falling Through the Net IV: Toward Digital Inclusion*, NTIA, U.S. Dept. of Commerce (Oct. 2000), *available at* http://www.ntia.doc.gov/files/ntia/publications/fttn00.pdf.

Table 3.8: Internet Use in the United States (Percent of Population): 1997–2001

	1997	1998	2000	2001
Total Population	22.2%	32.7	44.4	53.9
Race				
White	25.3	37.6	50.3	59.9
Black	13.2	19	29.3	39.8
Hispanic	11	16.6	23.7	31.6
Age				
18–24	31.6	44.3	56.8	65
25–49	27.1	40.0	55.4	63.9
50+	11.2	19.3	29.6	37.1
Income				
<$15,000	9.2	13.7	18.9	25
$35,000–$50,000	22.8	34.7	46.5	57.1
>$75,000	44.5	58.9	70.1	78.9
Education Level				
Less than H.S.	1.8	4.2	8.8	12.8
H.S. Diploma/GED	9.7	19.2	30.6	39.8
College Degree	41.4	58.4	72.5	80.8

Source: *A Nation Online: How Americans Are Expanding Their Use of the Internet, NTIA, U.S. Dept. of Commerce (February 2002), available at http://www.ntia.doc.gov/files/ntia/publications/anationonline2.pdf*

Contemporaneous inquiries into why individuals elected not to go online revolved almost exclusively around attitudes toward the Internet. A Pew survey from 2000, for example, found that most non-Internet users either perceived the Internet to be a "dangerous thing" or did not think they were "missing anything" by being offline.[161] The cost of Internet access and necessary hardware for going online (e.g., a computer) was also cited as an impediment for the unconnected.[162] Early analyses indicated, however, that the cost factor influenced decisions across every demographic and income group, suggesting that the issue of price sensitivity was more nuanced than initially thought.[163]

By the mid-2000s, broadband replaced dial-up as the preferred on-ramp to the Internet, a rapid shift caused by a growing appreciation among consumers and policy makers of the transformative potential of high-speed Internet connectivity.[164] To facilitate continued growth, a minimalist regulatory framework was implemented for broadband access.[165] One important result was across-the-board substantial investment in broadband delivery platforms, which, coupled with increasing consumer demand, extended next-generation networks to

161 *See* Amanda Lenhart et al., *Who's not Online: 57% of those Without Internet Access Say They do Not Plan to Log On*, at p. 3, Pew Internet & American Life Project (Sep. 2000), *available at* http://www.pewinternet.org/~/media//Files/Reports/2000/Pew_Those_Not_Online_Report.pdf.pdf.

162 *Id.*

163 *Id.* at 11. *See also A Nation Online: How Americans Are Expanding Their Use of the Internet*, at p. 75-76, NTIA, U.S. Dept. of Commerce (Feb. 2002), *available at* http://www.ntia.doc.gov/files/ntia/publications/anationonline2.pdf.

164 *See, e.g., Networked Nation: Broadband in America in 2007*, NTIA, U.S. Department of Commerce (Jan. 2008), *available at* http://www.ntia.doc.gov/files/ntia/publications/networkednationbroadbandinamerica2007_0.pdf (discussing the many ways in which broadband was expected to impact the economy and modern life).

165 *See supra,* section 2, for an overview of the regulatory response to broadband and the criticism that it received by GONs advocates.

more areas of the country, encouraged intermodal competition, and led to wider availability of better, cheaper services for households.[166]

Significant growth in adoption rates across every demographic group followed (see Table 3.9).

Table 3.9: Home Broadband Adoption (Percent of Population): 2005–2008

	2005	2006	2007	2008
Total Population	33%	42	47	55
Race				
White	31	42	48	57
Black	14	31	40	43
Hispanic (English Speaking)	28	41	47	56
Age				
18–29	38	55	63	70
30–49	36	50	59	69
50–64	27	38	40	50
65+	8	13	15	19
Income				
<$20,000	13	18	28	25
$50,000–$75,000	35	48	58	67
>$100,000	62	68	82	85
Education Level				
Less than H.S.	10	17	21	28
H.S. Diploma/GED	20	31	34	40
College+	47	62	70	79

Source: *John Horrigan, Home Broadband Adoption 2008, Pew Internet and American Life Project (July 2008), available at http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Broadband_2008.pdf*

As the market for high-speed Internet access continued to develop (on both the supply side and demand side) and as the service became increasingly integral to modern life, understanding the mechanics of broadband adoption and the reasons for non- or under-adoption became a priority. Studies from the early 2000s had confirmed the hazards associated with extending "real world" inequalities into cyberspace.[167] More generally, however, the danger of being left on the wrong side of the digital divide became increasingly palpable as consumers and businesses used their connections for a broader range of personal, civic, social, and commercial activities. Studies increasingly identified digital literacy as a vital component associated with broadband adoption; those without the skills to harness the power of broadband were more likely to view it as too costly or not worth an investment of time and money.[168] As a result, policy makers and other stakeholders slowly began to appreciate the complexities inherent in broadband adoption and focused more on the demand side of the connectivity equation.

166 *See supra,* section 3.1.1, for additional discussion.
167 *See, e.g.,* Paul DiMaggio et al., *Social Implications of the Internet,* 27 Annual Review of Sociology 307–336 (2001).
168 *See, e.g.,* Karen Mossberger et al., Virtual Inequality: Beyond the Digital Divide (Georgetown University Press: Washington, D.C. 2003).

Nevertheless, some continued to believe price was the primary reason for non-adoption in many communities. Much of the appeal of municipal Wi-Fi projects and other GONs from this era hinged on the perceived ability to use these networks to offer free or low-cost broadband Internet access to vast swaths of the population.[169] It was argued that free, readily available Internet access would be enough on its own to encourage non-adopters to go online via a high-speed connection. But, as discussed in **section 2,** many of these systems eventually did not fulfill expectations because of under-use.[170] Free, it turned out, was not enough to attract non-users.[171]

3.1.2.2 Identifying and Understanding Major Barriers to Broadband Adoption

The complex and multifaceted nature of connecting the unconnected became more apparent to policy makers and other stakeholders in the wake of federal efforts to strengthen high-speed Internet access. In conjunction with preparation of its *National Broadband Plan*, the FCC in early 2010 released a comprehensive analysis of broadband adoption in the United States.[172] The FCC would use these findings to inform dozens of recommendations included in its *Plan*, prepared at the behest of Congress to develop a strategy for using broadband to realize a number of "national purposes."[173] More generally, these findings served to sustain the momentum of a variety of other federal broadband-related efforts, including the allocation of billions of dollars in support of programs to bring broadband to unserved areas, raise adoption rates, and improve digital literacy skills.[174]

These efforts encouraged more comprehensive investigations of the myriad practical barriers to broadband adoption in specific user communities and sectors of the economy. The resulting studies, along with the *National Broadband Plan,* provided a more complete understanding of the factors that influence broadband adoption decisions.[175]

A key point that emerged was that many chose not to adopt broadband because they did not see it as relevant to them and thus not worth the investment of time and money to purchase the service (and related equipment, like a computer) and learn how to use it.[176] This outlook impacted the perceived affordability of broadband, contributing to a significant number of non-adopters who viewed the service as too expensive despite the fact

169 *See, e.g., Wi-Fi Everywhere*.

170 *See supra,* section 2.2. *See also Reality Bites*, Aug. 30, 2007, The Economist, *available at* http://www.economist.com/node/9726651 ("Worse, the networks that have been completed have attracted few users. Taipei's city-wide WiFly system, the largest such network in the world, was reckoned to need 250,000 regular subscribers by the end of 2006 in order to break even, but had attracted only 30,000 by April 2007. America's biggest network, around Tempe, Arizona, was aiming for 32,000 subscribers, but had only 600 in April 2006 and has not provided figures since.").

171 These arguments were continuously made despite data to the contrary. Indeed, several studies at the time found that the price of broadband had little effect on adoption decisions. *See* John B. Horrigan, *Why it Will be Hard to Close the Broadband Divide*, at p. 3, Pew Internet & American Life Project (Aug. 2007), *available at* http://www.pewinternet.org/~/media//Files/Reports/2007/Broadband_Commentary.pdf.pdf ("Most research on broadband adoption suggests price is not a large factor in the purchasing decision."); Kenneth Flamm & Anindya Chaudhuri, *An Analysis of the Determinants of Broadband Access*, 31 Telecom. Pol'y 312-326 (July-August 2007).

172 *See* John Horrigan, *Broadband Adoption and Use in America*, at p. 3, OBI Working Paper Series No. 1 (Feb. 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296442A1.pdf ("*Broadband Adoption and Use in America*").

173 *National Broadband Plan* at p. 3.

174 *See, e.g.,* NTIA, BTOP: About, http://www2.ntia.doc.gov/about.

175 These studies included: Charles M. Davidson and Michael J. Santorelli, *Barriers to Broadband Adoption: A Report to the FCC*, Advanced Communications Law & Policy Institute, New York Law School (Oct. 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/ACLP%20Report%20to%20the%20FCC%20-%20Barriers%20to%20BB%20Adoption.pdf (identifying dozens of barriers impeding more robust broadband adoption by senior citizens and people with disabilities and across the education, healthcare, energy, and government sectors) ("*Barriers to Broadband Adoption*"); Jon Gant et al., *National Minority Broadband Adoption*, Joint Center for Political and Economic Studies (Feb. 2010), *available at* http://www.jointcenter.org/sites/default/files/upload/research/files/MTI_BROADBAND_REPORT_WEB.pdf (identifying barriers impacting African Americans and Hispanics) ("*National Minority Broadband Adoption*"); Dharma Dailey et al., *Broadband Adoption in Low Income Communities*, Social Science Research Council (March 2010), *available at* http://www.ssrc.org/workspace/images/crm/new_publication_3/%7B1eb76f62-c720-df11-9d32-001cc477ec70%7D.pdf (identifying barriers impacting low-income households) ("*Broadband Adoption in Low Income Communities*").

176 *See, e.g., Broadband Adoption and Use in America* at p. 5.

prices had been generally declining.[177] A related impediment to further adoption across most user groups was a lack of digital literacy skills.[178] The absence of these skills contributed to widely held fears among non-adopters about the security and privacy of going online and participating in activities like e-commerce.[179]

The impact of these attitudes toward broadband was heightened by numerous other barriers to adoption unique to particular user groups. Many were identified by researchers and social scientists, and used by the FCC in its *Plan*. Table 3.10 provides an overview of barriers impacting four under-adopting user groups: senior citizens, people with disabilities, minorities, and low-income households. A similar range of barriers was seen as obstacles to further use of broadband in key sectors like education, energy, and healthcare. Table 3.11 summarizes those barriers.

Table 3.10: Barriers Impacting Senior Citizens, People with Disabilities, Minorities, and Low-Income Households

Senior Citizens	People with Disabilities	Minority Communities	Low-Income Households
• Lack of awareness regarding the value of using broadband • Usability concerns • Low rate of computer ownership • Security and privacy concerns • Lack of senior-focused training programs	• Low levels of computer ownership • Negative perceptions about broadband accessibility and broadband-enabled services • Affordability concerns • Interoperability of assistive technologies • Lack of digital literacy skills	• Lack of awareness regarding the value of using broadband • Low rates of computer ownership • Affordability concerns • Underdeveloped digital literacy skills	• Perception that broadband is not a worthwhile investment of scarce funds • Lack of digital literacy skills • Low rates of computer ownership • Affordability concerns tied to billing issues

Sources: *National Broadband Plan; Barriers to Broadband Adoption; Broadband Adoption in Low Income Communities; National Minority Broadband Adoption*

Table 3.11: Barriers Impacting the Education, Energy, and Healthcare Sectors

Education	Energy	Healthcare
• Cost concerns • Outdated components of the E-rate program • Lack of a more targeted strategy for allocating federal funding • Inadequate teacher training • Demographic disparities in technology literacy • Organizational barriers among educators • Lack of adequate bandwidth within schools • Lack of national curriculum standards	• Outdated regulatory framework creates little incentive for utilities to innovate • State-by-state patchwork of regulation impedes national-scale deployment • Substantial upfront implementation costs • Lack of demand for smart home services by residential customers • Unresolved data security, cybersecurity, and privacy concerns	• Inadequate reimbursement mechanisms for most telemedicine services • Outdated privacy and security policies • State-by-state patchwork of rules regarding physician licensure and credentialing • Implementation cost concerns • Uncertainty regarding the applicability of tort law • Skepticism among healthcare providers and patients regarding the value of using these tools

Sources: *National Broadband Plan; Barriers to Broadband Adoption*

177 For additional discussion regarding the cost/affordability dynamic, *see* Charles M. Davidson, Michael J. Santorelli & Thomas Kamber, *Broadband Adoption: Why it Matters & How it Works*, 19 Media L. & Pol'y 14 (2009) ("*Broadband Adoption: Why it Matters & How it Works*").

178 *Broadband Adoption and Use in America* at p. 5.

179 *See, e.g., Barriers to Broadband Adoption* at p. 14.

3.1.2.3 Current Broadband Adoption Trends and Continued Challenges

Understanding these nuanced barriers and tailoring outreach efforts to meet unique, group-specific needs, have not translated into significant increases in national broadband adoption figures. Despite increased awareness of the benefits of broadband, hundreds of millions of dollars in funding to support community-based education and training initiatives aimed at bringing more non-users online, continued innovation and competition throughout the ecosystem, and a broader array of service options, adoption levels—across the entire population and in many user communities—have leveled off.[180] Table 3.12 summarizes this trend.

Table 3.12: Home Broadband Adoption (Percent of Population): 2009–2013

	2009*	2010**	2011†	2012††	2013†††
All Adults	65	68	69	65	70
Race					
White	69	72	74	70	74
Black	59	55	55	53	64
Hispanic	49	57	56	49	53
Age					
18–29	75	77 (16–44)	77 (16–44)	75	80
30–49	74			75	78
50–64	64	72 (45–64)	73 (45–64)	62 (50–64)	69 (50–64)
65+	35	45	49	41	43
Income					
Low-income	40 (<$20,000)	43 (<$25,000)	43 (<$25,000)	46 (<$30,000)	54 (<$30,000)
High-income	93 (>$75,000)	93 (>$100,000)	93 (>$100,000)	89 (>$75,000)	88 (>$75,000)
Education Level					
Less than H.S.	24	33	35	27	37
H.S. Diploma/GED	55	57	58	56	57
College+	86	87	88	85	89

* *Broadband Adoption and Use in America*

** *Exploring the Digital Nation: Computer and Internet Use at Home*, National Telecommunications and Information Administration, U.S. Dept. of Commerce (Nov. 2011), available at http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_computer_and_internet_use_at_home_11092011.pdf

† *Exploring the Digital Nation: America's Emerging Online Experience,* NTIA, U.S. Dept. of Commerce (June 2013), available at http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_-_americas_emerging_online_experience.pdf

†† Joanna Brenner & Lee Rainie, *Pew Internet: Broadband,* Pew Internet and American Life Project (Dec. 2012), *available at* http://pewinternet.org/Commentary/2012/May/Pew-Internet-Broadband.aspx

††† Kathryn Zickuhr & Aaron Smith, *Home Broadband 2013,* Pew Internet and American Life Project (Aug. 2013), *available at* http://pewinternet.org/~/media//Files/Reports/2013/PIP_Broadband%202013_082613.pdf

180 *See, e.g.,* Edward Wyatt, *Most of U.S. is Wired, but Millions Aren't Plugged in,* Aug. 19, 2013, N.Y. Times (reporting on recent Internet use and broadband adoption data and noting that usage levels have plateaued in recent years despite significant public and private expenditures to help close the digital divide).

Bridging these divides presents a major public policy challenge. Data and research discussed above indicate that simply installing more broadband infrastructure is not the solution (whether the infrastructure is privately or publicly owned). Policy focused on optimistic assumptions vis-à-vis demand side issues, such as "more supply will equal more demand" or that the price of broadband is the most important consideration, will not address the many community-specific barriers to broadband adoption.

There are numerous viable, impactful roles that policy makers can play on the demand side. A menu of successful approaches to bolstering adoption by addressing discrete barriers and improving digital literacy has emerged over the last few years. Many of the most effective approaches are being deployed at the state and local levels. As has been discussed at length elsewhere,[181] including the *National Broadband Plan*,[182] state and local governments are uniquely positioned to partner with experts in the private and nonprofit sectors toward these ends. Such initiatives have begun to move the needle on broadband adoption in under-adopting communities.[183] (A more comprehensive discussion of these roles is provided in **section 6**.)

3.2 Public Sector Performance to Date: Volatile Economics, Fiscal Instability, and Crumbling Infrastructure

The second key contextual point in any discussion about the viability of GONs revolves around the ability of municipalities, and, by implication, states, to fund the construction, ongoing maintenance, and evolving upgrades of these networks, and the opportunity costs of such funding.

Section 3.2.1 examines the economic realities facing municipalities and states across the country. The Great Recession exposed a number of critical weaknesses in local finances that, taken together, create an inhospitable environment for massive new investments in or the many risks associated with redundant long-term construction projects. The primary purpose of this analysis is to ground GONs discussions in the economic realities facing state and local governments.

Section 3.2.2 discusses the substantial critical infrastructure challenges currently facing the United States as a whole and individual states. By nearly every measure, basic public infrastructure, including roads, bridges, dams, water systems, ports, and the electric grid, is crumbling. Its replacement or repair will require trillions of dollars. To the extent that new funding is available for investment in towns, cities, and states, the data in this subsection indicate that those dollars should be allocated in support of repairing existing infrastructure. Calls to prioritize GONs as targets of public spending must be carefully scrutinized in light of these existing and future obligations.

3.2.1 Economic Realities Facing Municipalities and States

Detroit's recent bankruptcy filing offers a relevant, albeit extreme, example of the harsh economic realities facing states and municipalities of all sizes. No single event or project led to what is the largest municipal bankruptcy filing in U.S. history.[184] Rather, it was the convergence of a host of negative economic and fiscal trends decades in the making. These included a "shrunken tax base but still a huge, 139-square-mile city to maintain; overwhelming health care and pension costs; repeated efforts to manage mounting debts with still more borrowing; annual deficits in the city's operating budget since 2008; and city services crippled by aged

181 *See, e.g.,* Charles M. Davidson, Michael J. Santorelli & Thomas Kamber, *Toward an Inclusive Measure of Broadband Adoption*, 6 Int'l J. of Comm. 2555-2575 (2012) (discussing the importance of local social infrastructures) ("*Toward an Inclusive Measure of Broadband Adoption*").

182 *National Broadband Plan* at p. 167.

183 For additional examples and best practices, *see Broadband Adoption Toolkit*, National Telecommunications & Information Administration, U.S. Dept. of Commerce (April 2013), *available at* http://www2.ntia.doc.gov/files/toolkit_042913.pdf ("*Broadband Adoption Toolkit*").

184 *See* Monica Davey and Mary William Walsh, *Billion in Debt, Detroit Tumbles into Insolvency*, July 18, 2013, N.Y. Times.

computer systems, poor record-keeping and widespread dysfunction."[185] The result was the accumulation of about $18 billion in debt, of which more than half stemmed from pension and healthcare obligations, and a third from water and sewer systems.[186]

Municipal bankruptcies remain exceedingly rare—only one in 2,710 eligible localities has filed for bankruptcy protection since 2008 (see the box to the right for recent examples)[187]—yet the fall of Detroit is symptomatic of deep financial instability across local and state governments.[188] The Great Recession and the subsequent fallout have exposed many shortcomings in public sector finances, which, for too long, had been obscured by a relatively stable economic environment.[189]

Many of the financial woes plaguing municipalities large and small stem from inability or unwillingness to appreciate the long-term consequences of short-term investments or major contractual obligations. A leading example is the looming pension crisis facing local and state governments across the country. These entitlements have become so inured in the political and social fabric that many states have strict laws guaranteeing payment of benefits accrued regardless of prevailing economic conditions.[190] Moreover, creative accounting rules and unrealistic assumptions about how pension funds would grow over time allowed policy makers to gloss over significant deficiencies in these accounts or delay actions that might plug growing gaps.[191]

As a result, and coupled with significant budget shortfalls caused by the Great Recession, state and local pensions are anywhere from 25 percent to more than 50 percent underfunded, which translates to a shortfall

Municipal Bankruptcies Since 2008

Local Government Bankruptcy Filings

- Detroit, Michigan (pending)
- San Bernardino, California
- Mammoth Lakes, California (dismissed)
- Stockton, California
- Jefferson County, Alabama
- Harrisburg, Pennsylvania (dismissed)
- Central Falls, Rhode Island
- Boise County, Idaho (dismissed)

Other Municipal Bankruptcy Filings

- Sanitary and Improvement District #512, Douglas County, Nebraska
- Lost Rivers District Hospital, Idaho
- Mendocino Coast Health Care District, California
- Lake Lotawana Community Improvement District, Missouri
- Rural Water District No. 1, Cherokee County, Oklahoma

185 *Id.*

186 *See* Mike Patton, *Detroit Files for Bankruptcy Protection: The Facts, The Figures, and The Fallout*, July 22, 2013, Forbes.com, *available at* http://www.forbes.com/sites/mikepatton/2013/07/22/detroit-files-for-bankruptcy-protection-the-facts-the-figures-and-the-fallout/.

187 *See Bankrupt Cities, Municipalities List and Map*, Updated: Dec. 3, 2013, Governing.com, *available at* http://www.governing.com/gov-data/municipal-cities-counties-bankruptcies-and-defaults.html. *See also* Mike Maciag, *How Rare are Municipal Bankruptcies?,* Jan. 24, 2013, Governing.com, *available at* http://www.governing.com/blogs/by-the-numbers/municipal-bankruptcy-rate-and-state-law-limitations.html (providing an overview of state laws governing municipal bankruptcy procedures).

188 Standard & Poor's, in a recent analysis of municipal finances, predicted that such bankruptcies would remain rare going forward. *See* Gabriel J. Petek et al., *Municipal Bankruptcy: Standard & Poor's Approach and Viewpoint*, Standard & Poor's (Oct. 4, 2012), *available at* http://www.standardandpoors.com/spf/upload/Ratings_US/Municipal_Bankruptcy.pdf.

189 There is also growing concern that the Detroit bankruptcy could set a troubling precedent for how municipalities treat bond holders during times of fiscal instability or insolvency. More specifically, Detroit is seeking to deprioritize repayment of outstanding bonds by classifying all holders of city debt as a single class of unsecured creditors. *See* Nathan Bomey, *Detroit to Battle Bondholders in Bankruptcy Court,* Feb. 19, 2014, *USA Today*, *available at* http://www.usatoday.com/story/news/nation/2014/02/19/detroit-bankruptcy-bondholders-dispute/5601609/. This has already raised bond prices for localities in Michigan. *See* Mary Williams Walsh, *Woes of Detroit Hurt Borrowing by its Neighbors*, Aug. 9, 2013, N.Y. Times. *See also* Mike Cherney, Kelly Nolan and Emily Glazer, *Detroit Rattles Muni Market*, Aug. 8, 2013, Wall St. Journal (reporting on how similar approaches to Detroit's water and sewer bonds are impacting the broader municipal bond market).

190 *See* Alicia H. Munnell and Laura Quinby, *Legal Constraints on Changes in Local and State Pensions*, Center for Retirement Research at Boston College, Issue in Brief No. 25 (Aug. 2012), *available at* http://crr.bc.edu/wp-content/uploads/2012/08/slp_25.pdf (providing an overview of these various legal protections).

191 *See, e.g., Who Pays the Bill?* July 27, 2013, The Economist ("Pension accounting is complicated. What is the cost today of a promise to pay a benefit in 2020 or 2030? The states have been allowed to discount that future liability at an annual rate of 7.5%-8% on the assumption that they can earn such returns on their investment portfolios. The higher the discount rate, the lower the liability appears to be and the less the states have to contribute upfront.").

of at least $1 trillion and possibly as much as $3 trillion.[192] At the city level in particular, Pew has observed a "widening gap" between pension commitments and funding levels in 61 major cities across the United States.[193] This divide is compounded by similarly generous and legally protected commitments to fund healthcare for retirees. Pew notes that "unfunded liabilities for retiree healthcare loom even larger than for pensions."[194]

Beyond accelerating an avalanche of legacy costs for many cities and states, the Great Recession reminded citizens of the fragility of municipal finances and the fiscal interdependencies between local and state governments. City budgets are typically funded by a diverse mixture of tax revenues derived from individuals and businesses (e.g., sales, property, and income taxes), an assortment of fees and assessments, and state (and, to a more limited extent, federal) budget dollars. The extent to which a particular city or town relies on a certain source of income varies from municipality to municipality.[195] But, in general, about half of local budget revenues are derived from two primary sources: state budgets and property taxes.[196] Of the two, "states fund on average close to a third of local budgets."[197] As a result, municipal budgets are subject to negative shocks whenever there is economic turbulence at the national, state, or local level.

Conversely, given the close economic relationship between cities and states, negative shocks at the local level can trickle up to the state level. One recent study of state budget crises that occurred in the wake of the recent recession concluded that distressed municipal finances in general are a "major threat" to the fiscal sustainability of the states.[198] In short, as much as some municipalities wish to be independent from the influence of state legislatures and governors, these entities remain closely linked economically and tend to rise and fall together. In the GONs context, this linkage is critical because, despite the attempts by some to underscore the importance of preserving some semblance of self-governance, states have significant vested interests in monitoring the economic health (along with numerous other aspects) of their political subdivisions.[199] Because a municipal broadband network represents a significant, long-term commitment of capital and assumption of debt, state governments have a major role to play when they implement GONs-related legal processes to guide the decision-making of local officials.[200]

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192 *Id.* (quoting a report by Moody's that these funds are 52% underfunded). *See also* Alicia H. Munnell et al., *The Funding of State and Local Pensions: 2012-2016*, Center for Retirement Research at Boston College, Issue in Brief No. 32 (July 2013), *available at* http://crr.bc.edu/wp-content/uploads/2013/07/slp_32.pdf (estimating that these funds are underfunded by 27 percent).

193 *See A Widening Gap in Cities: Shortfalls in Funding for Pensions and Retiree Health Care*, The Pew Charitable Trusts (Jan. 2013), *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Retirement_security/Pew_city_pensions_report.pdf.

194 *Id.* at p. 2.

195 *See, e.g.,* Gerald Prante, *Where do State and Local Government Get Their Tax Revenue?* Fiscal Fact No. 194, Tax Foundation (Oct. 2009), *available at* http://taxfoundation.org/sites/taxfoundation.org/files/docs/ff194.pdf (providing an overview of some of the primary sources of tax revenue in states across the country).

196 *See, e.g., The Local Squeeze: Falling Revenues and Growing Demand for Services Challenge Cities, Counties, and School Districts*, at 1, The Pew Charitable Trusts (June 2012), *available at* http://www.pewstates.org/uploadedFiles/PCS_Assets/2012/Pew_Cities_Local%20Squeeze_report.pdf ("*Local Squeeze*").

197 *Id.* at 5.

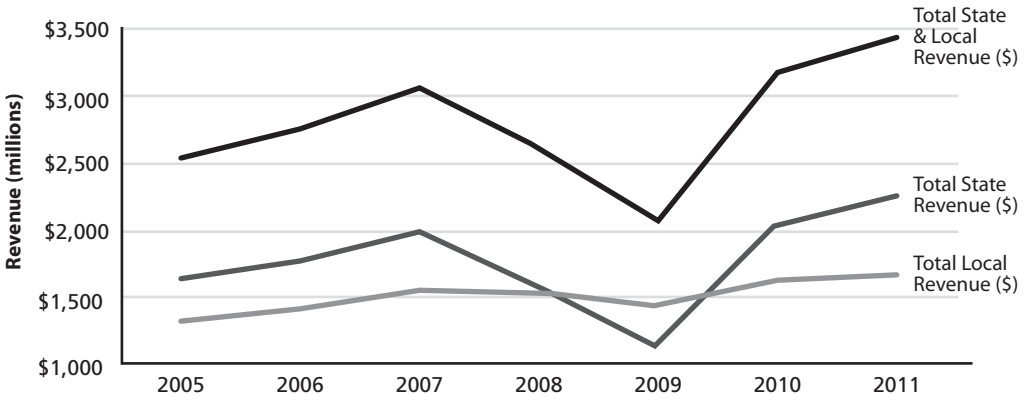
198 *See Report of the State Budget Crisis Task Force*, at p. 54-56, State Budget Crisis Task Force (July 2012), *available at* http://www.statebudgetcrisis.org/wpcms/wp-content/images/Report-of-the-State-Budget-Crisis-Task-Force-Full.pdf ("*State Budget Crisis Task Force Report*").

199 The contours of these relationships, especially in the context of monitoring the economic health of municipalities, are evident in the array of responses to local fiscal crises that have occurred in recent years. Some states, like New Jersey, have implemented relatively comprehensive oversight of local finances. Other states, like Michigan, have demonstrated a willingness to intervene in local matters when the situation becomes dire. In the case of Detroit, for example, the state governor appointed an emergency manager to oversee city government in an effort to manage what had quickly become a financial disaster. Still other states, like Pennsylvania and California, have been faulted for implementing a more hands-off approach to monitoring its municipalities. Much of this criticism stems from several major municipal bankruptcies in these states over the last few years. *See* Mark J. Magyar, *Strict Fiscal Oversight Keeps New Jersey Cities Out of Bankruptcy,* July 22, 2013, N.J. Spotlight, *available at* http://www.njspotlight.com/stories/13/07/21/strict-oversight-keeps-nj-cities-out-of-bankruptcy/?p=all; Monica Davey, *Michigan Naming Fiscal Manager to Help Detroit*, March 1, 2013, N.Y. Times, *available at* http://www.nytimes.com/2013/03/02/us/michigan-appoints-emergency-manager-for-detroit.html?_r=0; Hillary Russ, *Analysis: Pennsylvania City's Woes Fuel Debate on State Oversight*, July 15, 2012, Reuters, *available at* http://www.reuters.com/article/2012/07/15/us-usa-scranton-crisis-idUSBRE86E07C20120715.

200 To date, 19 states have enacted some type of law impacting the deployment of GONs. Many of these require municipalities to undertake comprehensive feasibility studies to ensure that the GON is economically viable. Very few have imposed outright bans on such networks.

While state and local revenues have improved (see Figure 3.2) and while progress has been made toward resolving many of the budget crises that had paralyzed state and local government in the recent past,[201] there is broad agreement that municipal finances in general remain unstable. Property and income tax collections have not grown in recent years, and growth in sales tax receipts remains tepid.[202] Any long-term drop in property tax revenues is especially critical because these receipts "make up more than two-thirds of total tax revenue for local governments as a whole and 100 percent of tax revenue for many school districts and counties."[203] Combined with other unfavorable conditions imposed on local governments by the Great Recession and its aftermath, many municipalities have been forced to slash budgets, dip into "rainy day" funds, or run deficits to continue providing core services to constituents.[204] For these reasons, there have been significantly more municipal credit *downgrades* than upgrades over the last few years.[205]

Figure 3.2: State & Local Revenues: 2005–2011



Source: *Census Bureau State & Local Government Finances Summaries: 2005–2011*

Though critically important to municipalities in the short term, fleeting dips in revenues and cuts to budgets pale in importance to the deep structural shifts remaking local economies across the country. Over the last four years, public sector employment at the state and local levels has been decimated by spending freezes and budget cuts. Indeed, between January 2009 and February 2014, state and local governments cut over 650,000 jobs.[206] The vast majority of these job losses—about 529,000—occurred at the local level.[207] Such deep and consistent cuts have been significant contributors to a national unemployment rate remaining at historically

201 *See, e.g., The Fiscal Survey of States: An Update of State Fiscal Conditions*, A Report by the National Governors Association and the National Association of State Budget Offices (spring 2013), *available at* http://www.nasbo.org/sites/default/files/Spring%202013%20Fiscal%20Survey%20of%20States.pdf (noting that "After several years of slow recovery in the national economy, fiscal distress is finally beginning to subside for most states." *Id.* at vii). *But see* Stephen Moore, *Christmas Comes Early for State Budgets*, July 6-7, 2013, Wall St. Journal (noting that recent increases in state tax revenues are likely to be fleeting and cautioning states to not overspend as a result lest they become embroiled in a "boom-and-bust" cycle of taxing and spending).

202 *See* Michael A. Pagano & Christiana McFarland, *City Fiscal Condition in 2013,* Research Brief on America's Cities, National League of Cities (Oct. 2013), *available at* http://www.nlc.org/Documents/Find%20City%20Solutions/Research%20Innovation/Finance/Final_CFC2013.pdf.

203 *State Budget Crisis Task Force Report* at p. 54.

204 *Id.*

205 *Id.* at p. 56. *See also* Priscilla Hancock, *Navigating the Municipal Market in 2013: Curb your Enthusiasm*, at p. 1, J.P. Morgan Investment Insights (March 2013), *available at* https://www.jpmorganfunds.com/blobcontent/48/731/1323356438694_II-MUNI-SPRING13.pdf ("Since the recession, credit downgrades have consistently exceeded credit upgrades by a significant margin, and no sector of the market has been spared.").

206 *See State and Local Government Employment: Monthly Data (as of March 7, 2014)*, Governing.com, *available at* http://www.governing.com/gov-data/public-workforce-salaries/monthly-government-employment-changes-totals.html.

207 *Id.*

high levels since the end of 2008.[208] Elevated levels of unemployment, coupled with a large pool of people who have given up looking for work, depress tax collections and property taxes, which in turn feeds into budget instability and creates considerable economic uncertainty.

In many instances, private sector job losses stemmed directly from the evisceration of industries that played essential roles in local economies for decades. Although some of these jobs (e.g., construction employment) reemerged in tandem with the revitalization of a particular sector (e.g., housing), there is broad agreement among economists and labor experts that many of the jobs that were lost as a result of the recession are unlikely to return.[209] The manufacturing sector, which has been shedding jobs for decades, is typically cited as the leading example of an industry that has suffered irreparable damage over the last few years.[210] Plant closings, staff reductions, and hiring and wage freezes contributed to significant turnover in this sector.[211] Such medium- and high-paying positions, which were once considered safe and reliable and thus capable of supporting families and communities for generations, have not rebounded during the recovery and have instead been replaced by mostly low-wage positions.[212] Overall, "more than half of all U.S. metro areas won't regain the jobs lost in the recession until the second half of 2015 or later."[213]

3.2.1.1 Observations

Using these dire economic conditions as an opportunity, some advocate in favor of municipal broadband networks by framing them as a critical input for jump-starting economic development.[214] The rationale offered to policy makers, local businesses, and residents typically includes the assumption that the new GON will enable a particular city, town, or region to create its own high-tech start-up community or to attract a range of new businesses.[215] The substantial upfront costs to build and maintain these networks are justified by proponents in light of the many benefits—new sectors, new jobs, and higher wages among them—that are promised to flow from the GON once fully deployed.[216]

There is disagreement among researchers as to whether a new municipal broadband network can revive or remake a local economy. While substantial empirical evidence indicates broadband and broadband-enabled

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208 *See* Bureau of Labor Statistics, Unemployment Rate, http://data.bls.gov/timeseries/LNS14000000. For additional discussion of state and local government employment losses, *see* Lucy Dadayan and Donald J. Boyd, *The Depth and Length of Cuts in State-Local Government Employment is Unprecedented*, Rockefeller Institute of Government at SUNY Albany, Issue Brief (Jan. 2013), *available at* http://www.rockinst.org/pdf/government_finance/2013-01-09-State-Local_Government_Employment.pdf.

209 *See, e.g.,* Bernard Condon and Paul Wiseman, *Recession, Tech Kill Middle-Class Jobs*, Jan. 23, 2013, Associated Press, *available at* http://news.yahoo.com/ap-impact-recession-tech-kill-middle-class-jobs-051306434--finance.html.

210 Between 1980 and 2005, this sector lost about a quarter of its overall workforce. This translates to about 4.5 million job losses. *See* Patricia Atkins et al., *Responding to Manufacturing Job Loss: What Can Economic Development Policy Do?*, Metropolitan Policy Program at Brookings (June 2011), *available at* http://www.brookings.edu/~/media/research/files/papers/2011/6/manufacturing%20job%20loss/06_manufacturing_job_loss.pdf.

211 This sector has lost well over two million jobs since the recession. For an overview of historical data, *see* Bureau of Labor Statistics, Manufacturing Employment Data, http://data.bls.gov/timeseries/CES3000000001.

212 *See* Brad Plummer, *How the Recession Turned Middle-Class Jobs into Low-Wage Jobs*, Feb. 28, 2013, Wash. Post Wonkblog, *available at* http://www.washingtonpost.com/blogs/wonkblog/wp/2013/02/28/how-the-recession-turned-middle-class-jobs-into-low-wage-jobs/ (reporting on data and analysis released by the Federal Reserve Bank of San Francisco).

213 *See* Tim Mullaney, *Many Cities Face Long Wait to Regain Lost Jobs,* June 26, 2013, USA Today, *available at* http://www.usatoday.com/story/money/business/2013/06/26/metro-areas-slow-jobs-recovery-since-recession/2453419/ (reporting on data and analysis released by the U.S. Conference of Mayors).

214 *See, e.g.,* The Politics of Abundance; *Community Broadband Creates Jobs,* Institute for Local Self-Reliance Fact Sheet, *available at* http://muninetworks.org/sites/www.muninetworks.org/files/fact-sheet-econ-dev.pdf ("*Community Broadband Creates Jobs*"); *Missing Our Gigabit Opportunity?,* Aug. 5, 2013, Gig.U Blog, *available at* http://www.gig-u.org/blog/missing-our-gigabit-opportunity.

215 *See, e.g.,* Mark Riffee, *Silicon Valley, Seattle…Chattanooga? Tennessee's 'Gig City' Woos Geeks*, Nov. 22, 2011, Wired, *available at* http://www.wired.com/business/2011/11/chattanooga-gigabit-network/; John Eligon, *Tech Start Ups Find a Home on the Prairie,* Nov. 21, 2012, N.Y. Times, *available at* http://www.nytimes.com/2012/11/22/us/silicon-prairie-takes-root-in-the-great-plains.html?_r=0 (reporting on how cities in the Midwest are attempting to rebrand themselves as part of the "Silicon Prairie").

216 *See, e.g., Business Case for Government Fiber* ("To make the case for investing in a government-owned fiber network, many communities define ROI more broadly and consider the "beyond the balance sheet" benefits that such a network would deliver.").

services create jobs and spur economic development in the United States,[217] there is little, if any, direct empirical evidence that GONs specifically have similar impacts on employment.[218] There is also robust discussion as to whether the presence of an ultra-high-speed broadband network will create new jobs and support new industries.[219] With numerous broadband options already widely available throughout the country, the introduction of a municipal supplier, even one that offers faster speeds in its locality, is unlikely on its own to transform the local economy. Indeed, a growing body of research indicates that the availability of broadband appears to be just one of many factors that impact local economic development.[220]

In the context of GONs that are positioned as essential to supporting the growth of a new high-tech sector, it must be recognized that competition for employment in the Internet ecosystem is very intense. Many of the industries that have been built online are surrounded by very high barriers to entry. To thrive, new firms require significant investment capital, as well as workers with specialized computer and digital literacy skills.[221] And unlike traditional economic hubs (e.g., the local industrial plant), start-ups and other digital firms often prefer to import talent from other states and countries rather than train new workers.[222] In addition, firms in this space tend to employ only a small number of people.[223]

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217 Numerous studies conducted over the last decade have examined the many economic and employment impacts of high-speed Internet connectivity on the U.S. economy. A representative sampling of these includes: Robert Crandall et al., *The Effect of Ubiquitous Broadband Adoption on Investment, Jobs, and the U.S. Economy*, New Millennium Research Council (Sept. 2003), *available at* http://newmillenniumresearch.org/archive/bbstudyreport_091703.pdf; William Lehr et al., Measuring Broadband's Economic Impact, Paper presented at TPRC (Jan. 2006), *available at* http://www.andrew.cmu.edu/user/sirbu/pubs/MeasuringBB_EconImpact.pdf; Robert Crandall et al., *The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data*, Brookings Institute (Nov. 2007), *available at* http://www.brookings.edu/views/papers/crandall/200706litan.pdf; *The Economic Impact of Stimulating Broadband Nationally*. Connected Nation (Feb. 2008), *available at* http://www.connectednation.org/_documents/connected_nation_eis_study_full_report_02212008.pdf; Roger Enter, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, White Paper for CTIA – The Wireless Association (May 2008), *available at* http://files.ctia.org/pdf/Final_OvumEconomicImpact_Report_5_21_08.pdf (updating a 2005, which is *available at* http://files.ctia.org/pdf/Report_OVUM_Economy.pdf); *Economic Impact of Broadband: An Empirical Study*, LECG (Feb. 2009), *available at* http://www.connectivityscorecard.org/images/uploads/media/Report_BroadbandStudy_LECG_March6.pdf; Mark Dutz et al., *The Substantial Consumer Benefits of Broadband Connectivity for U.S. Households*, Compass Lexecon/Internet Innovation Alliance (July 2009), *available at* http://internetinnovation.org/files/special-reports/CONSUMER_BENEFITS_OF_BROADBAND.pdf; Jed Kolko, *Does Broadband Boost Local Economic Development?*, Public Policy Institute of California (Jan. 2010), *available at* http://www.ppic.org/content/pubs/report/r_110jkr.PDF (finding a "positive relationship between broadband expansion and economic growth," but cautioning that the "economic benefits to residents appear to be limited."); Robert Crandall & Hal Singer, *The Economic Impact of Broadband Investment*, Broadband for America (Feb. 2010), *available at* http://www.broadbandforamerica.com/sites/default/themes/broadband/images/mail/broadbandforamerica_crandall_singer_final.docx; *The 2012 Jobs and Broadband Report*, Connected Nation (May 2012), *available at* http://www.connectednation.org/sites/default/files/cn_biz_whitepaper2012_final.pdf; Hanns Kuttner, *Broadband for Rural America: Economic Impacts and Economic Opportunities*, Hudson Institute (Oct. 2012), *available at* http://www.hudson.org/files/publications/RuralTelecom-Kuttner--1012.pdf.

218 Analyses in sections 4 and 5, *infra,* address some of the job creation claims made by GONs advocates.

219 *See, e.g.,* Julius Genachowski, *Faster, Sooner: Why the U.S. Needs 'Gigabit Communities,'* Jan. 18, 2013, Forbes.com, *available at* http://www.forbes.com/sites/ciocentral/2013/01/18/faster-sooner-why-the-u-s-needs-gigabit-communities/ (providing an example of the irrational exuberance that often surrounds talk of "gigabit communities").

220 *See, e.g.,* Jonathan Bowles and David Giles, *New Tech City*, Center for an Urban Future (May 2012), *available at* http://nycfuture.org/pdf/New_Tech_City.pdf (identifying numerous other factors impacting the creation and long-term viability of New York City's still-emerging high-tech sector) ("*New Tech City*"). For further analysis of claimed economic and employment impacts of GONs, *see infra,* sections 5.4 and 5.8.

221 *See, e.g., id.* (discussing the inputs required to sustain New York City's fledgling start-up sector).

222 The composition of Silicon Valley's high-tech workforce is often cited as an example of a high-tech cluster that does not reflect the composition of its surrounding areas. The high tech sector's recent push to reform national immigration laws also reflects a feeling that the domestic supply of qualified high tech workers is lacking. *See, e.g.,* Rebecca Greenfield, *Blacks and Hispanics Aren't Thriving in Silicon Valley's Meritocracy*, Feb. 7, 2013, The Atlantic Wire, *available at* http://www.theatlanticwire.com/technology/2013/02/blacks-and-latinos-arent-thriving-silicon-valleys-meritocracy/61890/ (reporting on minority underemployment in Silicon Valley); Eric Lipton and Somini Sengupta, *Latest Product From Tech Firms: An Immigration Bill*, May 5, 2013, N.Y. Times (reporting on the sector's recent push to reform national immigration laws to facilitate the importation of skilled tech workers).

223 Facebook employs less than 5,000 people. Google employs just over 44,000. AT&T has over 245,000 employees, while General Electric has well over 300,000. This data is *available at* www.finance.yahoo.com.

3.2.2 Infrastructure Challenges

In stark contrast to the robust U.S. broadband market, basic public infrastructure in the United States is suffering. There exist numerous examples of failing roads, bridges, dams, the electric grid, and other core public sector infrastructure across the nation. The box below provides just a few recent examples.

Examples of Major Infrastructure Failures: 2003–Present

2003 Northeast Blackout

- A sagging high-voltage line touching an overgrown tree set off a cascading failure of much of the Northeast United States' electric grid in August 2003. Fifty million people across eight states and parts of Canada were impacted, causing billions of dollars in lost economic activity and highlighting the fragile and antiquated nature of the nation's electric grid.[224]

Failure of Levees during Hurricane Katrina

- Hurricane Katrina exposed in dramatic fashion decades of neglect by local, state, and federal government entities in maintaining and updating the levee system in New Orleans to protect against more powerful storms. The storm damaged about half of all the protective structures in the city, contributing to widespread flooding that resulted in hundreds of deaths and tens of billions of dollars in property damage and lost economic activity.[225]

Major Bridge Failures in Minnesota and Washington

- In 2007, a bridge collapse in Minneapolis, Minnesota, resulted in the deaths of 13 people. The ultimate cause of the failure was an inability to adjust the design of the bridge to reflect ad hoc improvements to it over many decades. The original design of the bridge was "lighter and less expensive to build, but has gradually fallen out of favor with highway departments."[226]
- In 2013, the partial collapse of a bridge in Mount Vernon, Washington, was attributed to an outdated design. Prior to the failure, the bridge was listed as "fracture critical" and "functionally obsolete."[227]

Dam Failures and Near-Failures in the United States

- Between June 2005 and June 2013, there were 173 dam failures and 587 "episodes that, without intervention, would likely have resulted in dam failure."[228]

224 *See, e.g.,* JR Minkel, *The 2003 Northeast Blackout – Five Years Later*, Aug. 13, 2008, Scientific American, *available at* http://www.scientificamerican.com/article.cfm?id=2003-blackout-five-years-later; Charles M. Davidson & Michael J. Santorelli, *Realizing the Smart Grid Imperative: A Framework for Enhancing Collaboration Between Energy Utilities and Broadband Service Providers,* at p. 7-8, Time Warner Cable Research Program on Digital Communications (summer 2011), *available at* http://www.twcresearchprogram.com/pdf/TWC_Davidson.pdf ("*Realizing the Smart Grid Imperative*").

225 *See Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System: Draft Final Report of the Interagency Performance Evaluation Task Force*, Vol. I – Executive Summary and Overview, U.S. Army Corps of Engineers (June 2006), *available at* http://www.nytimes.com/packages/pdf/national/20060601_ARMYCORPS_SUMM.pdf; *A Failure of Initiative: Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina,* at p. 87-97, U.S. House of Representatives (Feb. 2006), *available at* http://www.c-span.org/pdf/katrinareport.pdf.

226 *See, e.g.,* Matthew L. Wald, *Faulty Design Led to Bridge Collapse, Inquiry Finds*, Jan. 15, 2008, N.Y. Times, *available at* http://www.nytimes.com/2008/01/15/washington/15bridge.html.

227 *See, e.g.,* Marisol Bello, *Bridge Collapse Shines Light on Aging Infrastructure*, May 24, 2013, USA Today, *available at* http://www.usatoday.com/story/news/nation/2013/05/24/washington-bridge-collapse-nations-bridges-deficient/2358419/.

228 *See* Association of State Dam Safety Officials, Dam Failures and Incidents, http://www.damsafety.org/news/?p=412f29c8-3fd8-4529-b5c9-8d47364c1f3e.

Appreciating the scale and scope of these particular failures, and the poor condition of U.S. infrastructure in general, should inform any discussion regarding how and where to allocate scarce public funding. In some cases, major natural disasters (e.g., historic hurricanes and floods) exposed underlying weaknesses in infrastructure that had not been updated or properly maintained for decades. In other cases, aged infrastructure failed due to neglect by public officials. Regardless of the particular circumstances that contributed to a fatal failure or near-failure, the common thread throughout is significant under-investment of public resources in shoring up what remains the foundation of modern commerce.

There is little dispute that government should invest public resources in building and maintaining basic infrastructure like roads, bridges, dams, and ports. This has been a core function of government at every level for centuries.[229] And for many decades, especially in the middle part of the 20th century, these investments were significant and typically represented several percentage points of annual GDP.[230] Beyond hastening the modernization of many aspects of American life, these investments consistently generated significant gains in productivity, economic output, and job creation.[231] But for many reasons, overall spending on public infrastructure in the U.S. has steadily decreased over the last few decades.[232] There is a widening gap between the amount spent each year on maintaining critical infrastructure and the amount needed to repair and modernize it. The result is crumbling roads, failing bridges, faulty dams, a fragile electric grid, inadequate ports, and decaying water systems.

This downward spiral has been chronicled by the American Society of Civil Engineers (ASCE). Since 1998, this group has assigned letter grades to various aspects of public infrastructure throughout the United States in an effort to draw attention to the funding gaps and public neglect that are causing such decay. Table 3.13 provides an overview of its findings from 1998 through 2013. These grades paint an ominous picture of infrastructure in the U.S., where little progress has been made in shoring up many of the key areas identified. This is made clear by a cumulative "GPA" that has barely risen in 15 years and an investment gap that has nearly tripled over the last 12 years.

The dire conditions described by these results and the many aspects of the U.S infrastructure crisis have been further fleshed out in other data released in the last few years. A 2013 analysis by *USA Today*, for example, found that only 38 percent of roads in the U.S. are in "good" condition.[233] Transportation for America recently reported that about 11 percent of U.S. bridges remain "structurally deficient" and require "significant maintenance, rehabilitation, or replacement."[234]

These data gain additional relevance and primacy when translated into economic impacts. Failure to modernize and strengthen U.S. transportation hubs, for example, has created bottlenecks and congestion that cost the country around $200 billion each year.[235] Similarly, with "42 percent of America's major urban highways … congested" due to chronic under-investment, the U.S. economy loses about $101 billion each annually in "wasted time and fuel."[236] It is also estimated that "deficient and deteriorating [mass] transit systems cost the

229 For an historical analysis, *see* John Williamson, *Federal Aid to Roads and Highways Since the 18th Century: A Legislative History*, Congressional Research Service (Jan. 6, 2012), *available at* http://www.fas.org/sgp/crs/misc/R42140.pdf.

230 *See, e.g.,* Chris Edwards, *Infrastructure Investment: A State, Local, and Private Responsibility*, Cato Institute Tax & Budget Bulletin No. 67 (Jan. 2013), *available at* http://www.cato.org/sites/cato.org/files/pubs/pdf/tbb_067.pdf (providing an historical overview of public and private investment in U.S. infrastructure) ("*Infrastructure Investment: A State, Local, and Private Responsibility*").

231 *See, e.g., A New Economic Analysis of Infrastructure Investment*, Report Prepared by the Department of Treasury with the Council of Economic Advisers (March 23, 2012), *available at* http://www.treasury.gov/resource-center/economic-policy/Documents/20120323InfrastructureReport.pdf (providing data regarding the economic impact of public infrastructure investment) ("*New Economic Analysis of Infrastructure Investment*").

232 *See, e.g., Falling Apart and Falling Behind,* Transportation Infrastructure Report 2012, Building America's Future (March 2012), *available at* http://www.bafuture.org/pdf/Building-Americas-Future-2012-Report-32013.pdf (examining recent trends in infrastructure investment and highlighting shortcomings) ("*Falling Apart and Falling Behind*").

233 *See* Gary Stoller, *U.S. Roads, Bridges are Decaying Despite Stimulus Influx*, July 29, 2013, USA Today, *available at* http://www.usatoday.com/story/news/nation/2013/07/28/roads-bridges-decaying/2594499/ ("*U.S. Roads, Bridges are Decaying*").

234 *See The Fix We're in For: The State of Our Nation's Bridges 2013*, Transportation for America, *available at* http://t4america.org/docs/bridgereport2013/2013BridgeReport.pdf.

235 *Falling Apart and Falling Behind* at p. 11.

236 *See* ASCE 2013 Infrastructure Report Card, Roads, http://www.infrastructurereportcard.org/a/#p/roads/overview.

U.S. economy $90 billion in 2010,"[237] while underinvestment in inland waterways throughout the country "cost American businesses $33 billion in 2010."[238] An increasing number of power outages and other problems with the U.S. electric grid cost the economy about $150 billion each year.[239]

Table 3.13: Summary of ASCE Infrastructure Report Cards: 1998–2013

	ASCE Grades				
	1998	**2001**	**2005**	**2009**	**2013**
Aviation	C-	D	D+	D	D
Bridges	C-	C	C	C	C+
Dams	D	D	D	D	D
Drinking Water	D	D	D-	D-	D
Energy	n/a	D+	D	D+	D+
Hazardous Waste	D-	D+	D	D	D
Mass Transit	C	C-	D+	D	D
Navigable Waterways	n/a	D+	D-	n/a	n/a
— Inland Waterways	n/a	n/a	n/a	D-	D-
— Levees	n/a	n/a	n/a	D-	D-
— Ports	n/a	n/a	n/a	n/a	C
Public Parks and Recreation	n/a	n/a	C-	C-	C-
Rail	n/a	n/a	C-	C-	C+
Roads	D-	D+	D	D-	D
Schools	F	D-	D	D	D
Solid Waste	C-	C+	C+	C+	B-
Waste Water	D+	D	D-	D-	D
Cumulative GPA	**D**	**D+**	**D**	**D**	**D+**
Investment Gap	**n/a**	**$1.3 trillion***	**$1.6 trillion***	**$2.2 trillion***	**$3.6 trillion****

Source: *ASCE Report Cards – 1998, 2001, 2005, 2009, 2013*

*Estimated five-year need

**Investment needed by 2020

Conversely, numerous positive economic impacts are expected to flow from improvements to these aspects of U.S. infrastructure. Job creation, for example, has long been tied to increases in infrastructure spending. By one estimate, a $1 billion investment in infrastructure "creates more than 25,000 jobs at construction sites and factories producing needed raw materials."[240] More broadly, McKinsey estimates that increasing infrastructure spending by one percent of GDP would "translate into … 1.5 million [direct and indirect jobs]" in the United

237 *See* ASCE 2013 Infrastructure Report Card, Transit, http://www.infrastructurereportcard.org/a/#p/transit/overview

238 *See Crying Out for Dollars*, Feb. 2, 2013, The Economist (reporting data and estimates by ASCE).

239 *See* Brad Plumer, *Bad News: The U.S. Power Grid is Getting Pricier, Less Reliable*, March 8, 2013, Wash. Post Wonkblog, *available at* http://www.washingtonpost.com/blogs/wonkblog/wp/2013/03/08/surprise-the-u-s-power-grid-is-getting-pricier-less-reliable/ (reporting on data analyses from a variety of sources). *See also Economic Benefits of Increasing Electric Grid Resilience to Weather Outages*, Executive Office of the President of the United States (Aug. 2013), *available at* http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf (providing data and observations regarding the significant costs that stem from weather-related power outages).

240 *Falling Apart and Falling Behind* at p. 5.

States.[241] Similarly, investments aimed at increasing the capacity of transportation networks—mass transit, inland waterways, freight and rail systems, and ports—are projected to not only generate new jobs, but also contribute to increased economic activity by, for instance, allowing the U.S. to become a more attractive conduit for shipping goods.[242]

These benefits are also expected to trickle down to the consumer level. Improving roads and bridges, building new transit systems, and boosting the efficiency of air travel will alleviate congestion and help consumers increase productivity (e.g., by not being stuck in traffic for as long or having as many flights delayed) and save money on fuel.[243] Improvements to the electric grid, including the introduction of "smart grid" technologies and services, are also expected to generate significant consumer welfare gains in the form of greater efficiency, more control over consumption, fewer outages, and lower rates.[244]

Closing investment gaps, reversing the long-term trend of ambivalence toward public infrastructure, and realizing the many benefits discussed above, however, will be challenging. Increasing public funding for these purposes will be difficult in the current political and fiscal environment, especially in light of imperatives to balance budgets and cut spending in both the short term and long term.[245] Compounding these difficulties are fundamental disagreements over the proper role of public funding for infrastructure projects going forward. Recent proposals for a national infrastructure bank, for example, acknowledge the heavy burden on state and local finances that increased spending on public infrastructure would have on already strained budgets, as well as shortcomings in existing federal funding mechanisms (e.g., the Highway Trust Fund).[246] A national infrastructure bank is thus seen as one way to help plug gaps by increasing federal infrastructure funding and using those funds to leverage additional private-sector participation in this endeavor.[247]

Alternatively, there have been calls for new policies that would increase private investment and participation in improving infrastructure. In recent years, private investment has dwarfed public spending on infrastructure: "private infrastructure spending—on factories, warehouses, freight rail, pipelines, refineries, and many other items—is about four times larger than federal, state, and local government infrastructure spending combined" and about five times larger if "defense spending is excluded."[248] Some remain skeptical of relying on the private sector to continue driving infrastructure spending, but, overall, there is broad bipartisan support for tapping into the economic incentives that drive such investment and using them to forge public-private partnerships (PPPs) in this context.[249] These arrangements are seen as optimal vehicles for addressing the U.S. infrastructure crisis given their track record of success in leveraging limited public dollars, along with private incentives and

241 *See* Richard Dobbs et al., *Infrastructure Productivity: How to Save $1 trillion a Year,* at p. 4, McKinsey Global Institute (Jan. 2013), *available at* http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Urbanization/Infrastructure%20productivity/MGI_Infrastructure_Full_report_Jan2013.ashx.

242 *See, e.g., Falling Apart and Falling Behind.*

243 *See, e.g., New Economic Analysis of Infrastructure Investment* at p. 18-20.

244 *See, e.g., Realizing the Smart Grid Imperative* (discussing the many benefits expected to flow from the broadband-enabled smart grid).

245 *See, e.g.,* Peter Baker and John Schwartz, *Obama Pushes Plan to Build Roads and Bridges*, March 29, 2013, N.Y. Times, *available at* http://www.nytimes.com/2013/03/30/us/politics/obama-promotes-ambitious-plan-to-overhaul-nations-infrastructure.html?_r=0 (detailing recent infrastructure spending proposals by President Obama and the political response by federal policy makers).

246 *See, e.g.,* William A. Galston and Korin Davis, *Setting Priorities, Meeting Needs: The Case for a National Infrastructure Bank*, at p. 3-4, Governance Studies at Brookings, Brookings Institution (Dec. 2012), *available at* http://www.brookings.edu/~/media/Research/Files/Papers/2012/12/13%20infrastructure%20galston%20davis/1213_infrastructure_galston_davis.pdf ("*Setting Priorities, Meeting Needs*").

247 *See, e.g.,* Douglas W. Elmendorf, *Infrastructure Banks and Surface Transportation*, Congressional Budget Office (July 2012), *available at* http://www.cbo.gov/sites/default/files/cbofiles/attachments/07-12-12-InfrastructureBanks.pdf (discussing how a national infrastructure bank would work).

248 *Infrastructure Investment: A State, Local, and Private Responsibility* at p. 1.

249 *See, e.g., Setting Priorities, Meeting Needs* at p. 2 (rationalizing that increasing federal government spending will help to forge partnerships that fund projects "on the basis of economic and social benefit, not political gain.").

expertise, to realize mutually beneficial goals.[250] PPPs are already popular among municipalities seeking to bolster local infrastructure (e.g., replacing a bridge[251]) or otherwise tap into the expertise of private sector firms (and individuals) to realize efficiencies and cost savings in numerous other instances.[252] (The use of PPPs in the context of broadband deployment is discussed in **section 6**.)

3.2.2.1 Observations

When some GONs proponents address the details of how a municipality might fund deployment of the municipal network,[253] a proposed broadband system is often cast as a modern-day utility that, like any utility, will require substantial and ongoing commitments of public dollars and close regulatory oversight to ensure certain pre-determined outcomes.[254] One rationale offered in support provides that, by taking ownership of broadband, the town or city will be able to "prioritize community needs, not distant shareholder desires."[255] Much confidence is placed in municipal business dealings, a sentiment tied directly to the notion that the primary mission of government is to "maximize the general welfare."[256] Implicit in this reasoning is optimism in the ability of local government to simply increase spending on what is deemed to be essential public infrastructure.[257]

The current state of the nation's public infrastructure, as well as a history of failed and failing GONs, predicts that, over the long run, government-owned broadband systems will likely suffer the same fate of other public infrastructure—stagnation, underinvestment, and public neglect. The investment gap for public infrastructure has nearly tripled over the last 10 years, while private investment in broadband has surged, casting doubt on the notion that government is better positioned to steer this market going forward.

The enthusiastic embrace of PPPs generally and in the broadband space specifically signals recognition among public and private stakeholders that government will play increasingly redefined roles in the infrastructure context going forward. Ongoing efforts to rein in government spending, balance budgets, and restructure

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250 For examples of how to structure successful PPPs, *see, e.g.,* Eric Boyer et al., *Public-Private Partnerships and Infrastructure Resilience: How PPPs Can Influence More Durable Approaches to U.S. Infrastructure*, U.S. Chamber of Commerce, National Chamber Foundation (Jan. 2012), *available at* http://emerging.uschamber.com/sites/default/files/PPPs%20and%20Infrastructure%20-%20NCF.pdf (identifying the many efficiencies that flow from properly structured and executed PPPs); Eduardo Engel et al., *Public-Private Partnerships to Revamp U.S. Infrastructure*, Discussion Paper 2011-02, The Hamilton Project, Brookings (Feb. 2011), *available at* http://www.brookings.edu/~/media/Research/Files/Papers/2011/2/partnerships%20engel%20fischer%20galetovic/02_partnerships_engel_fischer_galetovic_paper.PDF (same); Mark Perlman and Julia Pulidindi, *Public-Private Partnerships for Transportation Projects*, Municipal Action Guide, National League of Cities (May 2012), *available at* http://www.nlc.org/File%20Library/Find%20City%20Solutions/Research%20Innovation/Infrastructure/public-private-partnerships-for-transportation-projects-mag-may12.pdf (discussing the many merits of PPPs in the context of transportation projects); Emilia Istrate and Robert Puentes, *Moving Forward on Public Private Partnerships: U.S. and International Experience with PPP Units*, Brookings-Rockefeller Project on State and Metropolitan Innovation (Dec. 2011), *available at* http://www.brookings.edu/~/media/research/files/papers/2011/12/08%20transportation%20istrate%20puentes/1208_transportation_istrate_puentes.pdf (same); *For the Good of the People: Using Public-Private Partnerships to Meet America's Essential Needs*, at 4, National Council for Public-Private Partnerships (2002), *available at* http://www.ncppp.org/presskit/ncpppwhitepaper.pdf (providing a general overview of and introduction to how PPPs might be used in a variety of contexts).

251 There are numerous examples of PPPs that have been structured around replacing or modernizing a bridge. See, e.g., Martin Z. Braun & Freeman Klopott, Kiewit, *Macquarie Picked to Lead Goethals Bridge Project,* April 25, 2013, Bloomberg, *available at* http://www.bloomberg.com/news/2013-04-24/kiewit-said-to-be-selected-to-lead-new-goethals-bridge-project.html (providing details of a $1.5 billion PPP to replace an aging bridge connecting New York and New Jersey); *A River Runs Through It*, March 2, 2013, The Economist (discussing a PPP to replace a bridge connecting Indiana and Kentucky). *See also A Question of Trust*, May 12, 2012, The Economist (providing an overview of a program in Chicago that was designed to "match public infrastructure needs to private investors on a case-by-case basis").

252 An interesting new variant of the traditional PPP at the city level is the collaboration between city agencies and individuals (or firms) to put digital data to value-enhancing uses. *See, e.g.,* Ben Kesling, *Better Living Through Hacking*, Aug. 13, 2013, Wall St. Journal (profiling a program in Chicago to engage hackers and other computer experts in an effort to "sift through volumes of unorganized [city] data and turn it into useful information").

253 *See, e.g., Business Case for Government Fiber.*

254 The public utility argument in the broadband context has been made for many years. Indeed, it was echoed in the open access debate in the early 2000s and was at the center of the debate over network neutrality. These issues were discussed in section 2, *supra*.

255 *Averting the Looming Broadband Monopoly* at p. 7.

256 *Id.*

257 *See, e.g.,* Captive Audience (calling for the creation of a broadband infrastructure bank).

entitlements, will make it difficult, if not impossible, in the near term to fund discrete projects or support a national infrastructure bank.[258] And to the extent that funding is made available for investment in public works, data from the ASCE and elsewhere support the need to use these resources to address crumbling roads and failing bridges first and foremost, either directly or via PPPs. As such, the confidence that GONs advocates have in the public sector to fix what they see as a failing broadband market is misplaced.[259]

3.3 Takeaways

The data-based analyses included in this section support several important takeaways that are relevant to the GONs debate.

First, the broadband sector in the United States is healthy. The historical data and analyses provided in **section 3.1** demonstrate that the availability of different suppliers and the overall supply of broadband in the United States continue to improve year after year. Such forward progress signifies the success of a "light touch" bipartisan regulatory model that has placed consumer demand as the primary driver of competition and innovation in the broadband market.[260]

Second, despite these gains, the U.S. broadband market remains far from perfect. On the supply side, challenges remain in developing sustainable network deployment models in unserved areas. On the demand side, key user groups, including senior citizens, people with disabilities, and low-income households, continue to have low rates of broadband adoption relative to other groups. Similarly, a number of legal and regulatory barriers impede broadband diffusion across critical sectors like energy, education, and healthcare.

In light of these challenges, the conditions are ripe for targeted government interventions, which might include—

- Supporting broadband training programs;[261]
- Targeting subsidies for under-adopting groups where affordability may be an issue;[262]
- Rolling back legacy regulations impacting the deployment of broadband to rural and unserved parts of the country;[263]
- Forging PPPs with expert firms and nonprofits to realize well-defined goals on both the supply side and demand side;[264] and
- Addressing the dozens of unique barriers impacting adoption decisions in under-adopting user communities and sectors of the economy.[265]

258 *See, e.g.,* Philip Bump, *Obama Calls for Infrastructure Funding – for Fifth Time in Five Years*, March 29, 2013, The Atlantic Wire, *available at* http://www.theatlanticwire.com/politics/2013/03/obama-calls-infrastructure-spending-fifth-time-five-years/63696/ (chronicling repeated failed attempts by the president to rally support for increases in federal infrastructure spending).

259 *Evaluating the Rationales for Government-Owned Broadband Networks* at p. 1 (noting that GONs advocates "view local government as a collective *deus ex machina* needed to revitalize a flagging broadband sector").

260 *See, e.g.,* Gerald R. Faulhaber and David J. Farber, *The Open Internet: A Customer-Centric Framework*, 4 International Journal of Communication 302-342 (2010) (discussing the customer-centric regulatory framework that has long prevailed in the broadband space and arguing against the imposition of additional rules and requirements); Jeffrey A. Eisenach, *Broadband Competition in the Internet Ecosystem,* American Enterprise Institute (Oct. 2012), *available at* http://www.aei.org/files/2012/10/17/-broadband-competition-in-the-internet-ecosystem_164734199280.pdf (discussing the interplay of regulation and competition in the Internet ecosystem).

261 Local and state governments in particular are well positioned to assist in these endeavors. *See infra,* section 6, for additional discussion.

262 The FCC is currently contemplating how to shift subsidies for telephone service to cover broadband. *See In the Matter of Lifeline and Link Up Reform and Modernization*, Report and Order and Further Notice of Proposed Rulemaking, FCC 12-11, 27 FCC Rcd 6656 (rel. Feb. 6, 2012) (adopting a variety of reforms to these ends and calling for additional comment on additional proposed changes).

263 For an overview of these efforts to date, *see* Sherry Lichtenberg, *Telecommunications Deregulation: Updating the Scorecard for 2013*, NRRI (May 2013), *available at* http://nrri.org/documents/317330/0e3a5988-6f57-492d-8ce5-70926cfe68f4 ("*Telecommunications Deregulation: Updating the Scorecard for 2013*").

264 *See infra,* section 6, for additional discussion.

265 *See supra,* section 3.1.2, for discussion of these barriers, and *infra,* section 6, for recommendations regarding local and state action vis-à-vis removing them.

Third, the economic and infrastructure analyses in sections 3.2.1 and 3.2.2 should inform discussions regarding the efficacy of and need for a GON. Too often, the debate over GONs does not adequately examine hard data regarding either the health of the broadband market or the stark economic realities facing the public sector. Nor do discussions acknowledge the opportunity costs associated with steering scarce public funding away from more critical investments like shoring up basic public infrastructure.[266]

Too often, data purporting to substantiate the efficacy of municipal broadband networks are cherry-picked and offered in isolation from other relevant data. For example, two reports issued by the U.S. Government Accountability Office (GAO) in early 2014 appeared to include favorable data regarding the impact of GONs on broadband deployment and competition. Those who advocate in favor of GONs looked to these reports as proof that municipal networks are effective in spurring competition in local markets and as evidence that state laws impacting such deployment should be preempted by the federal government. However, in offering the data and analysis to Congress, the GAO provided a number of important provisos regarding the rigor of its data; accordingly, it warned that the limited scope of its inquiries should not been seen as conclusive of the viability of GONs in any context. Several other weaknesses in the GAO's analyses, including its omission of the high costs associated with building GONs, have been highlighted by others.

Going forward, discussions about GONs should be grounded in as much data as possible and should be properly contextualized. Doing so will yield more informed and impactful policies that steer investments of scarce public resources towards areas of greatest need.

266 For further discussion of the economic and employment benefits associated with investing public resources in modernizing basic public infrastructure, *see generally* Diana G. Carew & Michael Mandel, *Infrastructure Investment and Economic Growth: Surveying New Post-Crisis Evidence,* Policy Memo, Progressive Policy Institute (March 2014), *available at* http://www.progressivepolicy.org/wp-content/uploads/2014/03/2014.03-Carew_Mandel_Infrastructure-Investment-and-Economic-Growth_Surveying-New-Post-Crisis-Evidence.pdf.

Part II

Case Studies & Findings

4 Learning from Experience: Case Studies of 10 Major GONs

Dozens of cities and towns of all sizes have deployed, are in the process of deploying, or are considering the deployment of a GON. Recent data indicate 135 municipal fiber-optic broadband networks have already been built across the country:[267]

- 38 serve only businesses and several are public-private ventures,[268]
- 89 fiber-based GONs provide residential service.[269]

In addition, 74 communities throughout the United States have deployed cable-based GONs that provide Internet access and television services to residents.[270] Dozens of others have built some infrastructure—wire-line (fiber and cable) or wireless (mostly Wi-Fi)—meant to serve at least some residents and businesses.[271]

These are small numbers in the grand scheme of U.S. local government. Over 19,000 municipal governments exist across the country, along with an additional 16,500 town or township governments.[272] Some who advocate in favor of GONs view the slow, but steady, rise in municipal broadband deployments, especially those that are fiber-based, as supporting the arguments about the state of broadband in the United States and the relative ease of building and operating such complex, dynamic networks.[273] In addition, supporters of GONs also cite the rising number of public-private partnerships (PPPs) and other hybrid approaches to bolstering connectivity as further evidence in support of the perceived inadequacies of the market for high-speed Internet access.[274]

Unlike public-private and other hybrid approaches,[275] the planning, funding, construction, maintenance, and operation of a GON is handled completely by the municipality. These municipalities allocate a significant

267 *See* Masha Zager, *Number of Municipal FTTP Networks Climbs to 135*, at p. 22, Broadband Communities (May/June 2013).
268 *Id.* at p. 24.
269 *See* Community Broadband Networks, Map, http://www.muninetworks.org/communitymap.
270 *Id.*
271 *Id.* As noted above in section 2, the number of municipal wireless networks has decreased dramatically in recent years. This is due in large part to the emergence of 3G and 4G wireless broadband adoptions, which are incredibly popular with consumers, as well as a desire by cities to forge PPPs with ISPs to deploy Wi-Fi networks in public spaces (e.g., parks). Additional discussion regarding the latter is provided in section 6, *infra*.
272 *See* U.S. Census Bureau, Lists & Structures of Government, Population of Interest—Municipalities and Townships, http://www.census.gov/govs/go/municipal_township_govs.html.
273 *See, e.g.,* Susan Crawford and Robyn Mohr, *Bringing Municipal High-Speed Internet Access to Leverett, Massachusetts*, Research Publication No. 26 (Dec. 2013), The Berkman Center for Internet & Society at Harvard University, *available at* http://cyber.law.harvard.edu/publications/2013/internet_to_leverett (profiling a "successful" GON in the "hope" that it will "be helpful to other cities that are considering launching fiber optic networks."); Press Release, *Community Broadband Networks Lead the Way on US Ignite Partnership*, June 14, 2012, New America Foundation, *available at* http://newamerica.net/pressroom/2012/community_broadband_networks_lead_the_way_on_us_ignite_partnership (arguing that community broadband networks are on the cutting-edge of innovation in this space vis-à-vis incumbent ISPs); *The Assault on Municipal Broadband,* Free Press Issue Brief (July 2012), *available at* http://www.freepress.net/sites/default/files/resources/brief_broadband.pdf (arguing that GONs should be seen as a necessary community investment because broadband is a "modern-day utility").
274 There is an array of alternative, non-GON approaches to bolstering broadband connectivity on both the supply side and the demand side. Many of these are structured as public-private partnerships, the most successful of which leverage public resources and private expertise to deploy, maintain, and operate high-speed networks. These and other effective non-GONs models for bolstering broadband connectivity are discussed in more detail in section 6.
275 For an overview of how these types of arrangements are typically structured, *see, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Broadband and the Empire State: Achieving Universal Connectivity in New York*, at p. 23-31, ACLP at New York Law School (Sept. 2012), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/ACLP%20Report%20-%20Broadband%20and%20the%20Empire%20State%20-%20September%202012.pdf ("*Broadband and the Empire State*"). For additional discussion *see infra,* section 6.

Table 4.1: Overview of GONs Case Studies

	Network Overview				Cost to Build				Financials (most recent annual figures)			
	Network Type	Status	Subscribers	Fiber Miles	Bonds	Loans*	Gov't Grants	Cross-Subsidies	Revenues	OpEx	Debt Service	PILOTs**
EPB Chattanooga, TN	FTTH	Built	55,000[1]	8,000[2]	$229M[3]	$74.5M[4]	$111M[5]	None	$80.7M[6]	$26.06M[7]	$2.05M[8]	$1.6M[9]
BVU Opt-Net Bristol, VA	FTTH	Built	13,400[10]	1,288[11]	$72+M[12]	$23.7M[13]	$90.4M[14]	None[15]	N/A[16]	N/A[17]	N/A[18]	N/A[19]
LUS Fiber Lafayette, LA	FTTH	Built	14,000[20]	800[21]	$132M[22]	$16.4M[23]	None	None[24]	$24M[25]	$29.3M[26]	$1.5M[27]	$0[28]
FiberNet Monticello, MN	FTTH	Built	1,270[29]	151[30]	$26.4M[31]	$4.1M[32]	None	$4.45M[33]	$1.756M[34]	$2.292M[35]	$1.8M[36]	$0[37]
CFU Fiber Cedar Falls, IA	FTTH	Partially Built	17,000[38]	750[39]	$18.45M[40]	$2.0M[41]	$880k[42]	None	$14.3M[43]	$13.2M[44]	$1.7M[45]	$0[46]
nDanville Danville, VA	FTTH	Partially Built[47]	200[48]	165[49]	None	$2.5M[50]	$1M/ year[51]	None	$1.8M[52]	$1.7M[53]	$0	$250k[54]
UTOPIA UT (multiple cities)	FTTH	Partially Built[55]	8,240[56]	1,800[57]	$185M[58]	$29.7M[59]	$37.2M[60]	None	$11.7M[61]	$12.4M[62]	$12.8M[63]	$0
TVC Groton, CT	Hybrid Fiber/ Coaxial[64]	Built & Sold	N/A[65]	N/A[66]	$34.5M[67]	N/A	None	$2.5M/ year[68]	N/A	N/A	N/A	N/A
iProvo Provo, UT	FTTH	Built & Sold	N/A[69]	N/A[70]	$39.5M[71]	$1M[72]	None	$19.3M[73]	$570k[74]	$1.89M[75]	$3.3M[76]	N/A
Greenlight Wilson, NC	FTTH	Built	6,000[77]	N/A	$33.7M[78]	$4.75M[79]	None	None	$11.42M[80]	$11.42M[81]	$3.02M[82]	$0[83]

M=million; k=thousand

*Financial transfers from a municipality or utility are often in the form a loan. While some have challenged these loans as cross-subsidization, courts often find that these transfers are not, in fact, cross-subsidies. Other networks receive loans directly from financial institutions instead of bonding. As such, this column includes loans from municipalities, utilities, and financial institutions.

**PILOTs, or payments in lieu of taxes, are payments made by utilities and GONs to compensate local governments for tax revenue lost as a result of utilities' entity status and government affiliation. A lack of PILOT payments is essentially equivalent to a lack of tax payments by a private sector entity.

Endnotes are included in Appendix I.

amount of public resources (e.g., taxpayer dollars, debt obligations) in funding these projects, frequently without finding an outlet to hedge against or otherwise spread the many associated risks.[276] In addition, the vast majority of GONs have been deployed in areas already served by multiple wireline and wireless broadband ISPs.[277] As discussed in more detail below such duplicative deployments tend to either undermine the GON or skew market forces.

To better understand the practical difficulties and financial hazards associated with municipal broadband projects, this section profiles 10 GONs. These include networks in Chattanooga, Tennessee; Bristol, Virginia; Lafayette, Louisiana; Monticello, Minnesota; Cedar Falls, Iowa; Danville, Virginia; UTOPIA, Utah (a consortium of 16 cities); Groton, Connecticut; Provo, Utah; and Wilson, North Carolina. These particular networks represent a broad spectrum of recent U.S. municipal broadband efforts. While they share many traits, including being built in areas already served by broadband ISPs, the story of each individual GON provides a series of lessons and insights that can be used by jurisdictions considering the creation of a GON. Table 4.1 provides an overview of the 10 GONs case studies and presents key information on each case.

4.1 Chattanooga, Tennessee

The city-owned gigabit broadband network in Chattanooga, Tennessee, is often cited as a prime example of how municipal networks can thrive under the right circumstances.[278] Since its 2010 launch, the city has rebranded itself as "the gig city"[279] and has begun the processes of trying to use its network to grow a high-tech sector from scratch, and streamline a number of core municipal functions.[280] Federal policy makers have taken note and have cited Chattanooga as a model that other cities might follow in meeting a "gigabit city challenge," which calls for "at least one gigabit community in all 50 states by 2015."[281] Yet a number of aspects of the Chattanooga GON render it unique and may make it difficult for other municipalities to replicate. The system in Chattanooga also has a very high price tag, which caused the city to assume a heavy debt burden and raises the possibility that, over time, the costs of this network might very well outweigh any consumer benefits.

Chattanooga, Tennessee At-A-Glance

City Population: 171,279 (2012)

Year of Network Launch: 2010

Current Status: Built

Number of subscribers: 55,000

Revenues: $80.7 million

Operating Expenses: $26.1 million

Note: Additional information on the Chattanooga network is contained in Table 1 and in Appendix I.

276 Indeed, many of the most popular means of funding these public networks involve either the assumption of significant new debt by a municipality or the reallocation of funds that could be used for other, more impactful purposes (e.g., improving local electric and water systems). *See How Municipal Networks are Financed*, Institute for Local Self-Reliance (Jan. 2014), *available at* http://www.ilsr.org/wp-content/uploads/2014/01/financing-munis-fact-sheet.pdf.

277 *Compare* Community Broadband Networks, Map, http://www.muninetworks.org/communitymap, *with* National Broadband Map, http://www.broadbandmap.gov/.

278 *See, e.g.,* Christopher Mitchell, *Broadband at the Speed of Light: How Three Communities Built Next-Generation Networks,* at p. 31-60, Institute for Local Self-Reliance (April 2012), *available at* http://www.ilsr.org/wp-content/uploads/2012/04/muni-bb-speed-light.pdf ("*Broadband at the Speed of Light*"). *See also* Edward Wyatt, *Fast Internet is Chattanooga's New Locomotive*, Feb. 3, 2014, N.Y. Times, *available at* http://www.nytimes.com/2014/02/04/technology/fast-internet-service-speeds-business-development-in-chattanooga.html ("*Chattanooga's New Locomotive*").

279 *See* The Gig City, http://www.thegigcity.com/.

280 *See, e.g.,* Steve Lohr, *Fastest Net Service in U.S. Coming to Chattanooga*, Sept. 12, 2010, N.Y. Times, *available at* http://www.nytimes.com/2010/09/13/technology/13broadband.html?pagewanted=all (reporting on the city's plans to use its gigabit network for these and other purposes); Laura Baverman, *Chattanooga's Gig City Makes Play to be 'Internet of Things' Capital*, March 15, 2013, Upstart Business Journal, *available at* http://upstart.bizjournals.com/companies/hatched/2013/03/15/need-bandwidth-come-to-gig-city-and.html?page=all (reporting on the city's Gig Tank program to encourage and incubate high-tech startups).

281 *See* Press Release, *FCC Chairman Genachowski Issues Gigabit City Challenge*, Jan. 18, 2013, FCC, *available at* http://www.fcc.gov/document/fcc-chairman-genachowski-issues-gigabit-city-challenge.

4.1.1 Background

The fiber-optic network that would eventually evolve into Chattanooga's gigabit GON first emerged in April 1996, when the board of the city's electric utility[282] —the Electric Power Board (EPB)—passed resolutions authorizing construction of a communications network to connect electrical assets (e.g., substations) and the use of $350,000 to fund the first phase of build-out.[283]

Once deployed, the network was under-utilized for a number of years, leaving the local government and EPB to consider how to put the network to more productive uses.[284] At that time, numerous legal restrictions limited the types of services and businesses in which a municipal utility could engage vis-à-vis its communications network. In the early 2000s, the state legislature began to amend its laws to allow municipal utilities like EPB to offer non-electric services (including "cable service, two-way video transmission, video programming, [and] Internet services")[285] and make loans between their divisions.[286] These amendments spurred plans to commercialize EPB's emerging broadband network. In 2007, the EPB board approved a plan to offer fiber-to-the-home (FTTH) service; in November 2008, the city of Chattanooga granted EPB a franchise for these purposes.[287]

EPB's expansion into the market for telecommunications and broadband services was met with lawsuits from incumbent ISPs and an array of other organizations. The Tennessee Cable Telecommunications Association, for example, filed suit against EPB claiming that its business plan violated Tennessee state law.[288] In particular, the group argued that EPB was illegally cross-subsidizing its communications services with revenue from its electric service.[289] The case was eventually dismissed, and EPB was free to continue with its expansion plans.[290]

4.1.2 Cost and Financing

The EPB fiber network, which supports its gigabit broadband service and a smart grid system,[291] was financed with a number of intra-utility loans, one-off federal grants, and significant debt. All told, the smart grid and broadband networks have cost approximately $390 million to deploy.[292]

At the outset, EPB Fiber, the division of the utility responsible for building the GON, received a $50 million loan from EPB Electric during the planning phase of the FTTH network.[293] In 2009, EPB was awarded $111.5 million in federal stimulus funding from the U.S. Department of Energy in support of its smart grid system.[294] To raise additional funds needed to build the fiber-optic network, EPB issued $229 million of local revenue

282 The board is comprised of five members appointed by the Mayor, each serving a staggered five-year term. Appointments must be approved by the city council. *See Pre-Filed Rebuttal Testimony and Exhibits of Harold E. DePriest, President and CEO of Electric Power Board of Chattanooga*, at p. 3, Tennessee Regulatory Authority, Docket No. 02-00562 (Dec. 22, 2003), *available at* http://www.tn.gov/tra/orders/2002/0200562ao.pdf.

283 *Broadband at the Speed of Light* at p. 32.

284 *Id.*

285 Tenn. Code Ann. § 7-52-601(a), *available at* http://www.lawserver.com/law/state/tennessee/tn-code/tennessee_code_7-52-601.

286 Tenn. Code Ann. § 7-52-603(a)(1)(B), *available at* http://www.lawserver.com/law/state/tennessee/tn-code/tennessee_code_7-52-603.

287 *Broadband at the Speed of Light* at p. 35.

288 *See Cable Group Files Suit To Try To Block EPB Fiber Optic Plan*, Sept. 21, 2007, The Chattanoogan, *available at* http://www.chattanoogan.com/2007/9/21/113785/Cable-Group-Files-Suit-To-Try-To-Block.aspx.

289 *Id.*

290 *See* Press Release, *TCTA Lawsuit Against EPB Dismissed*, April 15, 2008, EPB, *available at* https://www.epb.net/news/news-archive/tcta-lawsuit-against-epb-dismissed/.

291 For an overview of the smart grid system, *see* EPB Electric Power, Smart Grid, https://www.epb.net/power/home/products/smart-grid/.

292 *See* Kevin E. McCarthy, *Chattanooga High Speed Broadband Initiative*, Dec. 14, 2012, Research Report 2012-R-0515, Office of Legislative Research, Connecticut General Assembly, *available at* http://www.cga.ct.gov/2012/rpt/2012-R-0515.htm ("*Chattanooga High Speed Broadband Initiative*").

293 *Id.*

294 *Id. See also* Press Release, *EPB Chattanooga Awarded Federal Stimulus Grant for Smart Grid,* Oct. 28, 2009, EPB, *available at* https://www.epb.net/news/news-archive/epb-chattanooga-awarded-federal-stimulus-grant-for-smart-grid/.

bonds, which carried an interest rate of 4.5 percent and were rated as AA+ by Fitch.[295] About 70 percent of this bond issue—$162 million in all—was used to fund the fiber-optic build-out.[296]

The local revenue bonds have a 25-year maturity and are due to be paid in full in 2033.[297] The EPB communications division maintains a $5 million line of credit secured by revenues and assets, which is used for working capital needs (by mid-2012, about half of this balance was outstanding).[298] In March 2011, EPB obtained a bank loan for $19.5 million over the course of 60 months, guaranteed by the revenues and finances of its communications division.[299] The purpose of this loan was to pay off the loan provided by EPB's electric division.[300] In August of 2012, EPB obtained a $60 million revolving line of credit to pay the remaining loan balance.[301] The line of credit is secured by the assets and revenues from the video and Internet system.[302]

In the recent past, EPB has made a number of financial decisions aimed at securing lower interest rates and more favorable financing terms.[303] Many of these actions were enabled by the network's close relationship with the larger EPB utility and the city of Chattanooga (and, by extension, its residents), all of whom serve as financial backstops for the system. In 2012, there was a downgrade of the utility's bond rating.[304] The downgrade was due to an "increase in leverage to fund capex in the electric system's smart grid."[305] Fitch, the ratings agency, also expressed concern with the use of cross-subsidies (i.e., money from the Fiber division supporting the Electric division) and cost savings (from the smart grid) instead of rate increases to support future EPB investments.[306] In particular, Fitch noted that it was wary of the "variable nature" of these revenue sources.[307]

4.1.3 The Network

The EPB FTTH network is fully operational and provides broadband for schools, residences, and local businesses.[308] The service is available to 170,000 homes, schools, and businesses in the service area, covering 600 square miles and a population of several hundred thousand people.[309] As of September 2013, EPB Fiber had "over 55,000 residential and business customers."[310] Its residential services bring in roughly 65 percent of overall revenue.[311] With regard to its signature gigabit service, by the end of 2013, "only about 3,640 residents, or 7.5 percent of its Internet-service subscribers, [had] signed up" for it.[312] In addition, "roughly 55 businesses" also subscribe to the gigabit service.[313]

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295 *See, e.g., Chattanooga High Speed Broadband Initiative*.
296 *Id.*
297 *Id.*
298 *See Senior Management Report & Financial Information 2012*, at p. 43, EPB (Sept. 2012), *available at* https://www.epb.net/flash/annual-reports/2012/assets/uploads/EPB-Financials.pdf ("*Senior Management Report & Financial Information 2012*").
299 *Id.* at p. 44.
300 *Id.*
301 *See Senior Management Report & Financial Information 2013*, at p. 53, EPB (Sept. 2013), *available at* https://www.epb.net/flash/annual-reports/2013/downloads/EPB_Financials_2013.pdf ("*Senior Management Report & Financial Information 2013*").
302 *Id.*
303 *Id.* at p. 43.
304 *See, e.g.,* Bhala Mehendale, *Fitch Downgrades Chattanooga Electric Power Board, TN Electric System Revs to 'AA'*, March 7, 2012, Fitch Ratings, *available at* http://mobile.reuters.com/article/companyNewsAndPR/idUS241871+07-Mar-2012+BW20120307 ("*Fitch Downgrades Chattanooga Electric Power Board*").
305 *Id.*
306 *Id.*
307 *Id.*
308 The construction timeline was projected to extend over 30 months. *See* Karl Pfeil & Jason Clark, *Fitch Rates Chattanooga Electric Power Board's $215MM 2008 Utility Revs 'AA'*, Feb. 13, 2008, Fitch Ratings, *available at* http://www.fitchratings.com/creditdesk/press_releases/detail.cfm?pr_id=405532.
309 *See Popular Annual Financial Report for the Year Ended June 30, 2012*, at p. 8, City of Chattanooga Finance & Administration Department, *available at* http://www.chattanooga.gov/images/finance_files/FY12_PAFR_updated.pdf.
310 *See EPB Increasing Fiber Optic Speeds; Lowering Customer Prices*, Sept. 17, 2013, The Chattanoogan.com, *available at* http://www.chattanoogan.com/2013/9/17/259342/EPB-Increasing-Fiber-Optic-Speeds.aspx.
311 *Senior Management Report & Financial Information 2012* at p. 17.
312 *Chattanooga's New Locomotive*.
313 *Id.*

An array of lower-tier services is available to residential customers. EPB Fiber offers high-speed Internet, television, and phone, which can be purchased individually or as a bundle. Monthly subscription prices range from $57.99 for basic, stand-alone Internet access with speeds of 100 Mbps, to $149.22, which includes a gigabit connection (1,000 Mbps), an unlimited phone plan, and a premium television package.[314] As a stand-alone feature, a gigabit connection is available for $69.99 per month.[315]

Overall, EPB Fiber's business is profitable. Its revenues were $80 million in 2013, with expenses of $59,877,000.[316] EPB Fiber's total liabilities are $78,055,000[317] (the utility's total liabilities are $514,808,000[318]). While EPB itself is relatively stable, its bond rating was downgraded by Fitch (from AA+ to AA) as a result of the credit risk created by its cross-funding scheme.[319]

4.1.4 Community Impact

The gigabit network in Chattanooga has been the source of considerable attention regarding the merits of engaging in government-directed broadband advancement. Some see the FTTH system and the city's efforts to rebrand itself as a high-tech hub as a reasonable reaction to a long-term decline in the local industrial base.[320] As such, there is significant enthusiasm around the potential for using the GON to spur economic development and create new jobs.

The city has engaged in an aggressive campaign to support high-tech entrepreneurship and encourage more established firms to relocate to the city.[321] For example, EPB and city officials highlight that Chattanooga is home to a new Amazon.com fulfillment center, which opened in 2011 and currently supports about 2,700 jobs.[322] While some argue that the existence of the gigabit network likely had little, if any impact, on Amazon's decision to open a plant in Chattanooga.[323] The Chattanooga plant was one of a number of new distribution centers that Amazon opened in 2010 and 2011.[324] Moreover, an array of tax breaks played a pivotal role in enticing the company to the area as the city competed with other localities to bring the thousands of low-tech jobs to Chattanooga.[325] To date, no empirical evidence exists to confirm a causal relationship about the positive impact of the FTTH network on jobs in Chattanooga.[326] The number of new jobs stemming from the

314 *See* EPB Fiber Optics, Packages—Custom Bundle, https://epbfi.com/enroll/packages/.
315 *Id.*
316 *Senior Management Report & Financial Information 2013* at p. 18.
317 *Id.* at 70.
318 *Id.* at 24.
319 *See Fitch Downgrades Chattanooga Electric Power Board. But see EPB Gets Bond Rating Upgrade,* Oct. 19, 2012, The Chattanoogan, *available at* http://www.chattanoogan.com/2012/10/19/236771/EPB-Gets-Bond-Rating-Upgrade.aspx (reporting that Standards and Poor's had raised EPB's credit rating).
320 *See, e.g.,* The Gig City, About, http://www.thegigcity.com/about ("**The Gig City is a city of pioneers.** Chattanooga has a rich legacy of entrepreneurs—from startups that grew into industry game-changers to civic leaders who changed Chattanooga from the "dirtiest city in America" into Outside Magazine's "best town ever."); Tod Newcombe, *Chattanooga's Internet Rise,* Jan. 22, 2013, Governing.com, *available at* http://www.governing.com/columns/Chattanoogas-Internet-Service-Is-No-Choo-Choo.html.
321 *See, e.g.,* Sarah Rich, *Chattanooga's 'Gig Tank' Results in Real-Time Translator and Research Sharing Apps*, Sept. 11, 2012, Government Technology, *available at* http://www.govtech.com/e-government/Chattanoogas-Gig-Tank.html (reporting on the city's Gig Tank initiative, which was described by officials as "part startup accelerator, part think tank and part contest" for entrepreneurs and students to spend the summer in Chattanooga and develop ideas for applications based on the gigabit per second broadband access available in the city.").
322 *See, e.g.,* Mike Pare, *President Obama Tours Amazon in Chattanooga as Officials Prepare to Increase Workforce*, July 31, 2013, Times Free Press, *available at* http://www.timesfreepress.com/news/2013/jul/31/president-obama-tours-amazon-chattanooga-officials/.
323 Indeed, after a recent tour of the facility in July 2013, President Obama did not even mention the gigabit network in remarks to the company. For a transcript of his remarks, *see President Obama's Speech at Amazon in Chattanooga,* July 30, 2013, Times Free Press, *available at* http://www.timesfreepress.com/news/2013/jul/30/prepared-transcript-president-obamas-speech-amazon/.
324 *See, e.g.,* Mike Pare, *Chattanooga Area Amazon Sites Fir Bigger Plan*, Jan. 30, 2011, Times Free Press, *available at* http://www.timesfreepress.com/news/2011/jan/30/amazon-sites-fit-bigger-plan/.
325 *See, e.g.,* Cheri Burt, *UPDATE: Hamilton County Commission approves tax breaks for Amazon.com*, Dec. 1, 2010, WRCBTV.com, *available at* http://www.wrcbtv.com/story/13594831/hamilton-county-commission-approves-tax-breaks-for-amazoncom.
326 *See, e.g., Chattanooga High Speed Broadband Initiative*.

network appears to be small: while the city claims that the network "created 1,000 jobs in the last three years, the Department of Labor reported that Chattanooga still had a net loss of 3,000 jobs in that period."[327]

EPB officials promote its smart grid network as another positive outgrowth of the fiber GON. This system, which uses the high-speed communications network to generate, aggregate, and analyze data from an array of sources (e.g., smart meters) about the distribution and consumption of electricity in near real-time, was completed in 2013.[328] Officials have already credited it with helping to save money by preventing widespread power outages. For example, a windstorm in early 2013 brought down power lines that resulted in power outages impacting 3,500 customers; EPB officials believe that that number would have been over 8,000 if not for the smart grid.[329] EPB officials estimate that the smart grid system could generate annual cost savings of around $50 million.[330]

While these particular gains are impressive, there is debate as to whether the gigabit GON was actually necessary to achieve these service improvements. The communications requirements of even the most advanced smart grid components are significantly less than 1,000 Mbps.[331] The smart meters that were installed using the $111 million federal grant, for example, generate a relatively small amount of usage data that, even in the aggregate, do not necessitate a gigabit communications network.[332] Moreover, the intelligence of these new systems tends to be located either on the utility side or the customer side; the data generated and transmitted across communications networks feed into analytical tools that allow the utility or customer to adjust distribution or consumption patterns.[333] Even though the communications component of the Chattanooga smart grid might have resulted in cost savings in the short term, the utility will, in all likelihood, have to continue to invest in maintaining and upgrading the network, especially on the utility side, which could both drive up rates and undermine the utility's overall financial performance.[334]

4.1.5 Assessment

Using Chattanooga as a model for other municipalities to replicate in building a GON is problematic for several reasons.

First, this particular network arose out of unique circumstances. Although the roots of the system stretch back to the late 1990s, momentum around the gigabit GON was greatly bolstered by the economic responses to the Great Recession. The city received a one-time federal grant in excess of $110 million to deploy its smart grid, while actions by the Federal Reserve resulting in historically low interest rates allowed EPB to finance its network (and refinance its debt) in ways that might be difficult for other cities going forward, as interest rates are likely to rise in the future.[335]

Second, notwithstanding a creative corporate structure for the service, Chattanooga residents are not entirely shielded from liability stemming from the FTTH network. EPB is a nonprofit agency owned by the

327 *Chattanooga's New Locomotive.*
328 *Broadband at the Speed of Light* at p. 46.
329 *See EPB Says Smart Grid Paying Off Handsomely For Customers*, Jan. 18, 2013, The Chattanoogan, *available at* http://www.chattanoogan.com/2013/1/18/242501/EPB-Says-Smart-Grid-Paying-Off.aspx.
330 *Id.*
331 *See, e.g.,* Mari Silbey, *Chattanooga Powers Smart Grid with Gigabit Network*, May 1, 2012, Smart Planet, *available at* http://www.smartplanet.com/blog/thinking-tech/chattanooga-powers-smart-grid-with-a-gigabit-network/11464 (observing that "Many smart grid applications don't need the power of fiber. Meter reading, for example, doesn't require the communications network speed that streaming video does.").
332 *See, e.g., Communications Requirements of Smart Grid Technologies*, U.S. Department of Energy (Oct. 2010), *available at* http://www.gc.energy.gov/documents/Smart_Grid_Communications_Requirements_Report_10-05-2010.pdf (detailing the various kinds of technologies that will comprise the smart grid and assessing their individual communications needs).
333 *See, e.g.,* Kristen Korosec, *Using Big Data to Give the Smart Grid a Brain*, Oct. 29, 2012, Smart Planet, *available at* http://www.smartplanet.com/blog/bulletin/using-big-data-to-give-the-smart-grid-a-brain/4072.
334 *Id.*
335 *See, e.g.,* Mary Williams Walsh, *Cost of Public Projects it Rising, and Pain will be Felt for Years*, June 26, 2013, N.Y. Times, *available at* http://dealbook.nytimes.com/2013/06/26/bill-for-public-projects-is-rising-and-pain-will-be-felt-for-years/ (describing unfavorable conditions that will negatively impact the ability of municipalities to borrow in support of public projects).

city of Chattanooga. This structure allows the utility to take on liabilities without directly exposing the city government or taxpayers to these risks. In addition, the bonds issued in support of the network are structured to limit taxpayer liability. Even so, bondholders have a security interest in EPB's electrical revenues.[336] The bonds' structure is not technically a general obligation, so it has the effect of limiting the ability of creditors to access tax dollars. However, it does allow creditors to access revenues stemming from electric ratepayers. In short, if EPB was unable to pay down its debt obligations associated with the FTTH network, it might be forced to raise the rates of its 174,318 electrical customers.[337] Since EPB, like most local utilities, is a monopoly, this has the effect of exposing the entire city—FTTH subscribers and non-subscribers alike—to the substantial debts incurred in building the network.

Third, Chattanooga's long-term economic revival is likely driving many of the economic gains being attributed to the GON. Beginning in the 1980s, the city engaged public and private stakeholders in a comprehensive reassessment of its economy. The result was the creation and use of a series of public-private partnerships aimed at bolstering nearly every aspect of the city, from revitalizing the riverfront to building a world-class aquarium.[338] By the end of the 1990s, the results of these myriad efforts were impressive: there were clear—and in some cases, dramatic—increases in the number of businesses in the area, wages, jobs, and median household income.[339]

Additional Infrastructure Needs in Tennessee

The exclusively public nature of the Chattanooga GON not only contradicts the city's established preference for using PPPs to improve local economic conditions,[340] but the high upfront and recurring costs associated with running this network divert critical resources from local government priorities central to local government mission. According to the American Society of Civil Engineers (ASCE), infrastructure in Tennessee is in dismal shape—there are almost 1,200 structurally deficient bridges throughout the state; 2,700 bridges are functionally obsolete; and about 40 percent of the roads are of poor or mediocre quality.[341] In addition, ASCE estimates that the state needs to invest almost $5 billion to maintain and update its drinking and wastewater systems over the next 20 years.[342] Schools in the state also require about $3.6 billion in investment.[343] Equally important, and perhaps more pressing in the short term, a key pension fund administered by Chattanooga for retired members of the local police and fire departments is underfunded and facing a shortfall of $150 million.[344]

336 *See*, *Electric System Revenue Bonds, Series 2008A, City of Chattanooga Tennessee*, at p. 1, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2008), *available at* http://emma.msrb.org/MS270152-MS266407-MD521993.pdf ("*Electric System Revenue Bonds, Series 2008A, City of Chattanooga Tennessee*").

337 *Senior Management Report & Financial Information 2013* at p. 11.

338 For an overview of these myriad efforts, *see generally* David Eichenthal and Tracy Windeknecht, *Chattanooga, Tennessee: A Restoring Prosperity Case Study*, Metropolitan Policy Program at Brookings (Sept. 2008), *available* at http://www.brookings.edu/~/media/research/files/papers/2008/9/17%20chattanooga%20eichenthal%20windeknecht/200809_chattanooga.pdf.

339 *Id.* at p. 19.

340 *See generally id.*

341 *See* ASCE 2013 Infrastructure Report Card, States—Tennessee, http://www.infrastructurereportcard.org/a/#p/state-facts/tennessee.

342 *Id.*

343 *Id.*

344 *See, e.g.,* Joy Lukachick, *Chattanooga Mayor Andy Berke Names Task Force to Study Fire and Police Pensions*, Aug. 15, 2013, Times Free Press, *available at* http://www.timesfreepress.com/news/2013/aug/15/chattanooga-mayor-andy-berke-names-task-force-stud/. *See also* David Morton, *Primer on Chattanooga's Fire and Police Pension Fund*, Nov. 5, 2013, Nooga.com, *available at* http://www.nooga.com/164130/primer-on-chattanoogas-fire-and-police-pension-fund/ (providing a more in-depth overview of the ongoing crisis around a pension fund that is only 52 percent funded); Kimberly Barbour, *Looming Pension Fund Reform Blamed for Policy & Fire Exodus*, Dec. 17, 2013, WRCBTV.com, *available at* http://www.wrcbtv.com/story/24245101/influx-in-chattanoogas-police-fire-retirements (reporting on an influx in retirements ahead of what many expect to be significant cuts to reforms to the pension fund for retired members of the local fire and police forces).

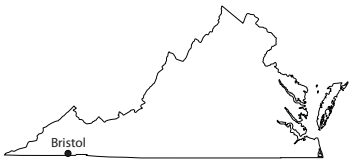
4.2 Bristol, Virginia

The GON in Bristol, Virginia, shares many similarities with the GON in Chattanooga:

- Both fiber-optic networks were built by the city-owned utility;
- Both were initially deployed for municipal purposes and later extended to compete with incumbent ISPs for residential and business customers; and
- Both offer gigabit speeds.[345]

In addition, the network in Bristol, much like the one in Chattanooga, is being lauded as an economic engine for the town and surrounding region as well as a possible template for other cities interested in building their own municipal broadband network.[346] From the standpoint of serving as a model for other municipalities, the Bristol network is also like Chattanooga in that it emerged from a very distinct set of circumstances — economic, financial, political, and otherwise. These unique attributes are discussed at length in the following case study.

Bristol, Virginia At-A-Glance



City Population: 17,662 (2012)

Year of Network Launch: 2002

Current Status: Built

Number of subscribers: 13,400

Revenues: NA

Operating Expenses: NA

Note: Additional information on the Bristol network is contained in Table 1 and in Appendix I.

4.2.1 Background

In 1999, BVU, the board of Bristol's municipal utility, and the Bristol City Council approved construction of a fiber-optic network to enhance communication between the utility's eight electric substations.[347] Later that year, the City Council voted to expand the network to connect all city offices, including City Hall, public schools, libraries, and the police and fire departments.[348] Looking beyond purely municipal functions, the council initially planned to partner with a private ISP in an effort to facilitate commercial broadband service to residents, but the city eventually elected to build that portion of the network itself.[349] To that end, the BVU board in 2001 approved an engineering study to determine the cost of providing FTTH service to all customers—public and private—throughout the utility's service territory.[350]

Efforts to expand the municipal network for commercial purposes faced numerous challenges from multiple parties, including the ISPs that were already serving the city. For example, one such incumbent argued that Virginia law barred municipalities from offering retail telecommunications services.[351] In response, Bristol sought a declaratory judgment from a federal court stating that the relevant state law was unenforceable because it was superseded by the 1996 Telecommunications Act.[352] The court agreed with the city and, in 2001,

345 *See, e.g.,* Arik Hesseldahl, *Want Gigabit Internet? You Don't Have to Move to Kansas City,* July 30, 2012, All Things D, *available at* http://allthingsd.com/20120730/want-gigabit-internet-you-dont-have-to-move-to-kansas-city/ (providing an overview of the network in Bristol).

346 *See, e.g.,* Bradley Kramer, *Pioneering Spirit: Bristol, VA, Trailblazing Muni FTTH*, at p. 22, LastMILE (Sept. 2008), *available at* http://www.metaswitch.com/sites/default/files/case-study-bvu.pdf; *Broadband at the Speed of Light* at p. 2-15.

347 *See* Wes Rosenbalm, *FTTU Broadband Network Currently Offered in Bristol Virginia and Neighboring Southwest Virginia Counties Through BVU OptiNet*, at p. 3, Report to Sheryl Bailey, Executive Director Virginia Resources Authority (Aug. 2008), *available at* http://www.wired.virginia.gov/pdf/BVU%20OptiNet_VRA%20Governor%20Report.doc ("*FTTU Broadband Network*").

348 *Id.*

349 *Id.*

350 *Id.*

351 This restriction was enacted in 1998. *See* HB 335, http://leg1.state.va.us/cgi-bin/legp504.exe?981+ful+CHAP0906.

352 *City of Bristol v. Mark L. Earley*, Case No. 1:00CV00173, (U.S. Dist. Va. Abington Dist. Ct May 26, 2001), *available at* http://www.vawd.uscourts.gov/OPINIONS/JONES/CITY.PDF.

ruled that the state law was "preempted by the Federal Telecommunications Act of 1996 … and is therefore invalid and unenforceable under the Supremacy Clause of the Constitution."[353] The law was quickly amended by the Virginia legislature, and BVU was eventually allowed to offer commercial communications services.[354]

In 2002, BVU began to deploy its network in the Bristol area.[355] During construction, the utility partnered with Cumberland Plateau Company (CPC), a nonprofit subsidiary of the Cumberland Plateau Planning District Commission, to expand the GON to industrial and business subscribers beyond Bristol in southwest Virginia.[356] This extension was funded by several state and federal grants, including a $1.6 million allocation from the U.S. Department of Commerce and a matching grant from the Virginia Tobacco Indemnification and Community Revitalization Commission.[357] The state funds stemmed from a sizable legal settlement with the tobacco industry.[358]

In 2009, the City Council asked the Virginia General Assembly to allow BVU to transition from city ownership to an independent authority owned by the state (BVU moved for independence so that it could legally expand its territory).[359] Amid some controversy,[360] the state legislature established the BVU Authority as an organization independent from the city and regulated by the state.[361] As a result, the Bristol City Council no longer approves the decisions of the BVU Authority Board.[362]

4.2.2 Cost and Financing

To date, over $100 million has been spent on this GON, with more than half coming from several rounds of municipal bond issuances. During the initial phase of construction, for example, BVU spent $13.6 million for equipment and network infrastructure.[363] To fund these and other network costs, $27.5 million in revenue bonds were issued in 2003, secured by the utility's assets.[364]

In 2010, the Authority "pledged future customer revenues, net of specified operating expenses, to repay $44,545,000 in revenue bonds issued [that] October."[365] Proceeds from this sale helped to refinance and refund previous bond issuances. These new bonds are "payable solely from BVU's net revenues and are payable through 2033."[366] By one recent estimate, the "total principal and interest remaining to be paid on the bonds is approximately $73,927,054."[367]

BVU has also received tens of millions of dollars in one-off grant funding from an array of federal and state entities. For example, deployment of the GON has been fueled by more than $24 million in federal grants

353 *Id.* at p. 18-19
354 *Broadband at the Speed of Light* at p. 4.
355 *Id.* at p. 6.
356 *Id.*
357 *Id.*
358 For additional information, *see* Virginia Tobacco Indemnification and Community Revitalization Commission, Home, http://www.tic.virginia.gov/. *See also* James Shea, *Tobacco Dollars Extend Broadband for Southwest Virginia,* Dec. 8, 2013, TriCities.com, *available at* http://www.tricities.com/news/local/article_ea52b42c-6083-11e3-8d56-0019bb30f31a.html ("*Tobacco Dollars Extend Broadband for Southwest Virginia*").
359 *See, e.g.,* David McGhee, *BVU Spinoff Motivation Questioned,* Oct. 15, 2009, News Channel 11, *available at* http://www.wjhl.com/story/20794222/bvu-spinoff-motivation-questioned.
360 *See, e.g.,* Frank Goodpasture III, *Don't Let Split Vote Take BVU from City*, Oct. 27, 2009, Tricities.com, *available at* http://www.tricities.com/news/article_4039d978-d4bd-51df-a79c-5857c180e4c9.html.
361 *See* BVU Authority Transition Agreement, *available at* http://static.mgnetwork.com/tri/media_path/-temp/BVU_Doc001.pdf.
362 *Broadband at the Speed of Light* at p. 3.
363 *Id.* at p. 2.
364 *Id.*
365 *See City of Bristol Audited Financial Statement: For the Year Ended June 30, 2012*, at p. 61, *available at* http://www.bristolva.org/DocumentCenter/View/246.
366 *Id.* These bonds limit direct taxpayer liability, but allow the network to increase revenues through raising prices and rates.
367 *Id.*

since 2003,[368] with an additional $28.4 million coming in July 2010 via the federal stimulus program.[369] These funds were allocated to BVU in support of a "388-mile fiber addition to its existing network that would bring up to 10 Gbps middle mile service to a rural, eight-county region of southwestern Appalachian Virginia."[370] With regard to state-specific grant funding, BVU has received over $30 million in "monetary grant awards" from the Virginia Tobacco Commission between 2003 and 2011.[371]

4.2.3 The Network

As of early 2012, BVU coverage exceeded 35,000 homes and businesses.[372] This number has likely grown as the network expands to other parts of Southwest Virginia. By the end of 2013, BVU had signed up about 13,400 subscribers.[373] Under its OptiNet brand, BVU offers voice, video, and data services to customers via its FTTH network. Service options range from a 20 Mbps stand-alone broadband connection for $39.95 per month to $319.95 per month for an asymmetrical 1 Gbps connection.[374] Television and telephone services are also available as stand-alone products or as part of a bundle.[375]

Despite BVU Authority and BVU OptiNet's financial viability, the GON has struggled financially. Year-over-year revenue growth remains modest, but the GON has managed to be self-sustaining based on current rates and charges.[376] In the most recent financial year, BVU reported that OptiNet had generated $2 million in profit.[377] OptiNet has yet to contribute funds directly to the city of Bristol.[378]

4.2.4 Community Impact

The Bristol GON has received praise for spurring economic development in the city and surrounding areas in southeast Virginia. One leading example: defense contractor Northrop Grumman's decision to build a new data facility in the BVU service territory.[379] Although the company highlighted the local network as one of the reasons for locating the center in the area, Northrop had already committed to building the facility somewhere in Virginia.[380] Northrup and the state of Virginia had previously entered into a 10-year, $2.4 billion contract whereby the private contractor would "overhaul the state's computer networks" and otherwise manage critical

368 *See* Susan Kendall, *Moody's Assigns A2 Issuer Rating to BVU Authority (VA),* Nov. 9, 2010, Moody's, *available at* http://www.moodys.com/research/MOODYS-ASSIGNS-A2-ISSUER-RATING-TO-BVU-AUTHORITY-VA-Rating-Update--RU_16711855 ("*Moody's Assigns A2 Issuer Rating to BVU*").

369 *Id*. For additional discussion regarding the federal stimulus program for broadband, *see infra*, section 6.1.2.

370 *See* Broadband USA, Grantees—Bristol Virginia Utilities Board, http://www2.ntia.doc.gov/grantee/bristol-virginia-utilities-board.

371 *See Funding Revitalization and Innovation in the Tobacco Region,* at p. 3, Virginia Tobacco Commission (June 2011), *available at* http://www.tic.virginia.gov/images/VA%20Business%20Magazine%20Ads/Broadband/June%202011%20Virginia%20Business%20Magazine%20Broadband.pdf. *See also Tobacco Dollars Extend Broadband for Southwest Virginia.*

372 *Broadband at the Speed of Light* at p. 2.

373 *Tobacco Dollars Extend Broadband for Southwest Virginia.*

374 *See* BVU OptiNet, Internet Packages, http://www.bvu-optinet.com/templates/default.php?purl=internet_res_hispeed&turl=inside_3col_std_template.htm.

375 For additional information, *see* BVU OptiNet, Home, http://www.bvu-optinet.com.

376 *See* Stacy Mawson, *Fitch Affirms Bristol Virginia Utilities Authority Util Sys Rev Bonds at 'A-'; Outlook Stable*, Dec. 28, 2012, Fitch Ratings, *available at* http://www.fitchratings.com/creditdesk/press_releases/detail.cfm?pr_id=778403.

377 *See* David McGee, *BVU Reports Financial Gains, Lower Expenses*, Feb. 6, 2013, Bristol Herald Courier, *available at* http://www.tricities.com/news/local/article_f4c3103a-6dab-11e2-a07c-0019bb30f31a.html.

378 *See Budget Comparison & Budget for 2013-2014*, at p. 8, City of Bristol, *available at,* http://www.bristolva.org/DocumentCenter/View/357.

379 *Broadband at the Speed of Light* at p. 3.

380 *See, e.g., Fibre in Paradise,* Feb. 18, 2010, The Economist, *available at* http://www.economist.com/node/15549324 (providing an overview of the Northrup project). *See also* Press Release, *Northrop Grumman and the Virginia Information Technologies Agency Open New High-Tech Facility in Russell County, Va.,* Dec. 12, 2007, Globe Newswire, *available at* http://globenewswire.com/news-release/2007/12/12/370405/132900/en/Northrop-Grumman-and-the-Virginia-Information-Technologies-Agency-Open-New-High-Tech-Facility-in-Russell-County-Va.html (providing additional background regarding the contractual relationship between Northrop and the state).

aspects of the newly created Virginia Information Technologies Agency.[381] (Northrop was already one of the largest employers in the state.) As such, the jobs and investment stemming from the new facility in southeast Virginia were expected and not necessarily created by the GON.

Other jobs have been created since construction of the GON. DirecTV, for example, hired 100 locals for a "virtual call center" in 2010.[382] These new employees work from home and earn $10 per hour.[383] Broadband is necessary to support these jobs, but the presence of the GON does not appear to have been essential in bringing these jobs to fruition.[384]

Alpha Natural Resources, a large coal company, built its new headquarters in Bristol, Virginia, the heart of "coal country." There is debate about the role that broadband played in the company's decision to stay in Bristol. [385] An array of multi-million dollar tax incentives offered by the city and state was also a major factor in the decision-making process.[386] Location in coal country was another consideration.[387]

For Bristol, the decision to create an independent BVU Authority has been a divisive issue.[388] There has been significant debate at the local level regarding the merits of providing broad independence to an entity that oversees a network built with taxpayer resources. Although the use of such public authorities is a standard practice in many states, some residents accused the city of shifting to an authority model in an attempt to prevent public scrutiny of a project that had amassed significant debt.[389] Creating a quasi-independent authority allowed the city to remove the GON's tens of millions of dollars of debt from its books and freed the new entity to assume even more debt and grow beyond the boundaries initially set for it.[390]

4.2.5 Assessment

In assessing the Bristol experience, it is important to understand factors that make the Bristol GON experience unique and may make it difficult for other jurisdictions to replicate. Like many other GONs across the country, the municipal broadband network in Bristol has significant debt and, though profitable, there is continued debate as to whether the benefits of the system outweigh the significant public resources that were used to build it.

The Bristol network, much like GONs in Chattanooga and elsewhere, owes its existence in large part to federal and state grant funding unlikely to be replicated over the long term. The Bristol network benefited from over $30 million in state funding that stemmed from a major legal settlement with the tobacco industry in the 1990s.[391] Even with this infusion of funding, the GON, as discussed above, remains about $70 million in debt.

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381 *See* Rosalind S. Helderman, *Virginia Revises Troublesome Northrop Contract,* April 7, 2010, Washington Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2010/04/06/AR2010040604178.html?hpid=sec-metro.

382 *See* Michael Owens, *DirecTV Plans to Hire 100 for Virtual Call Center*, March 31, 2010, Tricities.com, *available at* http://www.tricities.com/news/article_327f3bd5-7ecc-5399-8f19-30614268eb83.html.

383 *Id.*

384 *Id.*

385 *See, e.g., Community Broadband Creates Jobs* at p. 1.

386 *See* David McGee, *$3 million in Local Incentives for Alpha Natural Resources to Build Near Sugar Hollow Park*, Nov. 13, 2009, WJHL, *available at* http://www.wjhl.com/story/20780580/3-million-in-local-incentives-for-alpha-natural-resources-to-build-near-sugar-hollow-park (discussing the array of local and state tax incentives).

387 *See, e.g., Alpha Natural Resources Opens Headquarters in Bristol Virginia,* Nov. 29, 2011, Yes Virginia Business Blog, *available at* http://www.yesvirginia.org/BlogSpot/post/Alpha-Natural-Resources-Opens-Headquarters-in-Bristol-Virginia.aspx ("Location was a key deciding factor in Virginia's favor. According to CEO Kevin Crutchfield, "The property is in a very attractive park-like setting and has easy Interstate access. A distinct advantage of the new location is its proximity to many of the company's operations and its convenience for Alpha's current corporate office work force."").

388 *See* Dave McGee, *Bristol Council Meeting Tinged with Thorns of Criticism,* June 23, 2010, Tricities.com, *available at* http://www.tricities.com/news/article_d810e7e0-ac1e-52ad-bd1f-fee92a9c24fa.html.

389 *See* Daniel Gilbert, *BVU asks judge to throw out lawsuit that would block utility's separation bid*, Dec. 23, 2009, WJHL, *available at* http://www.wjhl.com/story/20779711/bvu-asks-judge-to-throw-out-lawsuit-that-would-block-utilitys-separation-bid.

390 *Id.*

391 The money stems from a $200 billion settlement with major tobacco companies in the 1990s. Funds are allocated annually to states. *See, e.g.,* Paige Winfield Cunningham, *Your Tobacco Settlement Funds at Work*, Dec. 5, 2010, Wash. Post Local Blog Network, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2010/12/04/AR2010120403000.html.

Additional Infrastructure Needs In Virginia

The decision to invest tens of millions of dollars of public funding in the GON resulted in resources not being allocated to shoring up failing infrastructure in the Bristol area, as well as other parts of the state. Roads, bridges, and dams throughout the state are failing and in need of billions of dollars in investment over the next decade. In particular, about a quarter of its bridges are either structurally deficient or functionally obsolete, while nearly half of the roads in the state are of poor or mediocre quality.[392] In addition, the state's drinking and wastewater facilitates require in excess of $12 billion in investment by 2020 to adequately maintain and upgrade these vital elements of the state's public infrastructure.[393]

4.3 Lafayette, Louisiana

The municipal fiber-optic system built in Lafayette, Louisiana, is cited as perhaps the most "legitimate" of the public-owned networks in the country. The local utility that built the network prevailed in legal challenges and a public referendum regarding whether it could use public funds to support construction.[394] As result of the referendum and legal challenges, Lafayette's municipal system has often been cited by GONs advocates as a model for GONs in other locations. An examination of this GON identifies a clear need for policy makers, residents, businesses, and other stakeholders, both in Lafayette and elsewhere, to keep reviewing the short- and long-term prospects of this municipal broadband system.

Lafayette, Louisiana At-A-Glance

City Population: 122,761 (2012)

Year of Network Launch: Late 1990s

Current Status: Built

Number of subscribers: 14,000

Revenues: $24 Million

Operating Expenses: $29 Million

Note: Additional information on the Lafayette network is contained in Table 1 and in Appendix I.

4.3.1 Background

Lafayette's fiber-optic GON began in the late 1990s with construction of a single fiber ring by the municipally owned local utility, Lafayette Utilities System (LUS). The purpose was to enhance communication across its electric network.[395] During the planning phase, LUS determined it could deploy a significant amount of excess capacity (i.e., eight times as many fiber strands) for only 20 percent above the original estimated cost.[396] The low cost of fiber at this time was due in large part to the glut of redundant fiber-optic networks built in cities and states across the country in the last half of the 1990s. Much of this fiber remained "dark" for years, and thousands of miles remain unlit.[397] The Lafayette City-Parish Council voted to proceed with the expanded fiber ring in 1998.[398]

392 *See* ASCE 2013 Infrastructure Report Card, States—Virginia, http://www.infrastructurereportcard.org/virginia/virginia-overview/.
393 *See* ASCE 2013 Infrastructure Report Card, States—Virginia, http://www.infrastructurereportcard.org/a/#p/state-facts/virginia.
394 *See, e.g.,* Rick Jervis, *Louisiana City Blazes High-Speed Web Trail,* Feb. 5, 2012, USA Today, *available at* http://usatoday30.usatoday.com/news/nation/story/2012-02-01/broadband-telecom-lafayette/52920278/1 (providing relevant background information regarding the construction of this GON) ("*Louisiana City Blazes High-Speed Web Trail*").
395 *See* LUS Fiber, History, http://www.lusfiber.com/index.php/historical-timeline.
396 *Broadband at the Speed of Light* at p. 17.
397 For a discussion of the conditions that led to the "glut," *see* Rebecca Blumenstein, *How the Fiber Barons Plunged the U.S. into a Telecom Glut*, June 18, 2001, Wall St. Journal.
398 *See* LUS Fiber, History, http://www.lusfiber.com/index.php/historical-timeline.

By 2002, LUS was offering wholesale data services to the city government that were faster than existing offerings but priced the same.[399] As a result, and in an effort to explore other potential uses for the network, the City Council authorized a study to examine the feasibility of using the network for non-government purposes.[400] In 2004, the city government undertook a robust market study of possible next steps for the burgeoning LUS network.[401] Also during this time, the Louisiana state legislature passed the Local Government Fair Competition Act, a bill that, among other things, set forth a process to guide municipalities interested in deploying a GON (including the completion of a feasibility study) and prohibited the use of cross-subsidies to support deployment of a communications networks.[402]

In the fall of 2004, LUS completed its feasibility report and brought the issue to the City Council.[403] The Council voted for the sale of revenue bonds to finance the project.[404] Local incumbents immediately challenged these actions in court, charging that state law required a referendum before issuing bonds.[405] The court agreed, and Lafayette held a referendum in 2005. Residents voted in favor of the $125 million bond issue by a margin of nearly two to one.[406]

Additional legal challenges followed. Citizens, incumbent ISPs, and others argued that the LUS-issued bonds were an illicit form of cross-subsidization that placed an unfair burden on taxpayers and utility customers.[407] The Supreme Court of Louisiana sided with LUS in early 2007.[408] Soon thereafter, LUS issued $110 million in revenue bonds. Network construction began in 2008; by 2009, it began to connect users.[409]

4.3.2 Cost and Financing

The original backbone and network frame were transferred from the utility to LUS Fiber, a municipally owned subsidiary of LUS, in November 2007.[410] LUS Fiber reimbursed the utility for the transfer and other startup costs. The purchase of the assets and other startup costs were funded by loans between the utility and LUS Fiber at market terms and rates.[411] Although these are loans that must be repaid, LUS Fiber does not consider such loans as debts on its balance sheet.[412]

To date, the costs of building and maintaining the GON in Lafayette have exceeded the initial $125 million bond authorized by referendum. More specifically, the city's first bond issuance—$110,405,000 in communications system revenue bonds—was in 2007, followed by a second, smaller issuance—$14,595,000—in 2011.[413] An additional $7 million in bonds was issued in 2012.[414] Furthermore, LUS Fiber took out other loans

399 *Broadband at the Speed of Light* at p. 17.
400 *Id.* at p. 18.
401 *Id.*
402 *See* Local Government Fair Competition Act, ACT No. 736, Louisiana Legislature (Reg. Session 2004), *available at* http://www.legis.la.gov/legis/ViewDocument.aspx?d=820786.
403 *Broadband at the Speed of Light* at p. 20.
404 *Id.*
405 *See generally BellSouth Telecommunications, Inc. v. City of Lafayette*, Nos. 05-1478, 05-1505 (Ct. of App. 3rd Cir., Jan. 5, 2006), *available at* http://caselaw.findlaw.com/la-court-of-appeal/1090681.html.
406 *See, e.g.,* Press Release, *Louisiana Community Fights Back at BellSouth*, Nov. 28, 2005, LUS Fiber, *available at* http://www.lus.org/site.php?pageID=295&newsID=470.
407 *See, e.g., Elizabeth W. Naquin et al. v. Lafayette City Parish Consolidated Government*, No. 2006-C-2227 (Sup. Ct. of La., Feb. 22, 2007), *available at* http://www.lasc.org/opinions/2007/06C2227.opn.pdf.
408 *Id.*
409 *Broadband at the Speed of Light* at p. v.
410 *See Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana,* at p. 42, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2010), *available at* http://emma.msrb.org/EA494408-EA384388-EA781227.pdf ("*Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana*").
411 *Id.*
412 *See Communications System Revenue Bond, Series 2012, City of Lafayette Louisiana*, at p. 39, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2011), *available at* http://emma.msrb.org/ER539796-ER417759-ER819677.pdf.
413 *Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana* at p. 42.
414 *See* Dan Aschenbach, *Moody's Assigns A1 to Lafayette, Louisiana Combined Utility Revenue Bonds; Outlook Stable*, Nov. 26, 2012, Moody's, *available at* http://www.moodys.com/research/Moodys-Assigns-A1-to-Lafayette-Louisiana-Combined-Utility-Revenue-Bonds-New-Issue--NIR_900823593 ("*Moody's Assigns A1 to Lafayette, Louisiana*").

over the years and says it will continue to do so in the future. For example, LUS Fiber borrowed $16,429,422 from the utility for "the acquisition of fiber infrastructure, startup costs, and operations."[415] In 2012, the City Council approved an additional $5.5 million loan for LUS Fiber.[416] Taken together, the total principal of LUS Fiber's debt is in excess of $150 million, exclusive of startup costs and fees.

While LUS Fiber is technically independent of the utility, "there is a relationship in that should LUS [Fiber] encounter a credit event or default on [its] bonds, LUS combined utilities revenues could be used to pay debt service."[417] Specifically, even though LUS Fiber's structure and financing are intended to limit direct taxpayer liability, like most GONs its financing mechanisms do not completely isolate the risk. While the communications system is separate from the utilities system, "if the [former] fails to generate sufficient revenues to pay debt service for its bonds, the [latter] is required to pay the debt service."[418] Thus, utilities customers are exposed to the risks associated with Lafayette's investment in municipal broadband.

4.3.3 The Network

The fiber-optic GON in Lafayette is fully operational. LUS Fiber offers television, broadband, and telephone service throughout the city. As of May 2013, the system had attracted 14,000 customers, about one-third of its total potential subscribers.[419] Its services can be purchased separately or as a bundle. The price for a 3 Mbps connection is $19.95 per month (as part of a bundle), while its gigabit service costs $999.95 per month.[420] Additional speed tiers include stand-alone symmetrical connections of 15 Mbps ($34.95/month), 40 Mbps ($49.95/month), 75 Mbps ($99.95/month), or 100 Mbps ($199.95/month).[421] Rates are regulated by the City Council.[422]

A recent audit of LUS Fiber found that, while the system is generating revenues sufficient to cover its debt payments, it has been running at an overall loss for the last few years.[423] Including depreciation, LUS Fiber "ended 2012 with a loss of $11,869,564, compared with a loss of $16,519,323 in 2011."[424] In addition, one recent analysis suggests the system, as of just a few years ago, was losing anywhere from $30,000 to $45,000 a day.[425] For these many reasons, the date by which the GON is expected to be fully self-sustaining has been pushed back several times, first to 2013,[426] then to 2014,[427] and most recently to 2015.[428]

Beyond the unique symbiotic relationship with LUS generally, there is some evidence to suggest the communications division is a drag on the overall performance of the parent utility. Moody's, for example, noted in a recent review of LUS's revenue bonds that "LUS has a high debt ratio if telecommunications system debt is included in LUS debt ratios given LUS Combined Utilities has obligation to pay if system doesn't pay."[429] Like the other GONs examined in this section, the financial stability of this GON in both the short term and long term remains uncertain and should continue to be closely monitored.

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415 *Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana* at p. 43.

416 *See, e.g.,* Richard Burgess, *Official: LUS Fiber Taking Off,* Aug. 24, 2012, The Advocate, *available at* http://theadvocate.com/home/3632694-125/official-lus-fiber-taking-off ("*LUS Fiber Taking Off*").

417 *Moody's Assigns A1 to Lafayette, Louisiana.*

418 *See Electric Revenue Bond, Series 2012, Lafayette Public Power Authority,* at p. 54, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2012), *available at* http://emma.msrb.org/ER634382-ER491088-ER893967.pdf. ("*Electric Revenue Bond, Series 2012, Lafayette Public Power Authority*").

419 *See* Richard Burgess, *LUS Announces Number of Subscribers*, May 29, 2013, The Advocate, *available at* http://theadvocate.com/news/6038657-123/lus-announces-number-of-subscribers ("*LUS Announces Number of Subscribers*").

420 *See* LUS Fiber, Pricing, http://lusfiber.com/index.php/package-price-internet.

421 *Id.*

422 *Moody's Assigns A1 to Lafayette, Louisiana*.

423 *See* Alex Labat, *LUS CPA Explains Fiber Audit,* May 20, 2013, KATC-TV.com, *available at* http://www.katc.com/news/lus-cpa-explains-fiber-audit/#_.

424 *LUS Announces Number of Subscribers.*

425 *See generally* Steven Titch, *Lessons in Municipal Broadband from Lafayette, Louisiana,* Reason Foundation (Nov. 2013), *available at* http://reason.org/files/municipal_broadband_lafayette.pdf.

426 *Moody's Assigns A1 to Lafayette, Louisiana*.

427 *LUS Fiber Taking Off.*

428 *LUS Announces Number of Subscribers.*

429 *Moody's Assigns A1 to Lafayette, Louisiana*.

4.3.4 Community Impact

NuComm International in 2006 promised to bring 1,000 new jobs to Lafayette by building an expansive call center near the city.[430] NuComm management said the presence of the GON had a major influence on its decision, along with several monetary enticements from local government (including $1 million from the state's Rapid Response economic development program and another $1 million from the Lafayette Economic Development Authority).[431] The center, which employed an average of 495 employees, suffered massive layoffs in 2009 and eventually closed.[432]

Another company that relocated is Pixel Magic, a special effects company that opened a satellite office in Lafayette in 2009.[433] The company was solicited via an aggressive campaign by state officials, which included an array of tax breaks, free office space, and other non-financial incentives (e.g., employee recruiting services).[434] According to a company official, "Pixel Magic chose Louisiana because of its variety of locations, the growth of the film industry in the state and its lucrative tax breaks for film production and digital media."[435] The firm, which typically hires on a project-to-project basis, tends to employ anywhere from 100 to 200 people.[436]

In general, the local economy remains dominated by the energy and healthcare industries, which account for about 40 percent of all economic activity.[437] Moreover, its proximity to the coast and other transportation hubs has made it an attractive destination for a range of non-high-tech trade industries, tourism, and hospitality.[438] Despite many efforts to date, very few tech-oriented companies in the area outside the thousands of workers employed by incumbent ISPs like Cox and AT&T employ more than a few dozen people.[439]

4.3.5 Assessment

A notable feature of the Lafayette GON is the significant amount of debt that accrued during the construction of the network. As discussed in **section 3,** debt of any size, especially during such volatile economic times, is of concern to municipal and state governments. In the case of Lafayette, this concern is acute given that its GON has not yet become financially self-sustaining and, after investing more than $150 million, the network has attracted only 14,000 subscribers (there are 48,800 in Lafayette, Louisiana[440]).

There is continued debate about the investment in the Lafayette GON in light of other pressing local priorities. The Lafayette budget has been in flux in recent years. Although it was able to squeeze $18 million in savings in 2012 (due in large part to a massive hiring freeze),[441] the local school system has faced a number of

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430 *See* LUS Fiber, History, a*vailable at,* http://www.lusfiber.com/index.php/historical-timeline. *Broadband at the Speed of Light* at p. 30.
431 *See Call Center at Mall Likely to Shut Down*, Jan. 17, 2012, Associated Press, *available at* http://www.goerie.com/article/20121201170999.
432 *See* Tonya LaCoste, *Only a Few Managers Lefts at Transcom*, Feb. 1, 2012, KATC.com, *available at* http://www.katc.com/news/only-a-few-managers-left-at-transcom.
433 *See, e.g., Community Broadband Creates Jobs.*
434 *See* Louisiana Economic Development, Case Study: Pixel Magic, http://www.louisianaeconomicdevelopment.com/page/pixel-magic.
435 *See Pixel Magic to Open Studio in Lafayette,* Nov. 6, 2009, NewsOK, *available at* http://newsok.com/pixel-magic-to-open-studio-in-lafayette/article/feed/103201.
436 *See, e.g.,* Letitia Walker, *More Jobs Available at Pixel Magic*, April 1, 2010, KATC.com, *available at* http://www.katc.com/news/more-jobs-availabe-at-pixel-magic/.
437 *See Leading Locations for 2013: Ranking MSAs for Economic & Job Growth*, Area Development (2013), *available at* http://www.areadevelopment.com/Leading-Locations/Q2-2013/Leading-Locations-2013-Full-Results-262716.shtml.
438 *See, e.g., Economic Profile: Lafayette, Louisiana*, Lafayette Economic Development Authority (July 2013), *available at* http://www.lafayette.org/uploads/LafayetteLAEconomicProfile71713.pdf.
439 *Id.*
440 *See* Census Bureau, State and County Quick Facts, Lafayette (city), Louisiana, http://quickfacts.census.gov/qfd/states/22/2240735.html.
441 *See* Richard Burgess, *Lafayette Sees Bigger Fund Balance*, May 29, 2013, The Advocate, *available at* http://theadvocate.com/news/6099240-123/lafayette-sees-bigger-fund-balance ("*Lafayette Sees Bigger Fund Balance*").

budget challenges in recent years, some of which have threatened the elimination of jobs.[442] In addition, recent spending cuts forced the local government to prioritize spending in ways that have led to neglect of key local infrastructure like roads and drainage.[443]

Additional Infrastructure Needs in Louisiana

In the aggregate, cuts in funding to maintain local infrastructure contribute to the overall crumbling nature of roads, bridges, dams, and other such structures throughout the state. Nearly two-thirds of the roads in Louisiana are of poor or mediocre quality.[444] Similarly, failure to address school budget gaps, along with prioritizing bond issuances in support of a GON instead of school construction, has contributed to a $7 billion shortfall in school infrastructure funding throughout the state.[445]

4.4 Monticello, Minnesota

The municipal broadband network in Monticello, Minnesota, provides a case study illustrating the volatile reality of many GONs.

4.4.1 Background

Monticello began investigating the feasibility of building a city-owned fiber-optic broadband network in 2005.[446] A task force was established and explored how the city might pay for the network without having to implement a tax levy.[447] The study concluded such a network was feasible, and the Monticello City Council approved a plan to deploy the GON in September 2006.[448] In 2007, the town held a legally mandated referendum to approve the sale of bonds that would be used to fund network deployment; the item passed by a margin of nearly three to one.[449]

Shortly thereafter, the local incumbent ISP, TDS Telecom, sued to enjoin the city from using a bond issuance to fund the GON. The case delayed construction, but was decided in favor of Monticello.[450] When the case was still before the court, the city reached

Monticello, Minnesota At-A-Glance

City Population: 12,964 (2012)

Year of Network Launch: 2010

Current Status: Built

Number of subscribers: 1,270

Revenues: $1.756 Million

Operating Expenses: $2.292 Million

Note: Additional information on the Monticello network is contained in Table 1 and in Appendix I.

442 *See* Charles Lussier, *School Board Delays Vote on Budget*, July 19, 2013, The Advocate, *available at* http://theadvocate.com/home/6527575-125/school-board-delays-vote-on.
443 *Lafayette Sees Bigger Fund Balance.*
444 *See* ASCE 2013 Infrastructure Report Card, States—Louisiana, http://www.infrastructurereportcard.org/a/#p/state-facts/louisiana.
445 *Id.*
446 *See City of Monticello, Minnesota, Telecommunications Revenue Bonds, Series 2008*, at p. 20, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (June 19, 2008), *available at* http://emma.msrb.org/MS271839-MS268494-MD531794.pdf ("*City of Monticello, Minnesota, Telecommunications Revenue Bonds, Series 2008*").
447 *Id.*
448 *Id.*
449 *Id.* at p. 21.
450 *See Bridgewater Telephone Co. v. City of Monticello*, File No. 86-CV-08-4555 (Wright Cty. Dist. Ct., June 2, 2009).

out to TDS and raised the idea of collaborating in the construction of a citywide fiber-optic network.[451] City officials reasoned that such a partnership would help to reduce costs and assure more efficient deployment.[452] TDS ultimately declined, reasoning that the proposed approach would be "anti-competitive" and might raise antitrust concerns.[453]

Construction of the GON began in earnest in 2009 after the case was decided in the city's favor, and FiberNet, the official name of the GON, began offering broadband service to customers in the spring of 2010.[454]

4.4.2 Cost and Financing

In 2008, Monticello issued two series of bonds totaling $26,445,000.[455] The bonds have interest rates of 6.5 and 6.7 percent[456] and reach full maturity in 2031.[457] These funds were secured solely by the net revenues of Monticello FiberNet.[458] In terms of allocating the funds, the city estimated that actual construction of the GON would cost $16,762,765 and take 30 months to complete.[459] Ongoing operational costs and unanticipated expenses have proven to be substantial and in excess of initial estimates.[460] Combined with tepid demand for its services, the GON encountered significant financial difficulties.

4.4.3 The Network

Monticello FiberNet is a city-owned 151-mile FTTH network that offers broadband, telephone, and television services to municipal buildings, schools, homes, and businesses.[461] Major business decisions are made by Monticello's advisory board and general manager.[462] The advisory board consists of five voting members: the mayor, a council member, and three community members; the city administrator and the general manager of FiberNet are non-voting members.[463] The general manager oversees employees, creates annual budgets, and is responsible for managing day-to-day activities.[464]

The network is fully operational. Residents can choose from an array of stand-alone and bundled offerings. Examples include a symmetrical 10 Mbps broadband connection for $29.95 per month, a symmetrical 30 Mbps connection for $52.95 per month, and a symmetrical 50 Mbps connection for $95.35.[465] These prices decrease with the addition of other services. For example, the monthly price of the 10 Mbps connection decreases to $24.95 with the addition of voice and television services.[466]

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451 *See Letter from Jeff O'Neill, City Administrator, to Tom Ollig, TDS,* July 17, 2008, *available at* http://www.muninetworks.org/sites/www.muninetworks.org/files/TDSLetter_joint%20fiber%20install_071708.pdf.
452 *Id.*
453 *See* Mike Schoemer, *TDS Turns Down City's Offer for Cooperative Installation*, Aug. 21, 2008, Monticello Times, *available at* http://www.muninetworks.org/sites/www.muninetworks.org/files/2008-TDS-Turns-Down-City.pdf.
454 *See City of Monticello, Minnesota, General Obligation Refunding Bonds, Series 2011*, at p. A-10, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Sept. 15, 2011), *available at* http://emma.msrb.org/EP571899-EP448885-EP848794.pdf.
455 *City of Monticello, Minnesota, Telecommunications Revenue Bonds, Series 2008* at p. i.
456 *Id.*
457 *Id.* at 4.
458 *Id.* at 10.
459 *Id.* at 21.
460 For a recent accounting, *see City of Monticello, Mn, Telecommunications Revenue Bonds, Series 2008*, *Quarterly Report for Period Ending March 31, 2013*, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2013), *available at* http://emma.msrb.org/EA525726-EA409489-EA806402.pdf.
461 *See City of Monticello, Minnesota, Telecommunications Revenue Bond, 2012 Annual Report*, at p. 3, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2013), *available at* http://emma.msrb.org/EA541341-EA422012-EA819011.pdf.
462 *Id.* at p. 5.
463 *Id.*
464 *Id.*
465 *See* City of Monticello, FiberNet, Residential Pricing, http://monticellofiber.com/ResidentialServices.cfm?ID=91&PID=103&siteID=1.
466 *Id.*

FiberNet has worked hard to grow its customer base since the service went live in 2010. As of March 2013, the network had 1,010 voice service customers, 1,270 Internet customers, and 970 TV customers.[467] One hundred and thirty of FiberNet's customers are businesses.[468] As a result of the lack of a strong customer base, the system appears not to be viable. In July 2012, FiberNet defaulted on its bond repayment because the city was unable to make "a monthly deposit into a debt service account as required by bond indenture."[469] The network continued to be in default and failed to make another scheduled payment in December 2012.[470] As of March 2013, total quarterly revenues were down to $439,141, which totals $1.75 million on an annualized basis.[471]

The Monticello GON was initially funded by revenue bonds that explicitly limited the city's liability, but ongoing financial difficulties have forced the city to intervene on several occasions.[472] For example, a recent audit of city financials (for fiscal year 2011) revealed several outstanding inter-fund loans to FiberNet, including a $3.1 million loan from the city's Liquor Fund and $323,000 from the General Fund.[473] In addition, "management report[ed] that inter-fund loans [grew] to $4.1 million [by September 2012], and expect[ed] additional monthly support of up to $60,000 through the end of fiscal 2012."[474] Even with city-sponsored cross-subsidization, the network continues to struggle financially. In the first quarter of 2013, FiberNet reported an operating loss of $134,278.44 and a negative cash flow of $159,644.49.[475] As a result, the city's credit rating was downgraded in September 2012.[476]

These losses and default on bond repayment obligations resulted in bondholders suing the city in late 2012.[477] In response, the city proposed a settlement that would repay bondholders 22 cents on the dollar, or $5.75 million of the over $26 million that was raised during the initial bond sales.[478] If accepted by bondholders, most of the $5.75 million would "become a general city obligation, payable from existing funds or funds generated by issuing a new bond."[479]

4.4.4 Community Impact

Evidence of FiberNet's positive impacts is limited as the city continues to address the significant financial shortcomings discussed above. GONs advocates have not attempted to frame the Monticello network as a driver of local economic development.

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467 *See City of Monticello, Mn, Telecommunications Revenue Bonds, Series 2008, (FiberNet Monticello Project), Quarterly Report for Period Ending March 31, 2013*, at p. 6, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2013), *available at* http://emma.msrb.org/EA525726-EA409489-EA806402.pdf ("*City of Monticello Quarterly Report for Period Ending March 31, 2013*").

468 *See* Tom Meersman, *Monticello's Model Broadband Effort in Peril*, June 7, 2012, Star Tribune, *available at* http://www.startribune.com/local/west/157992065.html?page=all&prepage=1&c=y#continue ("*Monticello's Model Broadband Effort in Peril*").

469 *See Comprehensive Annual Financial Report*, at p. 12, City of Monticello, Minnesota (Dec. 2012), *available at* http://www.ci.monticello.mn.us/vertical/Sites/%7B46185197-6086-4078-ADDC-0F3918715C4C%7D/uploads/2012_Monticello_CAFR_6000.pdf.

470 *Id.*

471 *See City of Monticello, Mn, Telecommunications Revenue Bonds, Series 2008, (FiberNet Monticello Project), Quarterly Report for Period Ending March 31, 2013*, at p. 3, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2013), *available at* http://emma.msrb.org/EA525726-EA409489-EA806402.pdf ("*City of Monticello Quarterly Report for Period Ending March 31, 2013*").

472 *See* Andrea Stenhoff, *Moody's downgrades to A2 from Aa3 the GOULT rating for City of Monticello (MN); concurrently downgrades lease revenue debt to A3 from A1,* Sept. 28, 2012, Moody's Investors Service, *available at* http://www.moodys.com/research/Moodys-downgrades-to-A2-from-Aa3-the-GOULT-rating-for-Rating-Update--RU_900688861 ("*Moody's downgrades City of Monticello*").

473 *Id.*

474 *Id.*

475 *City of Monticello Quarterly Report for Period Ending March 31, 2013* at p. 4.

476 *Moody's downgrades City of Monticello*

477 *See* Tim Hennigar, *Monticello Council Approves $5.75 Million Proposed FiberNet Bondholder Settlement*, June 17, 2013, Monticello Times, *available at* http://monticellotimes.com/2013/06/17/monticello-council-approves-5-75-million-proposed-fiber-net-bond-settlement/ ("*Monticello Council Approves $5.75 Million Proposed FiberNet Bondholder Settlement*").

478 *See Bondholders to Take Loss on Monticello Broadband*, Aug. 19, 2013, Associated Press, *available at* http://www.inforum.com/event/article/id/409548/.

479 *Monticello Council Approves $5.75 Million Proposed FiberNet Bondholder Settlement.*

Proponents of the GON have argued that it has sparked renewed competition among ISPs in the city.[480] One group estimated FiberNet saves Monticello $240,000 a year, and arrived at this figure by making a number of assumptions about hypothetical savings of individual households that have benefited from competing ISPs' lower prices.[481] While these service providers have adjusted their offerings in recent years, it can be argued that any perceived "savings" are outweighed by the substantial cost the city incurred for having to financially support the GON. Despite growing acceptance that FiberNet is negatively impacting city finances, some GONs advocates argue strongly that the municipal network is worthwhile because of its impacts on local competition.[482]

Proponents of this view tend to overlook the trends in broadband innovation over the last decade. Connection speeds across the country have consistently increased while prices have decreased and the diversity of offerings has multiplied.[483] Wireless broadband has further bolstered intermodal competition and provides Monticello residents with multiple options for getting online.[484] While some credit the Monticello GON with causing service improvements by local incumbents, the city could have saved millions of dollars and avoided such enormous risk by appreciating that organic forces were shaping the market as a function of the demands and actual usage patterns of residents.[485] Indeed, many citizens have expressed resentment toward the city government for getting into the business of broadband and failing.[486]

4.4.5 Assessment

The financial struggles of the GON in Monticello highlight a more general concern about the capability of municipal governments to successfully operate a GON. GON proponents argue that local government can be as nimble as the private sector when it comes to funding a new network and adjusting to competitive pressures. In light of the preceding analysis, Monticello appears to have been ill prepared to deal with market pressures and suffered as a result. The city's initial plan for the GON assumed that market conditions would not change once it entered the market.[487] When its competitors reduced prices, Monticello did not alter its plan and chose instead to adhere to the road map that had already passed muster with city officials. The result has been financial distress and support of the argument that municipalities are often ill equipped to compete in well-functioning dynamic markets.

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480 *See, e.g.,* Chris Mitchell, *A Closer Look at FiberNet Monticello,* June 8, 2012, Community Broadband Networks, Institute for Local Self-Reliance, *available at* http://www.muninetworks.org/content/closer-look-fibernet-monticello.

481 *Id.*

482 *See, e.g.,* Christopher Mitchell, *What if FiberNet Monticello Had Been Canned in 2008?*, June 29, 2012, Community Broadband Networks, Institute for Local Self-Reliance*, available at* http://www.muninetworks.org/content/what-if-fibernet-monticello-had-been-canned-2008 ("We continue to believe that Monticello made the smart choice in proceeding with its network, even in the face of all the adversity they have had. If it were possible to total up the many varied benefits to the community from the additional investment, choices, discounts, and multiplier effects, we believe it would significantly outweigh the negatives."); Christopher Mitchell, *Monticello Moves Closer to Settlement with Bondholders,* June 20, 2013, Community Broadband Networks, Institute for Local Self-Reliance*, available at* http://muninetworks.org/content/monticello-moves-closer-settlement-bondholders ("We continue to see FiberNet Monticello as benefiting the community on the whole") ("*Monticello Moves Closer to Settlement with Bondholders*").

483 For data and discussion, *see supra,* section 3.1.1.

484 The National Broadband Map reveals that every resident in Wright County, Minnesota, where Monticello is located, has access to at least three wireless broadband providers, while the vast majority has access to six. *See* National Broadband Map, Summarize: Wright County, MN, http://www.broadbandmap.gov/summarize/state/minnesota/county/wright.

485 The city was initially persuaded into exploring a municipal communications network by local business owners who were frustrated with unreliable telephone service. As discussed above, FiberNet has attracted only about 130 business customers to date. *Monticello's Model Broadband Effort in Peril.*

486 *See, e.g.,* Walt Markling, *Letter: FiberNet Remains a Costly Venture for City Residents in Monticello,* Feb. 28, 2013, Monticello Times, *available at* http://monticellotimes.com/2013/02/28/letter-fibernet-remains-a-costly-venture-for-city-residents-in-monticello.

487 *See* Nate Anderson, *Want 50Mbps Internet in Your Town? Threaten to Roll Out Your Own,* Oct. 27, 2009, Ars Technica*, available at* http://arstechnica.com/tech-policy/2009/10/want-50mbps-internet-in-your-town-threaten-to-roll-out-your-own/.

Infrastructure Needs in Minnesota

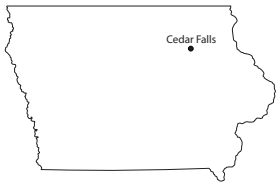
The financial difficulties facing the city and FiberNet raise the possibility that the GON will require general revenue expenditure that could be put to better and more productive uses. Infrastructure throughout the state, for example, is poorly rated and in desperate need of investment by state and local government. More than half the roads in the state are of poor or mediocre quality, while its schools have nearly $4 billion in infrastructure funding needs.[488] Billions of dollars in additional funding are needed to shore up other critical infrastructure, like the state's drinking and wastewater systems.[489]

4.5 Cedar Falls, Iowa

The municipal broadband network in Cedar Falls, Iowa, is one of the oldest in the country. First deployed in the mid-1990s, this GON evolved from a traditional cable broadband system, built atop a hybrid fiber/coaxial infrastructure, to one that is transitioning to all fiber-optic.

Though it has survived for several decades, the Cedar Falls model may be difficult for other localities to replicate. In its push to modernize and join the ranks of other "gig cities," Cedar Falls assumed a significant amount of debt with limited evidence that consumers wanted ultra-fast Internet connections. As a result, the system has experienced some financial volatility, which has led to a credit downgrade. It remains to be seen whether the benefits of this network will justify the significant costs associated with this municipality's ambitious expansion plans.

Cedar Falls, Iowa At-A-Glance



City Population: 39,993 (2012)

Year of Network Launch: Mid-1990s

Current Status: Partially Built

Number of subscribers: 17,000

Revenues: $14.3 million

Operating Expenses: $13.2 million

Note: Additional information on the Cedar Falls network is contained in Table 1 and in Appendix I.

4.5.1 Background

Cedar Falls Utilities (CFU) began to explore the feasibility of building a municipal communications network in the early 1990s.[490] After two years of study, the Cedar Falls City Council established a Municipal Communications Utility and transferred authority to the CFU Board of Trustees.[491] The project began in earnest after the issue was put before voters in 1994.[492] Seventy-one percent voted in favor of deploying a GON that would be managed and controlled by the CFU Board of Trustees.[493] Voters also approved a $3 million bond issuance to finance the project.[494]

488 *See* ASCE Infrastructure Report Card 2013, States—Minnesota, http://www.infrastructurereportcard.org/a/#p/state-facts/minnesota.
489 *Id.*
490 *See* Doris J. Kelley, *A Study of the Economic and Community Benefits of Cedar Falls, Iowa's Municipal Telecommunications Network*, 2, Oct. 2. 2003, Cedar Falls Utilities, *available at* http://www.lus.org/uploads/AStoryofTwoCities.pdf ("*Study of the Economic and Community Benefits*").
491 *Id.*
492 *See City of Cedar Falls, Iowa $3,000,000 General Obligation Bonds, Series 1995B*, at p. 6, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (June 9, 1995), *available at* http://emma.msrb.org/MS111001-MS86309-MD167913.pdf ("*Cedar Falls $3,000,000 General Obligation Bonds, Series 1995B*").
493 *Id.*
494 *Id.*

At first, the network offered only cable service,[495] but by 1997, the utility began to offer Internet service via CyberNet, a 10 Mbps citywide Ethernet network.[496] At that point, the network was composed of hybrid fiber/coaxial (HFC).[497] In 2010, CFU began to replace the coaxial portion of its network with fiber and started to extend the fiber directly to homes and businesses.[498] This upgrade eventually allowed CFU to offer 1 Gbps speeds to customers.[499]

4.5.2 Cost and Financing

Deployment of the initial HFC network was funded by a $3 million bond issued in 1995 (it matured in 2008).[500] The upgrade to fiber and expansion of the network were slated to cost $17 million.[501] In 2009, Cedar Falls began to borrow funding for these purposes by issuing a general obligation bond for $2,320,000.[502] The bond matures in 2024 and has a rising interest rate that begins at .075 percent and increases throughout the bond's life to 3.80 percent in the final year.[503]

Cedar Falls can repay this general obligation bond through any mechanism, including its taxing powers.[504] In 2010, Cedar Falls assumed additional debt to further fund the project when it borrowed $13,130,000 using communications utility revenue capital loan notes,[505] which carry an interest rate of three percent and mature in 2024.[506] This debt was secured by a first lien on revenue from the communications utility.[507] The GON also benefited from loans from the electric utility, totaling over $2 million by the end of 2011,[508] and grants from the federal government, totaling $877,433, in support of network expansion to previously unserved areas.[509] As of the end of 2012, the total annual cost of operating the GON was $13,199,726, up from $8,924,912 in 2009.[510] Maintenance and system operation cost $8,009,105 and sales, customer service, and corporate operations totaled $2,999,629.[511]

495 *Study of the Economic and Community Benefits* at p. 2.
496 *Id*. at p. 3.
497 *Id*.
498 *See* John Molseed, *CFU Adds Fiber Optic Links to All Customers*, June 13, 2010, WCF Courier, *available at* http://wcfcourier.com/news/local/article_4cccdbd5-1341-594a-bb4c-701305cd218b.html?mode=story ("*CFU Adds Fiber Optic Links*").
499 *See, e.g.,* Jon Ericson, *Cedar Falls Joints Elite 'Gigabit City' List*, May 8, 2013, WCF Courier, *available at* http://wcfcourier.com/business/local/cedar-falls-joins-elite-gigabit-city-list/article_588684f4-4750-54c9-8c49-48fd5b891ba1.html.
500 *Cedar Falls $3,000,000 General Obligation Bonds, Series 1995B* at p. 6.
501 *CFU Adds Fiber Optic Links.*
502 *See City of Cedar Falls, Iowa, $2,320,000 General Obligation Capital Loan Notes, Series 2009B*, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Nov. 30, 2009), *available at* http://emma.msrb.org/EP357783-EP282175-EP677366.pdf.
503 *Id*. at p. 13.
504 *Id.* at p. 2.
505 *See Municipal Communications Utility of the City of Cedar Falls Iowa, $13,130,000 Communications Utility Revenue Capital Loan Notes, Series 2010*, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Sept 1, 2010), *available at* http://emma.msrb.org/EA404810-EA316792-EA712527.pdf.
506 *Id*. at p. 19.
507 *Id*. at p. 1.
508 *See Financial Statements of the Municipal Electric, Gas, Water, and Communications Utilities of the City of Cedar Falls, Iowa, For the Year Ending Dec 31, 2011*, at p. 28, Cedar Falls Utility (March 2012), *available at* http://auditor.iowa.gov/reports/1223-0046-C000.pdf ("*Financial Statements For the Year Ending Dec 31, 2011*").
509 *See Advancing Broadband: A Foundation for Strong Rural Communities*, at p. 29, Rural Utilities Service, U.S. Dept. of Agriculture (Jan. 2011), *available at* http://www.rurdev.usda.gov/supportdocuments/RBB_report_whole-v4ForWeb.pdf.
510 See *Financial Statements of the Municipal Communications Utility of the City of Cedar Falls, Iowa*, *Including Independent Auditor's Report, For the Years Ended Dec. 31, 2012 and 2011*, at p. 3, Cedar Falls Utility (April 4, 2013), *available at* http://emma.msrb.org/EP760639-EP589987-EP991542.pdf ("*CFU Auditor Report, For the Years 2011 and 2012*"). *See also Financial Statements For the Year Ending Dec 31, 2011* at p. 3.
511 *See CFU Auditor Report, For the Years 2011 and 2012* at p. 3.

4.5.3 The Network

CFU's FTTH network is 95 percent complete.[512] The new gigabit system was switched on in May 2013.[513] This GON offers only broadband Internet access and television services, not telephone. Customers also have access to CFU's wireless hotspots, which are available in parts of downtown Cedar Falls.[514] In terms of specific offerings, services include a stand-alone asymmetrical 2 Mbps connection for $29.95 a month ($34.95 for rural customers), a 30 Mbps asymmetrical connection for $64.50 per month ($69.50 for rural customers), and a 1 Gbps asymmetrical connection for $265 a month ($270 for rural customers).[515] Prices for business consumers are substantially higher (e.g., $950.00 per month for 1 Gbps in the city, $990 per month in rural areas).[516] CFU also makes available lit or dark dedicated fiber connections between customer-owned facilities, and wholesale bandwidth for other ISPs.[517]

Over the last decade, the financial viability of the GON in Cedar Falls has fluctuated. The system rarely generated revenues to cover its total costs in the years before its upgrade,[518] and over the last few years, while total operating revenues exceeded total operating expenses, operating expenses continue to grow at a fast pace.[519]

4.5.4 Community Impact

There are a number of positive impacts that have resulted from the GON in Cedar Falls which are often cited by CFU proponents and GON supporters.[520] The utility estimates its customers pay about $200 less each year for their Internet service than residents in neighboring "peer communities" in Iowa do.[521] As of May 2013, CFU accrued about 11,600 total subscribers,[522] but without knowing the types of connections these customers purchased, it is difficult to determine whether the significant costs associated with upgrading its network to all-fiber are delivering value to customers—and the city generally—in excess of these reported savings. With anecdotal evidence suggesting very few customers opt for CFU's fastest speed tiers, it can be argued that the costs of building this GON outweigh the benefits that may stem from it.[523]

Evidence that the GON spurred economic development and job creation is limited. A study from the early 2000s found that, while the presence of the GON appeared to play some role in influencing several firms to relocate to Cedar Falls, it was just one of many, arguably more important factors, making it difficult, if not impossible, to "verify that these developments [were] the direct result of the City's broadband delivery system."[524]

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512 *See* CFU, Internet, http://www.cfu.net/cybernet/default.aspx.

513 *See CFU Launches Gigabit Internet Service*, May 28, 2013, Cedar Falls Times, *available at* http://www.communitynewspapergroup.com/cedar_falls_times/news/article_09479d64-c7ca-11e2-80e2-0019bb2963f4.html ("*CFU Launches Gigabit Internet Service*").

514 *See* CFU, Free Wi-Fi Zones, http://www.cfu.net/cybernet/wifi.aspx.

515 *See* CFU, Internet—Residential Services, http://www.cfu.net/cybernet/residential-service.aspx.

516 *See* CFU, Internet—Business Services, http://www.cfu.net/cybernet/business-service.aspx.

517 *See* CFU, Internet and Fiber Services, http://www.cfu.net/customer-service/commercial-services/fiber-services.aspx.

518 *See, e.g.,* Ronald Rizzuto, *Iowa Communications Systems: The Financial Track Record,* Heartland Institute (Sept. 2005), a*vailable at* http://heartland.org/sites/all/modules/custom/heartland_migration/files/pdfs/17724.pdf.

519 *CFU Auditor Report, For the Years 2011 and 2012* at p. 6.

520 *See* CFU, Community Benefits, http://www.cfu.net/about/community-benefits.aspx.

521 *See CFU Residential Report Card for the Period of June 2012—May 2013,* CFU, *available at* http://www.cfu.net/webres/File/RPT_card.pdf.

522 *CFU Launches Gigabit Internet Service*.

523 *See, e.g., id.* (noting that these speeds will be attractive mostly to business customers in the short term). *See also* Steve Donohue, *Iowa City Charging $275 Monthly for 1-Gig Broadband Service*, May 29, 2013, Fierce Cable, *available at* http://www.fiercecable.com/story/iowa-city-charging-275-monthly-1-gig-broadband-service/2013-05-29 (noting that there is little demand for the 1 Gbps service at this point in time).

524 *See* Doris Kelley, *A Study of the Economic and Community Benefits of Cedar Falls, Iowa's Municipal Telecommunications Network*, at p. 12, Iowa Association of Municipal Utilities (July 2004), *available at* http://www.baller.com/pdfs/cedarfalls_white_paper.pdf.

CFU supporters and GONs advocates argue that the city's investment in its fiber upgrade has had positive impacts on its credit rating.[525] However, Moody's recently downgraded its bond rating from A1 to A3.[526] Moody's reasoned that CFU's debt is becoming increasingly illiquid, the network is highly leveraged (due mostly to its fiber expansion), and the network lost several major customers to competitors in recent years.[527] These challenges will be difficult to overcome as incumbents begin to leverage their nimbleness and compete more vigorously with CFU, especially on the price for higher-speed tiers.[528]

4.5.5 Assessment

The huge cost and long-term debt associated with the municipal fiber system in Cedar Falls raise questions about opportunity costs and whether such substantial resources have been invested wisely. Such uncertainty gains additional primacy when viewed in light of other priorities competing for funding at the local level.

Recent debate over the town budget for fiscal year 2014 highlighted several of these.[529] Much to the dismay of many residents, the local government approved a property tax increase for the coming year.[530] Some of these revenues might have been used to pay for a new highway interchange,[531] highlighting another important trade-off that policy makers make when they elect to deploy a GON.[532]

Infrastructure Needs in Iowa

Public infrastructure throughout the state requires significant attention—nearly half of the roads in the state are of poor or mediocre quality; more than a quarter of its bridges are structurally deficient or functionally obsolete; and nearly $15 billion is needed to meet school, drinking water, and wastewater infrastructure needs.

525 *See, e.g.,* Christopher Mitchell, *Cedar Falls Utility Gets High Bond Rating from Moody's*, March 19, 2013, Community Broadband Networks, Institute for Local Self-Reliance, *available at* http://www.muninetworks.org/content/cedar-falls-utility-gets-high-bond-rating-moodys.

526 *See* Soo Yun Chung, *A3 Rating Applies to Approximately $13 Million Senior-Lien Revenue Debt Outstanding*, March 8, 2013, Moody's Investor Services, *available at* http://www.moodys.com/research/Moodys-downgrades-to-A3-from-A1-the-rating-on-Cedar--PR_268153 ("*A3 Rating Applies to Approximately $13 Million Senior-Lien Revenue Debt Outstanding*").

527 *Id.*

528 *See, e.g.,* Jeff Baumgartner, *Mediacom Faces 1 Gig Pressure in Iowa*, May 30, 2013, Multichannel News, *available at* http://www.multichannel.com/distribution/mediacom-faces-1-gig-pressure-iowa/143570.

529 *See* Tina Hinz, *Cedar Falls Budget Hearing Set for Feb. 25*, Feb. 18, 2013, WCF Courier, *available at* http://wcfcourier.com/news/local/cedar-falls-budget-hearing-set-feb/article_7771e49b-33a6-568c-b35f-b08c11339daa.html.

530 *See* Tina Hinz, *Cedar Falls Council Oks Budget; Tax Hike Irks Residents*, Feb. 26, 2013, WCF Courier, *available at* http://wcfcourier.com/news/local/govt-and-politics/cedar-falls-council-oks-budget-tax-hike-irks-residents/article_6cd83257-6fe2-5894-8cf1-eaeaa93581ff.html.

531 *Id.*

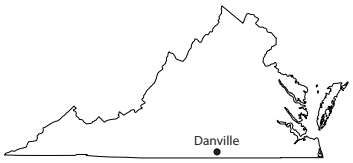
532 *See* ASCE Infrastructure Report Card 2013, States—Iowa, http://www.infrastructurereportcard.org/a/#p/state-facts/iowa.

4.6 Danville, Virginia

The government-owned broadband network in Danville, Virginia, is differentiated from other GONs in a number of ways:

- It adheres to an open access model, which means that the municipality only sells wholesale access to its network; it does not sell Internet access or other services directly to residents.
- Its financing model is extremely conservative — FTTH is being deployed on a pay-as-you-go basis, which has helped the city avoid amassing any debt associated with the GON.
- The network, called nDanville, has been consistently profitable and contributes hundreds of thousands of dollars annually to the city's general fund.

Danville, Virginia At-A-Glance



City Population: 42,996 (2012)

Year of Network Launch: Early 2000s

Current Status: Partially Built

Number of subscribers: 200

Revenues: $1.8 million

Operating Expenses: $1.7 million

Note: Additional information on the Danville network is contained in Table 1 and in Appendix I.

4.6.1 Background

The GON in Danville grew out of a fiber-optic network the local utility, the Danville Utilities Department, deployed in the early 2000s to enable more robust communications across its electric network.[533] The communications network was also built out to municipal buildings and schools.[534] In 2006, the utility studied the feasibility of turning its fiber network into an open access system that could be used by private ISPs to deliver communications services to residents and businesses.[535]

These efforts were reinforced by a parallel state-level initiative to improve rural communications capabilities. The Mid-Atlantic Broadband Cooperative (MBC) launched in 2003 to lead these efforts and spearhead the construction of an expansive broadband network in rural Virginia that could "provide unique opportunities for research/development and create opportunities for the private sector to deploy competitive broadband services."[536] The MBC network was funded by federal and state grants, the latter of which stemmed primarily from the state's tobacco settlement proceeds, some of which had also been channeled into the GON in Bristol, Virginia (see **section 4.2**). Together, these grants totaled over $40 million ($34 million of which came from the Tobacco Commission) and helped support deployment of a 700-mile middle-mile fiber network in the mid-2000s.[537] Danville eventually hooked up its fiber network to the MBC middle-mile network and began to plan for the expansion of its local infrastructure.

The network that emerged, nDanville, went live in late 2005 and was the "first municipal open access, open services network in the United States."[538] After the 2006 expansion, the utility in 2010 recommended the City Council vote to expand the fiber network to homes and businesses.[539] To that end, it offered a plan that would

533 *See, e.g.,* Andrew Michael Cohill, *Danville Transforms its Economy with Fiber*, Broadband Communities Magazine (Nov./Dec. 2011), *available at* http://www.bbpmag.com/MuniPortal/EditorsChoice/1111editorschoice.php ("*Danville Transforms its Economy*").
534 *Id.*
535 *Id.*
536 *See* Virginia Tobacco Indemnification and Community Revitalization Commission, MBC, http://www.tic.virginia.gov/mbc1.shtml.
537 *Id.*
538 *See* Danville, nDanville Fiber Optic Services Information, http://www.danville-va.gov/index.aspx?NID=668.
539 *See* Christopher Mitchell, *Danville City Council Nixes Expansion of nDanville Fiber Network*, Oct. 6, 2012, Community Broadband Networks, Institute for Local Self-Reliance, *available at* http://muninetworks.org/content/danville-city-council-nixes-expansion-ndanville-fiber-network.

expand the network to between 2,000 and 3,000 new homes funded by a $2.5 million loan.[540] The City Council voted against this proposal,[541] but a year later it approved a smaller-scale pilot program that would extend the network to 250 homes.[542]

4.6.2 Cost and Financing

The initial phase of the Danville network was constructed for $2.5 million. This stage used 70 miles of fiber-optic cable[543] and was funded by a loan from the electric utility, which has been paid back with interest.[544] Ever since, the portion of the GON that extends to homes and businesses has been built on a pay-as-you-go basis.[545] The initial 250-home pilot program approved by the city hinged on the utility's ability to fund the cost from reserves accrued from its telecommunications division.[546] As of December 2012, nDanville was debt-free and contributed over $300,000 to the city general fund each year.[547]

4.6.3 The Network

The emerging fiber-optic GON in Danville is open access, which means private ISPs can contract to use the infrastructure to deliver Internet, television, and telephone service to customers.[548] nDanville also provides free Wi-Fi access in several parks across the city.[549] In addition, during the second phase of its deployment (i.e., after initial deployment but before build-out to residents), nDanville constructed a medical network that brought fiber-optics to the local medical community.[550] The vast majority of the city's "medical offices, clinics and labs, including Danville Regional Medical Center," are connected to the network and use it to strengthen the quality and reach of their services.[551]

The last phase of deployment—bringing fiber to homes and businesses in Danville—is ongoing and is being "sized" according to the amount of reserve funding available in an effort to avoid amassing any debt.[552] Current customers have two choices of ISP—Gamewood Technology Group and Sunset Digital; the former offers several bundles of television, Internet, and telephone service, while the latter offers telephone and Internet service.[553] Gamewood's offerings range from a "bronze" package for $60 per month, which includes a 3 Mbps asymmetrical Internet connection, phone, and basic cable package, to a "platinum" package for $130 per month, which includes a 20 Mbps asymmetrical Internet connection, telephone, and an expanded cable package.[554]

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540 *Id.*
541 *Id.*
542 *See* Christopher Mitchell, *Open Access nDanville Network Goes Residential*, Aug. 11, 2011, Community Broadband Networks, Institute for Local Self-Reliance, *available at* http://muninetworks.org/content/open-access-ndanville-network-goes-residential ("*Open Access nDanville Network Goes Residential*").
543 *See City of Danville, Virginia, General Obligation Public Improvement Bonds, Series 2007*, at p. 36, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (March 31, 2007), *available at* http://emma.msrb.org/MS256957-MS232265-MD452865.pdf ("*Danville, Virginia, General Obligation Public Improvement Bonds, Series 2007*").
544 *See Editor's Choice: State-of-the-Art Broadband Builds Communities,* Broadband Communities Magazine (Dec. 2012), *available at* http://www.bbpmag.com/MuniPortal/EditorsChoice/1212editorschoice.php ("*State-of-the-Art Broadband Builds Communities*").
545 *See Comprehensive Annual Financial Report for the Fiscal Year July 1, 2001 to June 30, 2012,* at p. 14, Danville City Government, *available at* http://www.danville-va.gov/DocumentCenter/View/8624 ("*Comprehensive Annual Financial Report—Danville*").
546 *Open Access nDanville Network Goes Residential.*
547 *State-of-the-Art Broadband Builds Communities.*
548 *Danville Transforms its Economy.*
549 *See* Danville, Danville's Hot Parks, http://www.danville-va.gov/index.aspx?NID=669.
550 *Danville, Virginia, General Obligation Public Improvement Bonds, Series 2007* at p. 21.
551 *See Danville Medical Network Wins International Award*, May 19, 2011, Virginia Business, *available at* http://www.virginiabusiness.com/index.php/news/article/danville-medical-network-wins-international-award1/.
552 *Comprehensive Annual Financial Report—Danville* at p. 14.
553 For additional information, *see* nDanville, Our Service Providers, http://www.ndanville.com/our-service-providers/.
554 *See* nDanville, Packages, http://www.ndanville.com/our-service-provider/packages/.

4.6.4 Community Impact

The Danville fiber GON, though not yet fully deployed to residents, has already been credited with positive impacts. The medical network, for example, has won plaudits from a number of organizations and has been favorably received by healthcare professionals and local patients alike.[555] Danville also uses its fiber network to provide broadband access for its schools.[556] It receives about $1 million in federal E-rate funds annually for these purposes.[557]

Danville has also used the network to diversify the local economy and attract new technology-focused firms. This has been a policy imperative for the municipality, which saw its industrial base erode in the early 1990s, when Danville "lost thousands of agriculture- and textile-related jobs."[558] To date, a number of programs and initiatives have been launched in an effort to attract new firms to the area and encourage entrepreneurs and existing businesses to leverage the services provided via nDanville. These have included the Dan River Business Development Center, which is a nonprofit organization that seeks to "create an environment to enable entrepreneurs to succeed in establishing businesses and creating jobs in the Danville area."[559]

4.6.5 Assessment

The model employed by Danville to build its GON is mindful of the enormous costs associated with deploying such vast and complex infrastructure. That it has studiously avoided accruing debt and has been able to generate profits is notable. It is, however, too early to declare this GON a success or cite it as a model that other cities might adapt. The iterative nature of its deployment model runs the risk of ultimately undermining its ability to build out a citywide network, raising the possibility that its services will only be available in certain neighborhoods. Being able to pick and choose where it offers service provides it with embedded regulatory and competitive advantages over incumbent ISPs, many of whom have obligations to provide service to all households in a given area.[560]

Finally, nDanville's open access model is subject to much debate because, in the U.S. telecommunications context, many argue that this approach has repeatedly failed to generate excepted gains in competition and innovation.[561] In the broadband space in particular, there is little evidence this approach worked when open access was still required of DSL providers in the early 2000s.[562] In light of past failures, and recognizing the unique attributes of broadband service, the policy framework for broadband and other advanced communications services in the United States has been deliberately built around a preference for promoting facilities-based competition among ISPs.[563] The results to date (discussed in **section 3.1.1**) have been impressive and continue

555 *See, e.g.,* Intelligent Community, Founders Awards 2012, https://www.intelligentcommunity.org/index.php?src=gendocs&ref=Award_Founders&category=Events&link=Award_Founders.

556 *See Danville FY 2014 Adopted Budget Telecommunications Fund,* p. 17-1, (2014), *available at* http://www.danville-va.gov/documentcenter/view/9715.

557 Per a phone conversation with Jason Grey, Project Manager, nDanville.

558 *Danville Transforms its Economy.*

559 *See FY 2014 City Council Introductory Budget Summary*, at p. 4-72, Danville City Council, *available at* http://www.danville-va.gov/DocumentCenter/View/9335.

560 The practice of picking and choosing service areas is often referred to as "redlining." In the communications context, redlining is often avoided by contractual terms (e.g., franchise agreements that mandate universal service in a given territory), legislation (e.g., service obligations for telephone companies), or as a *quid pro quo* for receiving subsidies to provide service (e.g., in the case of the federal or state-level universal service funds). This issue has emerged in areas that are experimenting with hybrid approaches to bolstering broadband connectivity. Additional discussion is provided in section 6, *infra*. For a discussion of one recent example, *see* John McQuaid, *Will Poor People Get Google Fiber?*, April 13, 2013, Forbes.com, *available at* http://www.forbes.com/sites/johnmcquaid/2013/04/13/will-poor-people-get-google-fiber/.

561 For an extended discussion of how this approach failed in the market for basic telephone service, *see generally* Robert W. Crandall, Competition and Chaos: U.S. Telecommunications Since the 1996 Telecom Act (Brookings Press: Washington, D.C. 2005).

562 *Id.* at p. 127-129. *See also supra,* section 2.1, for additional discussion regarding the debate over open access policies in the early 2000s.

563 *See, e.g.,* George S. Ford, Thomas M. Koutsky & Lawrence J. Spiwak, *Competition After Unbundling: Entry, Industry Structure, and Convergence*, 59 Fed. Comm. L. J. 331 (2007) (providing an overview of this approach).

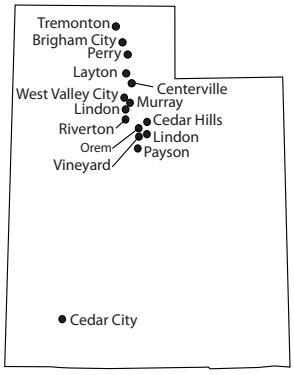
to accrue, fueling the debate over the ability of an open access approach to succeed over the long term, especially one funded in an ad hoc manner.

4.7 UTOPIA, Utah

The multi-city GON in Utah, dubbed UTOPIA, was initially seen as an ambitious attempt to marshal municipal resources in support of an open access FTTH network that would, eventually, deliver significant value to residents and business across every member city. For a number of reasons, UTOPIA has become financially problematic and has yet to deliver on many of the promises made by supporters prior to its launch.[564]

An emerging public-private partnership may eventually help to resurrect this network, but, thus far, the enormous costs of this network may overshadow any benefits that have emerged. As a result, UTOPIA offers a cautionary tale about municipal intervention into the broadband space. In April 2014, Macquarie expressed its desire to move forward with its plan to "build out the network, make it financially viable, assume the business risks and boost cash flow, ultimately retiring millions of dollars in public debt."[565] To do so, Macquarie proposed a "new utility fee on all residents of cities that opt into its plan. Estimated at $18 to $20 a month, the charge per household would apply even for residents who don't want its basic Internet service."[566]

UTOPIA, Utah At-A-Glance



Total Population of 15 Member Cities: 526,172 (2012)*

Year of Network Launch: 2008

Current Status: Partially Built

Number of subscribers: 8,240

Revenues: $11.7 million

Operating Expenses: $12.4 million

* Total Population 10 Cities Now Receiving Service: 441,334 (2012)

Note: Additional information on the UTOPIA network is contained in Table 1 and in Appendix I.

4.7.1 Background

In 2002, 16 cities in Utah agreed to jointly build a fiber-optic network, with 11 of the 16 cities pledging to finance the project through bond issuances.[567] The Utah Telecommunications Open Infrastructure Agency—UTOPIA—was formed to manage this endeavor.[568] In the following years, several of the member cities issued bonds to finance the project.[569]

564 Analyses of the failure of UTOPIA abound. *See, e.g.,* Steven Titch, *Despite Glossy Reports, Muni Broadband is Still a Net Loser*, May 6, 2013, Reason, *available at* http://reason.org/news/show/apr-2013-municipal-broadband; Andrew Moylan and Brent Mead, *Municipal Broadband: Wired to Waste*, at p. 11-12, NTU Policy Paper #129, National Taxpayers Union (April 9, 2012), *available at* http://www.ntu.org/news-and-issues/ntu-pp-128-municipal-broadband-wired-to-waste-1.pdf. Numerous other analyses are cited *infra.*

565 *See* Tony Semerad, *Australian firm proceeds with plan to take over struggling UTOPIA,* April 29, 2014, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/home3/57881464-200/network-macquarie-utopia-cities.html.csp.

566 *Id.*

567 *See* City of Orem, UTOPIA Information, http://orem.org/index.php/public-information/utopia-information.

568 UTOPIA was formed pursuant to Utah's Interlocal Cooperation Act. *See* Utah Code 11-13-101 et seq. *available at,* http://le.utah.gov/code/TITLE11/htm/11_13_010200.htm.

569 *See A Performance Audit of the Utah Telecommunication Open Infrastructure Agency*, at p. 2, Report to the Utah Legislature, No. 2012-08 (Aug. 2012), *available at* http://le.utah.gov/audit/12_08rpt.pdf ("*UTOPIA Audit*").

The initial deployment plan for UTOPIA, circa 2003, was ambitious. It consisted of a three-phase build-out that would be completed in three or four years.[570] In 2005, UTOPIA's board announced that the first phase had been a success—the network achieved "take rates high enough to meet business plan objectives."[571] Shortly thereafter, however, the GON stumbled and subsequently entered a downward trajectory.

In June 2006, the agency found out that its new network might qualify for additional financing through the Rural Utility Service (RUS), a federal agency that funds rural electric utility and telecommunications projects.[572] RUS ultimately agreed to provide UTOPIA with up to $66 million in debt financing if UTOPIA would prioritize network construction in rural cities with populations of less than 20,000 residents.[573] The agency accepted these terms and shifted its focus to bringing the network to its smaller member cities first.[574] The first installment of federal funds—$21 million in total—was released in 2007.[575] Soon thereafter, RUS suspended its support of UTOPIA until it "improved its financial condition and developed a new business plan."[576] As a result, UTOPIA spent several years attempting to resolve its dispute with RUS while also searching for additional funding to complete the network.[577] UTOPIA was able to obtain two rounds of refinancing via the creation of a sister program—the Utah Infrastructure Agency (UIA)[578]—which qualified for up to $65 million in debt financing.[579] In August 2010, UTOPIA obtained $16.2 million from the federally funded Recovery Act to help install fiber-optic lines directly to subscribing homes and businesses.[580]

UTOPIA has not met its goals for deployment and adoption. In 2007, UTOPIA made service available to 37,160 addresses, less than one-third of its original goal.[581] Moreover, the take-rate was disappointing as well. UTOPIA expected to have 49,350 subscribers in 2007, but only had 6,161.[582] By 2011, UTOPIA began to rely on payments from its newly formed affiliate, the UIA, to cover most of its annual operating deficit.[583]

4.7.2 Cost and Financing

The cost of UTOPIA has been very high: factoring in debt service and other payments, the total cost of the network approaches $500 million.[584] Of this, $185 million stems from long-term bond debt; the cost of the infrastructure itself was $110 million.[585] Construction delays and lack of consumer interest required the network to use a significant amount of its bond proceeds to service its debt ($48 million) and make up for operating deficiencies ($27 million).[586]

570 *Id*. at 6.
571 *Id*. at 7.
572 *Id.*
573 *Id*.
574 *Id*.
575 *Id*.
576 *Id*.
577 *Id.*
578 "The UIA is network is…connected to UTOPIA fiber optic network pursuant to an Indefeasible Right of Use Agreement between UIA and UTOPIA, which grants UIA access to certain facilities of and capacity in the UTOPIA network." *See Utah Infrastructure Agency Financial Statements—June 30, 2012*, at p. 2, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Dec. 13, 2012), *available at* http://emma.msrb.org/EP732731-EP568532-.pdf ("*Utah Infrastructure Agency Financial Statements—June 30, 2012*").
579 *Id*.
580 *See* Cathy McKitrick, *UTOPIA in Layton and Centerville Grows through Federal Funds*, Aug. 3, 2011, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/news/52290138-78/utopia-centerville-layton-fiber.html.csp.
581 *UTOPIA Audit* at p. 8.
582 *Id.*
583 *Utah Infrastructure Agency Financial Statements—June 30, 2012* at p. 8.
584 *See* Tony Semerad and Vince Horiuchi, *UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out?,* Dec. 3, 2012, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/news/55284692-78/utopia-network-fiber-west.html.csp ("*UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out*").
585 *UTOPIA Audit* at p. 11.
586 *Id.* at p. 13.

UTOPIA has liabilities that total at least $205 million.[587] This amount is expected to grow by $13 million each year that UTOPIA runs an operating deficit.[588] According to a state audit in 2012, UTOPIA had total net assets of negative $120 million.[589] Member cities are obligated to use taxpayer money to continue funding the network and servicing its debts until it is able to generate profits sufficient for these purposes.[590]

In December 2013, the financially troubled network announced an agreement with Macquarie Capital, a worldwide capital investment group, to work toward a public-private partnership.[591] Macquarie has invested in or advised on a number of public projects, including airports, roads, bridges, rail projects, sea ports, water and gas projects, and communications businesses in television, telephone, and radio.[592] It has a track record of bringing projects in on budget and on deadline.[593] The proposed partnership with UTOPIA hopes to complete deployment of the network infrastructure and increase its dwindling subscriber rate, while reducing costs.[594] Macquarie Capital will also assist with outside infusions of money, network design, buildout, finance and maintenance.[595]

The first stage of the partnerships entails an engineering and feasibility study to examine operational aspects of the current network and assess possible paths toward completion.[596] The ultimate goal is to develop a private-public partnership with any of the UTOPIA cities willing to participate, with Macquarie paying to build out network infrastructure and then operating it under a 30-year revenue-sharing contract.[597] The network will remain open access; Macquarie will partner with third-party service providers.[598] The member cities will continue to own the network and remain responsible for paying off the initial debt, while Macquarie Capital would be liable for any future debts.[599]

This emerging partnership is not without controversy. In the lead-up to the announcement, some 50 public officials from the network's member cities were required to sign non-disclosure agreements.[600] Many worry that this will undermine transparency, but UTOPIA's management believed that such discretion was needed to complete the deal.[601]

4.7.3 The Network

UTOPIA is owned and operated by the following member cities: West Valley City, Centerville, Murray, Lindon, Brigham City, Tremonton, Midvale, Orem, Payson, Perry, Layton, Cedar Hills, Cedar City, Vineyard, and Riverton.[602] The network is an open-access FTTH system, which means that UTOPIA "leases lines to private [ISPs] who deliver service to subscribers."[603]

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587 These encompass the $185 million in revenue bonds, nearly $16 million in notes to member cities, and $4.4 million in other liabilities. *Id*. at p. 10.
588 *Id*. at p. 12.
589 *Id.* at p. 9.
590 *Id*. at p. 11.
591 *See* Genelle Pugmire, *UTOPIA Announces Partnership with Private Capital Company*, Dec. 20, 2013, Daily Herald, *available at* http://www.heraldextra.com/news/local/central/orem/utopia-announces-partnership-with-private-capital-company/article_e364dbb4-6901-11e3-ad10-0019bb2963f4.html ("*UTOPIA Announces Partnership with Private Capital Company*").
592 *See* Vince Horiuchi & Tony Semerad, *Has Utah's UTOPIA network found a savior?*, Dec.19, 2013, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/money/57282051-79/macquarie-utopia-network-projects.html.csp.
593 *Id.*
594 *UTOPIA Announces Partnership with Private Capital Company.*
595 *Id.*
596 *Id.*
597 *Id.*
598 *Id.*
599 *Id.*
600 *See* Tim Gurrister, *UTOPIA Officials Bullish about Possible Major Partnership*, Nov. 30, 2013, Standard-Examiner, *available, at* http://www.standard.net/stories/2013/11/30/utopia-officials-bullish-about-possible-major-partnership ("*UTOPIA Officials Bullish*").
601 *See Our View: UTOPIA Dealings Must be in Open*, Nov. 18, 2013, Standard-Examiner, *available at* http://www.standard.net/stories/2013/11/15/our-view-utopia-dealings-must-be-open.
602 *See* UTOPIA, Board Members, http://www.utopianet.org/board-members.
603 *See* UTOPIA, About, http://www.utopianet.org/about-utopia/. Utah law requires public entities to offer municipally-owned broadband services on a wholesale basis. *See* Utah Code 10-18-101 et seq.

The network is partially operational and available to citizens of Brigham City, Centerville, Layton, Lindon, Midvale, Murray, Orem, Payson, Tremonton and West Valley City.[604] It intends to expand service to Cedar City, Cedar Hills, Perry, Riverton and Vineyard, but completion has been delayed by ongoing financial difficulties.[605] While the network is operating in many of its intended cities, it is still not 100 percent complete in any individual city; completion rates span from 0 percent in Perry to 96 percent in Brigham City and Tremonton.[606] Planners intended to pass through 141,000 addresses by September of 2007, but the network only passed 62,000 addresses as of June 2012, with 8,240 subscribers, or a 13 percent take rate, far below expectations.[607] UTOPIA had predicted it would have five times that amount by 2007.[608]

As an open access system, UTOPIA relies on local ISPs to provide customers with services. Some ISPs offer service only in one city, while some are systemwide. Brigham-net, for example, offers Internet, television, and telephone service only in Brigham City.[609] Customers can purchase a symmetrical 20 Mbps Internet connection for $34.95 per month and can upgrade to a 50 Mbps connection for an additional $5 per month.[610] A bundle including the 20 Mbps connection, television, and telephone costs $124.90.[611] Several other options are available depending on the city.[612] Several different ISPs offer 1 Gbps connections in select areas.[613] The cost ranges from $65 to $75 per month.[614]

UTOPIA continues to operate at a loss, as it has done since its launch over a decade ago.[615] The network's public-private partnership with Macquarie Capital may help alleviate these financial problems, but it cannot recover the system's high startup costs over the past decade.

4.7.4 Community Impact

Despite lofty aspirations about UTOPIA being a broadband utopia for residents and businesses,[616] there is broad agreement this GON has been a financial failure.[617] Criticism of this network has been sharp from residents, media outlets, and elected officials, some of whom were elected on anti-UTOPIA platforms. Brigham City Mayor Dennis Fife, who was elected in 2009 in part because of his criticism of the network, has repeatedly expressed disbelief that there is still support for the system after years of losses and hundreds of millions of dollars of debt.[618] There is a consensus that UTOPIA suffered from over-ambition, wasteful spending, poor planning, and ineffective leadership.

Citizens in particular have voiced criticism about the excessive and ongoing cost of a network that has yet to be fully built and is unable to generate enough revenue to service its debt and fund future deployments.[619] Citizens are particularly anxious about the financial state of UTOPIA because they are ultimately responsible for paying the bill. As discussed above, member cities are obligated to follow through on their pledges to provide sales tax revenue as security for their bonds.[620] This raises the possibility of tax hikes to cover these

604 *See* UTOPIA, FAQ, http://www.utopianet.org/faq/.
605 *Id.*
606 *UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out.*
607 *See Utah Telecommunication Open Infrastructure Agency, Financial Statements*, p. 2, June 20, 2012, UTOPIA, *available at* https://web.archive.org/web/20130203105656/http://utopianet.org/uploads/files/177_UTOPIA_Report_2012_-_Final.pdf.
608 *Id.*
609 *See* Brigham-net, Home, http://www.brigham.net/.
610 *See* Brigham-net, UTOPIA, http://www.brigham.net/utopia.htm.
611 *Id.*
612 *See* UTOPIA, Providers, http://www.utopianet.org/providers/.
613 *See UTOPIA Service Providers Reduce Price of Utah's Fastest Internet Connection,* Sept. 15, 2013, UTOPIA Net, *available at* http://www.utopianet.org/utopia-service-providers-reduce-price-of-utahs-fastest-internet-connection/.
614 *Id.*
615 *UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out.*
616 *See, e.g.,* Steven Cherry, *A Broadband Utopia,* April 28, 2006, IEEE Spectrum, *available at* http://spectrum.ieee.org/computing/networks/a-broadband-utopia ("*Broadband Utopia*").
617 *See, e.g., UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out* (highlighting discontent).
618 *UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out.*
619 *Utopia Audit* at p. 11.
620 *Id.*

costs or a costly default that could devastate some or all of the member cities. Another route, which Orem recently took, is to continue issuing bonds in the hope that the system can turn itself around and implement a profitable business model.[621]

Perhaps the most scathing criticism of UTOPIA was included in a 2012 audit prepared at the request of the Utah state legislature.[622] The analysis concluded that the network had not met any of its expectations, that bond proceeds were used wastefully, and that management had done a poor job of planning and executing.[623] The report stated, "We believe an underlying problem throughout UTOPIA's expansion is the lack of a carefully prepared development plan and policies to guide the construction of the network," and when the committee asked to see planning documents for UTOPIA's expansion, the "staff were unable to produce one."[624]

4.7.5 Assessment

To date, the failure of UTOPIA offers a number of important lessons for other cities now considering creating a GON. First, with regard to planning and managing expectations, the ambitious nature of the project led to a high-risk undertaking by local officials who were attracted by the promise of a FTTH network. The fanfare around this network, which was poised to be the largest of its kind when the project began, was fed by intense political pressure to deploy the network to every city at once.[625] This decision drove up costs without creating a single revenue-generating city network as a base to sustain future deployments.[626] As the network began to experience problems, this project stranded half-built infrastructure in some cities and left many others without anything to show for their investment.[627]

Second, and related, there was little effort to manage costs and adhere to a budget. Political pressure and the all-in mindset that drove UTOPIA from the start resulted in runaway costs that are now nearing a half-billion dollars. Initial concerns were countered by visions of using the new multi-city broadband network to encourage local economic development and transform these rural towns into competitive global hubs.[628] This has certainly not been the case as the network struggles to add subscribers.

In looking ahead to the future of UTOPIA, there continue to be different opinions as to the likelihood of future success. Some believe the network can be salvaged either by tweaking the business model[629] or continuing to build out in the hope more people will eventually subscribe and generate enough revenue to begin paying down debts.[630] The risk is that such determination to finish what has already been started will result in more debt, which in turn increases the likelihood of either a costly default or large tax hikes to continue servicing a mountain of debt.

UTOPIA's partnership with Macquarie Capital is a promising step toward getting the network on a more sustainable path and relieving taxpayers of future debt burdens. Nevertheless, the past, in the form of major debt loads and poor planning, weighs heavily on this network and may in due course lead to the conclusion that it failed to achieve its original ambitious objectives.

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621 *See* Emiley Morgan, *Orem Pledges $24M Bond to Fund UTOPIA Construction*, Feb. 28, 2013, Desert News, *available at* http://www.deseretnews.com/article/865574488/Orem-pledges-24M-bond-to-fund-UTOPIA-construction.html?pg=all ("*Orem Pledges*").
622 *See generally Utopia Audit.*
623 *Id.*
624 *Id.* at p. 24.
625 *Id.*
626 *Id.*
627 *Id.* at p. 16.
628 *See, e.g., Broadband Utopia; UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out.*
629 *See, e.g., Orem Pledges* (discussing a recent bond issuance by a member city and the negative response by residents).
630 *See, e.g., UTOPIA: Fiber-Optic Nirvana or a Nightmare with No Way Out* (quoting optimistic UTOPIA executives).

4.8 Groton, Connecticut

The government-owned broadband network deployed in Groton offers another example of a failed GON. Built amidst much acclaim and anticipation in the mid-2000s, the network quickly collapsed under the weight of soaring debt and tepid consumer demand. In early 2013, the city sold the system to private investors for $550,000, representing a loss of over $30 million. The city and its taxpayers remain responsible for more than $27 million in loans. This case study examines the motives that drove this GON's deployment and highlights the flawed assumptions that undergirded an unsuccessful financing plan and unrealistic business model.

Groton, Connecticut At-A-Glance

City Population: 40,115 (2010)

Year of Network Launch: 2004

Current Status: Built and Sold

Number of subscribers: NA

Revenues: NA

Operating Expenses: NA

Note: Additional information on the Groton network is contained in Table 1 and in Appendix I.

4.8.1 Background

The communications network that would eventually grow into a GON grew out of a strategic plan that the local utility, Groton Utilities, floated in 1999. As a result of declining revenues in its core business, the utility outlined a plan for constructing a 32-mile fiber-optic network, access to which would be sold on a wholesale basis to ISPs.[631] According to a company official, the initial impetus for this endeavor was to "make money" in an effort to offset sagging electricity revenues (at the time, the utility was also "developing plans to begin producing bottled water").[632] Later that year, residents approved a $6.9 million bond issue to support construction of the network.[633] The municipality prevailed in the legal challenges that followed,[634] and by the early 2000s it began to develop plans for deploying a hybrid fiber/cable network that would extend cable service to residents and thus compete directly in the market for broadband and television.[635]

Those who advocated for a municipal network in Groton were driven, in part, by local dissatisfaction with incumbent ISPs.[636] A survey commissioned by the state found that, of the 400 residents polled in the five towns that would be served by a municipal cable entity, 64 percent indicated they would be "very likely or likely" to

631 *See, e.g.,* Michael Costanza, *Groton Utilities Considering Telecommunications Service*, Oct. 22, 1999, The Day, *available at* http://news.google.com/newspapers?nid=1915&dat=19991022&id=QQchAAAAIBAJ&sjid=eXYFAAAAIBAJ&pg=5556,4321864 ("*Groton Utilities Considering Telecommunications Service*").

632 *Id.*

633 *See* Michael Costanza, *Groton City Backs Utilities' Proposal to Provide Telecommunications Service*, Nov. 2, 1999, The Day, *available at* http://news.google.com/newspapers?nid=1915&dat=19991102&id=RQohAAAAIBAJ&sjid=ynYFAAAAIBAJ&pg=4629,187783;

634 *See e.g.,* Tara Bahrampour, *Bid to Stop Groton,* June 5, 2001, N.Y. Times, *available at* http://www.nytimes.com/2001/06/05/nyregion/metro-business-briefing-bid-to-stop-groton.html (noting that "Southern New England Telecommunications has appealed an April ruling by the Department of Public Utility Control in Connecticut that would allow Groton Utilities to build a 32-mile fiber-optic network providing Internet access and other services in the Groton area.").

635 *See* Gladys Alcedo, *Hearing Planned On Proposal For New Cable Service*, March 11, 2003, The Day, *available at* http://www.theday.com/article/20030311/DAYARC/303119938/0/SEARCH ("*Hearing Planned*").

636 Competition in the U.S. video marketplace was still developing in the late 1990s and early 2000s. Satellite television service was becoming increasingly popular, but market entry by telephone companies had yet to materialize in any significant way. Of course, over the next decade, video choices would proliferate with the continued rise of satellite, the emergence of video services by telecom companies like Verizon and AT&T, and the rapid emergence of IP-enabled video. For additional discussion and analysis of this transformation, Compare *In the Matter of Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Eighth Annual Report, 17 FCC Rcd 1244, FCC 01-389 (rel. Jan. 14, 2002), with *In the Matter of Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Fifteenth Annual Report, 28 FCC Rcd 10496, FCC 13-99 (rel. July 22, 2013).

switch cable services "if a new competitor entered the market."[637] In response, incumbent firms argued against municipal entry by noting the many risks to taxpayers associated with owning and maintaining such a vast communications infrastructure.[638] The utility pressed ahead, and in 2003 the Groton City Council approved its plan. It authorized the formation of Thames Valley Communications (TVC), a city-owned taxable stock corporation, and approved a total of $6.9 million for the development of this new enterprise.[639] TVC was granted a franchise on January 1, 2004;[640] network construction began soon after, and parts of the network went live in May 2004.[641] Construction would stretch over the next few years.

4.8.2 Cost and Financing

The Groton GON was a costly venture for the city, its taxpayers, and its bondholders. Initial startup and construction costs totaled $16.9 million.[642] The city borrowed $34.5 million between 2006 and 2008 to build and expand the network.[643] This was substantially more—in terms of total dollars and total debt—than initially estimated by the city officials, who, in 2001, thought the entire network would cost "$25 million to $30 million, to be paid with operating revenue from the cable business."[644]

4.8.3 The Network

The network TVC eventually built was capable of delivering telephone, Internet, and cable service to residents and businesses in Groton, Gales Ferry, Stonington, and Pawcatuck.[645] From the beginning, some observers viewed the GON as financially unsustainable. It lost an average of $2 million a year while owing nearly $30 million in debt.[646] By 2012, the city decided to sell off the network to private investors. CTP Investors bid for, and eventually won, the right to purchase the GON for $550,000 in early 2013.[647] As a result of the sale, Groton Utilities will be required to pay off the remaining debt of $27.5 million via annual installments that began at $2.6 million and will decrease by about $100,000 each year over the next 14 years.[648]

The current, privately owned incarnation of TVC offers customers an array of standalone and bundled broadband, television, and telephone services.[649] Its broadband packages range from an asymmetrical 6.6 Mbps

637 *Hearing Planned.*
638 *See Editorial: City Utilities Goes Modern*, July 2, 2001, The Day, *available at* http://news.google.com/newspapers?id=C5tGAAAAIBAJ&sjid=7PgMAAAAIBAJ&pg=2445,251176&dq=groton+utilities+telecom+network+resident+vote+approve+1999&hl=en (endorsing the proposed GON but urging caution) ("*Editorial: City Utilities Goes Modern*").
639 *See City of Groton, Connecticut, General Obligation Bonds, Issues of 2006*, at p. 10, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Feb. 7, 2006), *available at* http://emma.msrb.org/MS244149-MS219457-MD427024.pdf ("*Groton General Obligation Bonds, Issues of 2006*").
640 *Id.*
641 *See Utilities Commission Meeting Minutes*, at p. 11, City of Groton (Nov. 23, 2004), *available at* http://www.cityofgroton.com/docs/minutes/ucommission/2004/ucommission11-23-04.pdf.
642 *Groton General Obligation Bonds, Issues of 2006* at p. 10.
643 *See, e.g.,* Deborah Straszheim, *Thames Valley Communications Transfers Ownership of Cable Company,* Feb. 2, 2013, Groton Patch, *available at* http://groton.patch.com/groups/politics-and-elections/p/thames-valley-communications-transfers-ownership-of-cbe9bb6eabc
644 *Hearing Planned.*
645 *See* Thames Valley Communications, About, http://www.tvcconnect.com/about-us.
646 *See, e.g.,* Greg Smith, *Groton Utilities' Venture Into Cable an Ambitious Idea that Didn't Pan Out,* Dec. 2, 2012, The Day, *available at* http://www.theday.com/article/20121202/NWS01/312029942/Groton-Utilities%27-venture-into-cable-an-ambitious-idea-that-didn%27t-pan-out ("*Ambitious Idea that Didn't Pan Out*").
647 *See* Greg Smith, *Original Bidder to Buy Groton Cable Company, but at Higher Price,* Jan. 15, 2013, The Day, *available at* http://www.theday.com/article/20130115/NWS01/130119838/1047.
648 *Id.*
649 *See* TVC, Rate Card, http://www.tvcconnect.com/wp-content/uploads/2013/11/RateCard.pdf.

connection for $29.99 per month, to an asymmetrical 55 Mbps connection for $59.99 per month.[650] As of 2012, TVC had 8,000 customers[651] across a service territory that covered at least 38,000 homes.[652]

4.8.4 Community Impact

Benefits that might have flowed from this GON have been overshadowed by the financial difficulties that have faced this network. It also appears that the network has not had a discernible impact on local employment. Groton's unemployment rate has been largely unchanged since deployment of the network and has generally tracked fluctuations in the national labor market.[653] Its relatively small subscriber base demonstrates the GON did not achieve one of its core goals: to compete directly with incumbent ISPs. On the contrary, the municipal system was weakened by the very competitive forces that the city thought were lacking.[654]

The large amount of debt accrued to build this system has had several negative impacts on residents. First and foremost, the town of Groton, even after selling off its failing asset, remains responsible for paying off tens of millions of dollars in debt. Due to the city's use of general obligation bonds, this onus falls directly on residents, either via increased taxes, fewer municipal services, or higher electricity rates.[655] Second and related, Groton's credit rating has been negatively impacted by the failed network. Moody's downgraded Groton's credit rating as a result of the failing municipal network,[656] and only after selling the GON to CTP was the city's credit outlook upgraded from "negative" to "stable."[657]

4.8.5 Assessment

The rise and fall of the GON in Groton highlights a number of assumptions often made by local officials and others who advocate in favor of municipal broadband deployment.

First, the size of the debt amassed by the city was driven up by the actions of city government and local utility officials, many of whom viewed the GON as a financial panacea that would be able to self-sustain and generate profits to help cross-subsidize other investments. As a result, the reasoning offered in support of the GON became a moving target. Initially, the GON was pitched as a wholesale network that would provide the utility with a new vehicle for making money to offset a decline in electricity revenues.[658] But the network eventually evolved into a commercial enterprise that would compete directly with incumbent ISPs. Such quixotic maneuvering drove up costs and greatly enhanced the risk exposure for residents, whose tax dollars were offered as collateral in exchange for the tens of millions of dollars in bond debt needed to fund deployment.

Second, expectations for the financial sustainability of the Groton GON appeared to be based on a small consumer survey undertaken in 2001, which found a majority of customers would consider switching cable providers if a competitor entered the market.[659] Such apparent pent-up demand for an alternative drove the development of a business plan largely hinged on the GON's ability to attract a substantial portion of these

650 *Id.*

651 Groton's annual report does not make clear which services these customers had purchased. *See Comprehensive Annual Financial Report, Fiscal Year Ending in 2012*, at p. iii, Dept. of Finance, City of Groton, Connecticut, *available at* http://emma.msrb.org/ER637248-ER493540-ER896400.pdf.

652 *Hearing Planned* (the 38,000 home estimate stems from a 2001 assessment by the city regarding the proposed GON).

653 *See* Groton, Connecticut Unemployment Rates, http://ycharts.com/indicators/groton_ct_unemployment_rate.

654 *See, e.g., Ambitious Idea that Didn't Pan Out.*

655 *Groton General Obligation Bonds, Issues of 2006* at p. 1.

656 *See Rating Action: Moody's Assigns Aa3 Rating to City of Groton's (CT) $23.2 million G.O. Bonds, Issue of 2013 Series A and B; Outlook Revised to Stable from Negative*, March 21, 2013, Moody's, *available at* https://www.moodys.com/research/Moodys-assigns-Aa3-rating-to-City-of-Grotons-CT-232--PR_269226 ("*Outlook Revised to Stable from Negative*"). *See also Rating Action: Moody's Downgrades the City of Groton's (CT) Long Term General Obligation Rating to Aa3 from Aa2; Negative Outlook Affirmed*, June 4, 2012, Moody's, *available at* https://www.moodys.com/research/Moodys-downgrades-the-City-of- Grotons-CT- long-term-general--PR_247614.

657 *Outlook Revised to Stable from Negative.*

658 *Groton Utilities Considering Telecommunications Service.*

659 *Hearing Planned.*

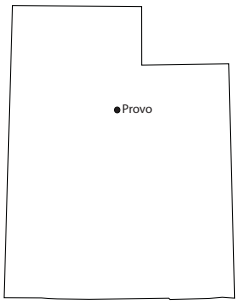
disillusioned customers and grow a subscriber base that would generate revenues sufficient to cover future deployments. Officials, however, failed to see the many risks inherent in this plan. An editorial in a local paper at the time identified these risks and called for caution: "… there is financial risk involved. Profits are not guaranteed, the business is competitive and market conditions can change dramatically in a short time."[660]

Third, the dynamism in the market proved prescient as the wider communications marketplace began to change in fundamental ways in the early and mid-2000s. Although competition in the market for video and broadband services might have been nascent in 2001, when the utility began to develop its plans for the GON, the advanced communications space began to proliferate in significant and profound ways shortly thereafter.[661] At the time, city officials and the utility were so focused on the promise of a municipal network that they failed to account for the rapid emergence of intermodal competition. Consequently, the resulting business model and the many predictions for success and viability were predicated on a static view of the market. But the marketplace and organic market forces soon addressed whatever shortcomings the city and utility were attempting to "fix" with its GON.

4.9 Provo, Utah

The GON in Provo, Utah, will forever be linked with Google, the company that purchased the municipal broadband network in 2013 for one dollar. Many now view the municipal broadband system in Provo as a failure that cost taxpayers about $60 million. After selling the system to Google, the city remains responsible for paying off nearly $40 million in debt over the next 12 years. In short, Provo joins the growing list of municipalities that have been forced to cut their losses, abandon their GON, and acknowledge their efforts to compete in the broadband sector did not live up to original expectations and ultimately proved costly to residents.

Provo, Utah At-A-Glance



City Population: 115,919 (2012)

Year of Network Launch: 2001

Current Status: Built and Sold

Number of subscribers: NA

Revenues: $570 K

Operating Expenses: $1.89 million

Note: Additional information on the Provo network is contained in Table 1 and in Appendix I.

4.9.1 Background

The roots of the FTTH municipal network that would eventually be deployed in Provo date back to 1998, when the city investigated whether and how it might construct a telecommunications system.[662] By 2001, the city successfully built a backbone network consisting of three fiber rings, which connected an array of municipal assets, including electric substations, city buildings, major traffic signals, and schools.[663] Thereafter, the city explored the feasibility of extending the network directly to residents and

660 *Editorial: City Utilities Goes Modern.*

661 For additional discussion and analysis, *see supra,* section 3.1.1.

662 *See The iProvo Timeline*, Apr. 21 2013, Daily Herald, *available at* http://www.heraldextra.com/news/local/central/provo/the-iprovo-timeline/article_92b618c2-3479-5125-bb89-96cd1e33b269.html ("*iProvo Timeline*").

663 *See City of Provo, Utah, $39,500,000 Sales Tax Revenue Bond, Series 2004 Taxable*, at p. 17, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Feb. 24, 2004), *available at* http://emma.msrb.org/MS217839-MS193147-MD374970.pdf ("*Provo $39,500,000 Sales Tax Revenue Bond, Series 2004*").

businesses.[664] Pressure from incumbent ISPs and state legislators, however, pushed city officials to shift their plan for the emerging GON to a wholesale model.[665]

In 2002, the city embarked on the second phase of building, a demonstration project that entailed the construction and operation of a wholesale FTTH network for 300 single-family houses and 30 apartment buildings.[666] The city partnered with retail providers to offer consumers television, telephone, and high-speed data services.[667] The City Council viewed this limited pilot as a success and voted to pursue the entire project in November 2003.[668] The next year, it agreed to issue $39.5 million in tax revenue bonds to finance the network, dubbed iProvo.[669] These funds would be used to build a fully fiber, open access network that would also be used for an array of internal purposes (e.g., control of traffic, electrical, and water systems; internal communication services).[670] The Council estimated that iProvo would be completed by 2006 and capable of generating a positive cash flow by 2008.[671]

The projected success of iProvo was tied directly to the ability of its primary ISP, HomeNet, to grow a robust subscriber base and generate revenues that could be used to cover the costs of building and maintaining the network. By 2005, less than a year after the network went live, HomeNet and iProvo began to run into trouble. In particular, HomeNet was only able to sign up 2,400 customers at its peak, and by 2005 it had lost one-third of them, dropping iProvo's subscribership to 1,600.[672] Consequently, HomeNet pulled out of its contract in July 2005[673] and filed for Chapter 11 bankruptcy protection.[674] This sent iProvo into a downward financial spiral where it was not gaining enough subscribers and revenues were down.[675] These troubles would only multiply over the next few years.

In 2006, low revenue and even lower subscriber rates forced iProvo to approach the city and request a loan of $1 million from its electricity reserve fund to cover costs for the next fiscal year.[676] The GON continued borrowing city funds throughout 2006 and 2007.[677] Subscriber and revenue growth, however, remained disappointing. In 2007, the network had initially expected it would be able to sign up an average of 60 subscribers per week; in reality, it was getting only 16.[678] By 2008, the year iProvo was supposed to be profitable, the network was on track to cost the city $2 million.[679]

It was becoming increasingly clear to the city that iProvo was unsustainable. The city was already investing millions of dollars annually to prop up the network[680] and was on track to lose more than $15 million in subsequent years if it continued to subsidize the GON.[681] As a result, the iProvo network was sold to a private

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664 *See* Steven Titch, *Spinning its Wheels: An Analysis of Lessons Learned from iProvo's First 18 Months of Municipal Broadband*, at p. 3, Reason Foundation (Dec. 2006), *available at* http://reason.org/files/33224c9b01e12f3b969f4257037c057e.pdf ("*Spinning its Wheels*").
665 *Id.*
666 *Id.*
667 *Id.*
668 *iProvo Timeline*.
669 *Provo $39,500,000 Sales Tax Revenue Bond, Series 2004* at p. 17.
670 *Id.*
671 *Spinning its Wheels* at p. 4.
672 *Id.* at p. 5.
673 *iProvo Timeline*.
674 *See* Tad Walch, *HomeNet Owes Provo and Other Creditors*, Feb. 3, 2006, Deseret News, *available at* http://www.deseretnews.com/article/635181385/HomeNet-owes-Provo-and-other-creditors.html?pg=all.
675 *See* John Twitchell, *Is iProvo in Trouble?*, July 12, 2005, Deseret News, *available at* http://www.deseretnews.com/article/600147949/Is-iProvo-in-trouble.html?pg=all.
676 *See* Steven Titch, *Provo Revisited: Another Year and Still Struggling*, at p. 3, Reason Foundation (April 2008), *available at* http://reason.org/files/33224c9b01e12f3b969f4257037c057e.pdf.
677 *Id.*
678 *See* Jens Dana, *Provo Eyes Ways to Fix its Network*, April 22, 2008, Deseret News, *available at* http://www.deseretnews.com/article/695272699/Provo-eyes-ways-to-fix-its-network.html?pg=all.
679 *Id.*
680 *See* Donald W. Meyers, *Veracity, OHIvey Offer Plans to Run iProvo*, May 6, 2011, Salt Lake Tribune, *available at* http://archive.sltrib.com/article.php?id=14941773&itype=storyID.
681 *See* Jens Dana, *iProvo, Broadweave Nearly Close Deal*, July 1, 2008, Desert News, *available at* http://www.deseretnews.com/article/700239528/iProvo-Broadweave-nearly-close-deal.html?pg=all.

company, Broadweave Networks, in May 2008 for $40.6 million.[682] As a condition of the sale, Broadweave agreed to pay off the $39.5 million bond that had been issued to build the GON.[683] But less than a year later, after merging with another company to form Veracity Networks,[684] the newly formed entity realized it could not build cash reserves, improve the network, or pay off lingering debt associated with the network.[685] Veracity asked the city to restructure the debt.[686] (To that point, Veracity had been drawing on a $6 million surety bond while it attempted to "save operating cash."[687]) In 2011, Veracity defaulted on its purchase agreement; control of the network reverted back to the city.[688] The city settled with Veracity and leased the network back to the company while it looked for a new buyer.[689] Also in 2011, the city "began charging $5.35 a month on residents' power bills to pay the bond payment."[690]

Like many problem GONs, Provo had a difficult time finding a buyer willing to purchase the network for the price of the assets, let alone the cost Provo paid to build the network. In April 2013, Provo finally found a buyer: the city sold the $40 million network to Google for one dollar.[691]

4.9.2 Cost and Financing

The FTTH GON in Provo was financed via a $39.5 million bond issue.[692] Beyond that, iProvo required about $2 million in subsidies from the city annually.[693] All told, additional taxpayer subsidization totaled $19.3 million.[694] The sale of the GON to Google does not remove the burden of debt from taxpayers. The city, and taxpayers by implication, are still responsible for the remaining debt on the original bond.[695] That works out to $3.3 million "in bond payments per year for the next 12 years."[696] In addition, the city of Provo will incur additional costs as a result of its deal with Google. It will have to not only retire the debt, but also "buy new equipment so it can operate city services independently from Google, and hire engineers to document the locations of all the fiber in the system."[697]

682 *See* Darren Murph, *Provo, Utah Sells iProvo Fiber-Optic Network to Broadweave,* May 9, 2008, Engadget, *available at* http://www.engadget.com/2008/05/09/provo-utah-sells-iprovo-fiber-optic-network-to-broadweave/.
683 *See Comprehensive Annual Financial Report, 2009, City of Provo, Utah*, *For the Fiscal Year Ended June 30, 2009,* at p. 9-10, Provo City, *available at* http://www.provo.org/userfiles/downloads/finance/cafrbook_2009.pdf.
684 *Id.*
685 *See* Donald W. Meyers, *Broadweave, Veracity Merge Companies, ask Provo to Restructure Payments*, Aug. 18, 2009, Salt Lake Tribune, *available at* http://archive.sltrib.com/article.php?id=13152591&itype=NGPSID.
686 *Id.*
687 *See* Donald W. Meyers, *Veracity Asks for More Time on Loan from Provo*, Sept. 2, 2009, Salt Lake Tribune, *available at* http://archive.sltrib.com/article.php?id=13255378&itype=NGPSID.
688 *See* Donald W. Meyers, *Provo Takes Back iProvo Network, Leases it to Veracity*, Apr. 18, 2012, Salt Lake Tribune, *available at* http://archive.sltrib.com/article.php?id=20654910&itype=storyID.
689 *Id.*
690 *See* Vince Horiuchi, *Provo Googled its Way out Fiber-Optic Network But Costs Live on*, June 3, 2013, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/money/56288307-79/network-iprovo-provo-google.html.csp.
691 *See* Angela Moscaritolo, *Report: Google Buying Provo Fiber Service for $1*, April 19, 2013, PC Magazine, *available at* http://www.pcmag.com/article2/0,2817,2417966,00.asp.
692 *Provo $39,500,000 Sales Tax Revenue Bond, Series 2004* at p. 17.
693 *See iProvo: A Requiem*, May 5, 2013, Utah Taxpayer's Association, *available at* http://www.utahtaxpayers.org/wp-content/uploads/2013/05/20-iProvo.pdf ("*iProvo: A Requiem*").
694 *Id.*
695 *See, e.g.,* Benjamin Wood, *Google Fiber Adds Value to Provo Network, But Taxpayer Debt Remains, Mayor Says*, April 18, 2013, Desert News, *available at* http://www.deseretnews.com/article/865578530/Google-Fiber-adds-value-to-Provo-network-but-taxpayer-debt-remains-mayor-says.html?pg=all.
696 *See* Vince Horiuchi, *Council Approves iProvo Sale to Google,* April 24, 2013, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/news/56206589-78/google-network-fiber-provo.html.csp.
697 *See Q&A With Mayor John Curtis, Provo, Utah*, at p. 40, Broadband Communities (May/June 2013), *available at* http://www.bbpmag.com/2013mags/may-june/BBC_May13_Q&AMayorCurtis.pdf.

4.9.3 The Network

The iProvo network in the city of Provo is operational but not entirely complete. The backbone has been deployed throughout the city, but only one-third of homes are connected to the network.[698] Under the city's management, subscription rates were much lower than anticipated.[699] At its peak, iProvo had about 11,000 subscribers, but churn rates were high.[700]

Prior to its sale to Google, iProvo offered triple-play packages to subscribers through contracted private ISPs. As an example of the services it offered, in 2004 HomeNet, iProvo's original retailer, offered several bundled packages of Internet access (up to 10 Mbps), cable telephone, and VoIP service, which ranged in price from $89.99 to $124.99 per month.[701] The services and pricing changed numerous times over the years as the network changed hands between public and private entities. Via Google Fiber, Google will offer subscribers free 5 Mbps service for a $30 activation fee; 1 Gbps connections will retail for $70 per month.[702] Google has no plans to offer services to businesses at this point in time.[703] But it has committed to providing "free Gigabit Internet service to 25 local public institutions like schools, hospitals, and libraries."[704]

4.9.4 Community Impact

In 2004, then-Mayor of Provo Lewis K. Billings enumerated the many benefits he foresaw for the fledgling FTTH network being in his city. These included "advanced telemedicine services," "interactive distance learning," "remote meter reading," and numerous other "things I can't even comprehend that will be enabled by the immense capacity of our network."[705] Nearly a decade later, few, if any, of these goals have been realized as the Provo GON transitions to yet another owner. Some have touted the benefits of gigabit connectivity in the city's schools, but there is little evidence that the network itself has generated tangible gains in outcomes.[706] Moreover, much of the excitement around educational technology in Provo schools seems to have stemmed more from the introduction of iPads than anything else.[707]

Over the course of its turbulent history, iProvo has been described as an example of government overreach. Residents, journalists, and elected officials alike have been critical of the GON. The Utah Taxpayers Association has characterized Provo's investment as a waste of taxpayer money. Early on, the group questioned, "Why is the city gambling with taxpayer money on a speculative venture when many private companies and cities have failed while attempting the same thing? Shouldn't we as taxpayers be able to vote before risking $40 million of OUR money?"[708]

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698 *See* Vince Horiuchi, *Provo Will be 3rd U.S. Metro Area to Get Speedy Google Fiber*, April 17, 2013, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/money/56168330-79/google-provo-network-fiber.html.csp.

699 *See, e.g.,* Jay Evenson, *Google Fiber Rescues Provo; What About UTOPIA?*, April 18, 2013, Deseret News, *available at* http://perspectivesonthenews.blogs.deseretnews.com/2013/04/18/google-fiber-rescues-provo-what-about-utopia.

700 *See* Jens Dana, *iProvo 'Surpassing Milestones'*, Sept 15, 2008, Deseret News, *available at* http://www.deseretnews.com/article/700258928/iProvo-surpassing-milestones.html?pg=all (reporting on subscription numbers); Jens Dana, *IProvo Experiencing 'Churn,'* Jan. 16, 2008, Desert News, *available at* http://www.deseretnews.com/article/695244527/IProvo-experiencing-churn.html?pg=all (reporting on customer cancellations).

701 *See* Chris Somerville, *HomeNet Launches TriplePlay on IProvo*, Dec. 10, 2004, Light Reading, *available at* http://www.lightreading.com/cable/homenet-launches-tripleplay-on-iprovo/240029971.

702 *iProvo: A Requiem.*

703 *Id.*

704 *See Google Fiber—On the Silicon Prairie, the Silicon Hills, and Now the Silicon Slopes*, April 17, 2013, Google Blog, *available at* http://googleblog.blogspot.com/2013/04/google-fiberon-silicon-prairie-silicon.html.

705 *See* Lewis K. Billings, *Benefits of a Community Broadband Network*, Oct. 11, 2004, Speech before the American Public Power Association Community Broadband Conference, *available at* http://www.provo.org/mayor.broadband.html.

706 *See, e.g.,* Mayor John Curtis, *What's the Latest on iProvo?,* July 27, 2011, Provo Insider, *available at* http://provomayor.com/2011/07/27/whats-the-latest-on-iprovo/.

707 *See* Genelle Pugmire, *Veracity Helps Provo Schools go High-Tech*, March 8, 2011, Daily Herald, *available at* http://www.heraldextra.com/news/local/central/provo/article_d38df969-a74b-5f8b-951d-9600e56fa587.html.

708 *See* Howard Stephenson, *UTOPIA Looks More and More Like a Rube Goldberg Cartoon*, Jan. 12, 2004, Utah Taxpayers Association, *available at* http://www.utahtaxpayers.org/?p=643.

Former Provo Mayor George Stewart, the mentor of the mayor who was responsible for launching iProvo, has been critical of his protégé and the network he built.[709] After a heated exchange during a City Council meeting, Stewart concluded that, "if I had been here two years ago, I would not have proposed iProvo." [710] The current mayor of Provo, John Curtis, has also been critical of the GON. He has been quoted as saying, "If I could, I would get a plot in the city cemetery and bury it. iProvo is gone, it was sold. I would never like to utter iProvo again."[711]

4.9.5 Assessment

The sale of iProvo to Google offers several insights that should inform ongoing debates over the efficacy of pursuing a municipal broadband network.

First, the sale to Google does little to erase the legacy of this municipal system. By 2013, iProvo had become a distressed asset that represented a failed foray into a competitive marketplace by the city government. The total cost of the network, estimated at around $60 million, may far outweigh any benefits that had accrued to the city up to that point.

Second, the sale of iProvo to Google is not the end of the story. Although the city and its mayor succeeded in its goal of selling the failing GON, Google was able to extract a favorable deal that might end up benefiting the company more than the residents it will serve. Google has committed to investing in upgrading the existing infrastructure to support gigabit connections and building out the network to all homes,[712] but it did not assume the nearly $40 million in debt that the city had previously tried to transfer on to its original private purchaser, Broadweave.[713]

The recent deal with Google requires Provo to spend upwards of $1.7 million on an array of items related to the transfer of ownership to Google.[714] Moreover, with much uncertainty surrounding Google's actual motivations for its small-scale gigabit fiber deployments, Provo residents could find themselves in another ambitious broadband experiment.[715]

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709 *See* Ace Stryker, *George Stewart: Man on a Mission*, Dec. 27, 2008, Daily Herald, *available at* http://www.heraldextra.com/news/local/george-stewart-man-on-a-mission/article_36913666-f18b-552d-b4f4-73a7b53056c4.html.

710 *See Off the Agenda: A Royal Rumpus: King George vs. Prince Lewis*, March 12, 2006, Salt Lake Tribune, *available at* http://archive.sltrib.com/printfriendly.php?id=3594292&itype=ngpsid.

711 *See* Genelle Pugmire, *Provo Mayor Gives Update on City's Economic Development, iProvo,* Oct. 1 2010, Herald Extra, *available at* http://www.heraldextra.com/news/local/article_e3ace13e-ea4f-51e4-a5d3-ad64adae91e6.html.

712 *See Google Fiber—On the Silicon Prairie, the Silicon Hills, and Now the Silicon Slopes*, April 17, 2013, Google Blog, *available at* http://googleblog.blogspot.com/2013/04/google-fiberon-silicon-prairie-silicon.html.

713 Cyrus Farviar, *Provo Doesn't Know Where its Fiber is, Google Makes City Spend $500,000 to Find It*, April 24, 2013, Ars Technica, *available at* http://arstechnica.com/business/2013/04/provo-doesnt-know-where-its-fiber-is-google-makes-city-spend-500000-to-find-i/.

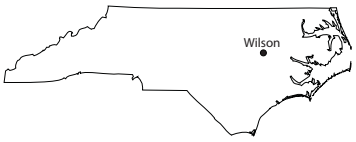
714 *Id.*

715 For an interesting analysis of possible motives, *see* Andres Cardenal, *Google Fiber: Unprofitable and Smart*, April 17, 2013, The Motley Fool, *available at* http://beta.fool.com/acardenal/2013/04/17/google-fiber-unprofitable-and-smart/31412/ (observing that "It´s essential for Google to make sure users will have access to the internet at a decent speed and a fair price, so they can actively use services like search and YouTube as much as they like, and Google gets to deliver more and better ads to that population…Not only that, every time someone uses one of Google´s services the company learns from that information and uses it to deliver better search results and more efficient advertising. Google needs us to be online as much as possible, both to make money by selling ads and to improve the quality of its services.").

4.10 Wilson, North Carolina

In April 2013, Wilson, North Carolina, became a "gig city."[716] After several years of competing with private ISPs in the market for Internet access, television, and telephone service, the city's GON was upgraded to a gigabit network in the expectation it would set a new standard for innovation and competition going forward. Today, the perceived success of the GON in Wilson is not clear-cut. Significant uncertainty surrounds many aspects of this network.

Wilson, North Carolina At-A-Glance



City Population: 49,610 (2012)

Year of Network Launch: 2008

Current Status: Built

Number of subscribers: 6,000

Revenues: $11.42 million

Operating Expenses: $11.42 million

Note: Additional information on the Wilson network is contained in Table 1 and in Appendix I.

4.10.1 Background

Beginning in the late 1980s, the city of Wilson, North Carolina, actively explored the possibility of entering the communications market as a service provider. In 1989, the city set aside $4 million to study the viability of creating or acquiring a cable company.[717] The primary motive of the city was to address what it saw as local discontent with the services offered by incumbents. In April 2001, Wilson took another step forward in its march toward a GON when it tried and failed to purchase outright the network of a local cable provider.[718] Later, Wilson sought to partner with incumbent ISPs in the construction of a FTTH network, but there was little interest in assuming the huge risks associated with building a network in the absence of any real demand.[719]

In November 2006, Wilson decided to go it alone. The City Council voted to authorize the issuance of $28 million in debt to build the FTTH network that city officials had long desired.[720] The network, dubbed Greenlight, began to connect some neighborhoods in 2008, and by 2009 the network went citywide.[721] As of January 2012, the network succeeded in passing 20,634 premises.[722] Later that year, the network began to expand into the surrounding county.

In response to concerns raised by a number of stakeholders, including incumbent ISPs, the state legislature passed a bill that sought to maintain a level playing field between public and private service providers (Wilson was exempt).[723] In particular, the bill, reflecting the enormous risk associated with such projects, required municipalities to hold hearings and a special election to approve projects, fund networks solely from revenues, and send a portion of revenues to the state's general fund.[724] The bill became law in May 2011.[725]

716 *See* Press Release, *City of Wilson to Offer Gigabit Internet Service to Customers by July*, April 19, 2013, GreenlightNC, *available at* http://www.greenlightnc.com/gigabit_press_release.php.
717 *See* Todd O'Boyle & Christopher Mitchell, *Carolina's Connected Community: Wilson Gives Greenlight to Fast Internet*, at p. 3, Common Cause and Institute of Local Self Reliance (Dec. 2012), *available at* http://www.ilsr.org/wp-content/uploads/2012/12/wilson-greenlight.pdf ("*Carolina's Connected Community*").
718 I*d*. at p. 1-2.
719 *Id*. at p. 2.
720 *Id*.
721 *Id*.
722 *See* Masha Zager, *Municipal FTTH Deployment Snapshot: Greenlight-Wilson, N.C.*, Broadband Communities Magazine (Jan. 2012), *available at* http://www.bbpmag.com/snapshot/snap0112.php.
723 *See An Act to Protect Jobs and Investment by Regulating Local Government Competition with Private Business*, H.B. 129, Feb. 21, 2011, *available at* http://www.ncga.state.nc.us/Sessions/2011/Bills/House/PDF/H129v3.pdf.
724 *Id.*
725 *See* Jim Barthold, *Governor Won't Sign Bill, So N.C. Broadband Restrictions Become Law*, May 23, 2011, Fierce Cable, *available at* http://www.fiercecable.com/story/governor-wont-sign-bill-so-nc-broadband-restrictions-become-law/2011-05-23.

4.10.2 Cost and Financing

Greenlight was largely funded through borrowing. In 2008, the City Council approved the issuance of $33,710,000 worth of certificates of participation (COPs).[726] COPs are typically used in lieu of bonds in an effort to circumvent debt limits.[727] They are akin to revenue bonds.[728] Debt from these certificates was payable from 2009 to 2033 at interest rates of between three and five percent (depending on the year).[729] The COPs are secured by a lease on the network's equipment; in the event of default, creditors can foreclose on the secured properties.[730] The city borrowed an additional $4.75 million from Wells Fargo in 2010.[731]

Operating expenses for the network are high. In 2013, Greenlight's total cost of operations was about $11,420,000.[732]

4.10.3 The Network

The Greenlight FTTH network is owned and operated by the city of Wilson, North Carolina.[733] It is operational and continues to expand.[734] The cost of continued construction is about $1,237,176 annually.[735] The network is not permitted to expand service or infrastructure beyond the Wilson county line.[736] Greenlight also offers an open Wi-Fi network in some parts of the city.[737] As of 2012, Greenlight amassed nearly 6,000 customers,[738] representing about 30 percent of the Wilson market.[739] Of these 6,000 customers, about 5,400 subscribe to some form of broadband services.[740]

Greenlight offers broadband, television, and telephone services, which can be purchased separately or in a bundle.[741] Bundled plans range in cost from $102.95 per month to $160.90 per month; all bundles come with a symmetrical 20 Mbps Internet connection.[742] As a stand-alone service, a symmetrical 20 Mbps broadband connection can be purchased for $39.95 a month, while a symmetrical 1 Gbps connection costs $154.95 per month.[743]

Greenlight's overall financial viability remains in question. While there is some evidence that the network is profitable,[744] operating revenues have not yet surpassed operating expenses.[745] Debt servicing and asset

726 *See generally Wilson, North Carolina, Certificates of Participation Series 2008*, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (May 1, 2008), *available at* http://emma.msrb.org/MS273964-MS271292-MD541860.pdf ("*Wilson Certificates of Participation Series 2008*").
727 COPs are defined as "A type of financing where an investor purchases a share of the lease revenues of a program rather than the bond being secured by those revenues." *See* Investopedia, Certificate of Participation, http://www.investopedia.com/terms/c/certificateofparticipation.asp.
728 *See, e.g.,* Christopher Mitchell & Todd O'Boyle, *Wilson Gives the Greenlight to Fast Internet*, at p. 50, Broadband Communities (Jan./Feb. 2013), *available at* http://www.bbpmag.com/2013mags/jan-feb/BBC_Jan13_Greenlight.pdf ("*Wilson Gives the Greenlight to Fast Internet*").
729 *Wilson Certificates of Participation Series 2008.*
730 *Id.* at p. 19.
731 *Carolina's Connected Community* at p. 8.
732 Per an email from Kim Hands, Director of Finance, Wilson, NC.
733 *See* Wilson Greenlight, FAQ, http://www.wilsonnc.org/living/fiberopticnetwork/greenlightfaq/.
734 *Carolina's Connected Community* at p. 16.
735 *See Comprehensive Annual Financial Report*, at p. 11, Wilson, North Carolina (June 30, 2012), *available at* http://www.wilsonnc.org/attachments/pages/597/Complete%20CAFR%20Report%202012.pdf ("*Comprehensive Annual Financial Report—Wilson*").
736 *Carolina's Connected Community* at p. 16.
737 *See, e.g.,* Wilson, Greenlight—About, http://www.wilsonnc.org/departments/greenlightITS/.
738 *Comprehensive Annual Financial Report—Wilson* at p. 253.
739 *Carolina's Connected Community* at p. 9.
740 *Id.*
741 *See* Greenlight, Packages, http://greenlightnc.com/packages/.
742 *Id.*
743 *See* Greenlight, About: Internet, http://greenlightnc.com/about/internet/.
744 *See, e.g., Carolina's Connected Community* at p. 9.
745 Email from Kim Hands, Director of Finance, Wilson, NC. Operating expenses do not include payments related to debt service, taxes, or other such expenses that arise as a result of operating a business.

depreciation, coupled with higher than expected expenses, may impact on its long-term sustainability.[746] In 2012, the network had an operating loss of $220,956.[747]

4.10.4 Community Impact

Local officials and GONs proponents assert that the primary benefit of the Greenlight network has been its ability to impose price discipline on incumbent ISPs.[748] Proponents have also asserted the city's entrance into the marketplace spurred incumbents to upgrade their networks in an effort to compete with Greenlight's speeds.[749] Additional benefits cited by supporters include using the GON to support a more robust security camera network throughout the city and serving as another community asset to lure new businesses.[750]

Claims about spurring competition should be evaluated in view of the larger dynamics at play in the broadband space. As discussed in **section 3.1,** the long-term trend in the U.S. broadband market has been toward faster speeds, lower prices, and more robust intermodal competition as consumers embrace mobile alternatives. Moreover, as has been observed in other contexts (e.g., Monticello), local governments have shown limited capability to engage in sustainable competition with private-sector firms.[751] Even if a GON does help to spur price adjustments among ISPs in the short-term, the pace and intensity of subsequent competition may tend to outstrip the ability of a local government to keep up in the long run.

The impact of Greenlight on local economic development is unclear at this point. The unemployment rate in Wilson County, for which Wilson city serves as the seat, has risen steadily in recent years (it was 9 percent in December 2013) and continues to be above statewide and national averages.[752] In addition, Wilson's leading employers tend to be manufacturing firms, which typically do not require gigabit broadband to operate.[753] If Wilson intends to use Greenlight to diversify its local economy (e.g., by attempting to shift it to become more technology-focused), it is likely to face numerous barriers on the demand side of the connectivity equation.

4.10.5 Assessment

Despite a number of perceived positive impacts, there is much uncertainty about the future of this GON. The debt structure of Greenlight is troubling. It has been asserted that Wilson's use of COPs was acknowledgment that the municipality was intentionally circumventing state law and the will of local residents. Article 5, section 4 of North Carolina's state constitution prohibits local governments from "contract[ing] debts secured by a pledge of its faith and credit unless approved by a majority of the qualified voters of the unit who vote thereon."[754] Greenlight's financing model was not approved by a referendum. It was, as discussed above, initiated by a City Council vote. In addition, the use of COPs has done little to mitigate the risk for taxpayers. The COP agreement states that if revenue derived from the network is not enough to make payments, the city will use taxpayer money from the city's general fund to cover those obligations.[755]

Perhaps more important is that this GON was built in an area with low consumer demand for and use of broadband. Deploying a broadband network in such an area not only jeopardizes the ability of the system

746 *Comprehensive Annual Financial Report* at p. 11.
747 *Id.* at 24.
748 *See, e.g., Wilson Gives Greenlight To Fast Internet* at p. 52.
749 *Id.*
750 *See, e.g.,* Lisa Gonzalez, *Wilson's Greenlight Getting the Publicity It Deserves*, July 24, 2013, Community Broadband Networks, Institute for Local Self-Reliance, *available at* http://www.muninetworks.org/content/wilsons-greenlight-getting-publicity-it-deserves.
751 *See supra,* section 4.4, for additional discussion.
752 *See Unemployment Rate in Wilson County, NC,* Federal Reserve Bank of St. Louis (July 30, 2013), *available at* http://research.stlouisfed.org/fred2/series/NCWILS0URN.
753 *See, e.g., Table 3: Major Employers*, Wilson Economic Development Council, *available at* http://www.wilsonedc.com/wp-content/uploads/2011/04/Wilson_NC_Data_Standards_Table_3.pdf.
754 *See* Art. V, § 4, North Carolina Constitution, http://www.ncga.state.nc.us/legislation/constitution/ncconstitution.html.
755 *Wilson Certificates of Participation Series 2008* at p. 15.

to become profitable and self-sustaining, it also serves as another example of the seemingly myopic focus on supply side issues in the broadband space. As noted elsewhere, North Carolina is tied with Mississippi as the least connected state in the country.[756]

Some advocates, who argue that low adoption is the result of overly expensive and uncompetitive broadband in these states, have attempted to position GONs like Greenlight as possible effective approaches capable of driving down prices and thus increasing take-rates.[757] As discussed in **section 3.1.2,** this view of broadband adoption fails to account for the many nuances associated with bolstering connectivity in under-adopting areas. There is significant evidence to suggest that efforts focused on key demand side issues are capable of closing connectivity gaps in areas that are similar to Wilson.[758] In other words, a GON is unlikely to solve the connectivity crisis in Wilson or in North Carolina.

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756 *See, e.g.,* Christopher Mitchell & Todd O'Boyle, *At the Bottom of the Broadband Barrel*, Jan. 28, 2013, News Observer, *available at* http://www.newsobserver.com/2013/01/28/2639486/at-the-bottom-of-the-broadband.html.

757 *Id*.

758 Numerous examples are provided in section 6, *infra.* However, one leading example of a successful public-private approach to bolstering broadband connectivity in rural and poorer areas is ConnectKentucky. For an overview, *see* Ann Carrns, *Faster and Stronger*, July 28, 2008, Wall St. Journal (describing the program as working "to expand the availability and use of broadband Internet connections in the state's rural areas." Moreover, "According to ConnectKentucky, [as of July 2008] 95% of the state's households can… buy high-speed Internet service, up from 60% in 2004. ConnectKentucky's efforts, funded 90% by the state and 10% by private businesses and foundations, show how public-private partnerships, as well as a willingness by local governments to work with less-established telecommunications providers, can drive increased access to high-speed Internet service and spur economic development.").

5 Conclusions About the Efficacy of GONs in the United States

The case studies in **section 4,** coupled with quantitative and qualitative analyses included in **sections 2 and 3,** support a range of conclusions about GONs in the United States. The following findings expand on these conclusions by tying together the data and observations from previous sections. Taken together, these findings make a strong case for approaching GONs proposals with skepticism.

Findings About GONs

Finding One: Failed and failing GONs offer much-needed perspective about the complexities and challenges associated with building and deploying advanced communications networks.

Finding Two: Many GONs raise fundamental concerns regarding sustainability, fair competition, and consumer welfare.

Finding Three: Calls for achieving subjective speed benchmarks should not supplant actual consumer demand as the primary driving force shaping the broadband ecosystem.

Finding Four: The direct economic impact of GONs, especially around job creation, is difficult to measure given the many other contributing factors.

Finding Five: Governments are not well-equipped to compete in dynamic markets.

Finding Six: The substantial costs of building, maintaining, and operating GONs mitigate perceived benefits.

Finding Seven: Pursuit of a GON often diverts scarce public resources from more pressing priorities.

Finding Eight: A GON will not spawn the next Silicon Valley.

Finding Nine: GONs are not remedies for perceived or actual broadband connectivity challenges.

Finding Ten: State-level policy makers have important roles to play in the GONs context.

5.1 Finding One: Failed and failing GONs offer much-needed perspective about the complexities and challenges associated with building and deploying advanced communications networks.

For policy makers considering whether to pursue a GON, the failed and failing GONs offer a more instructive perspective about the complexities and challenges of building and deploying advanced communications networks than the apparent successes do.

First, municipal networks viewed as successful generally had their genesis in unique circumstances that are extremely difficult to replicate. The gigabit network in Chattanooga, for example, benefited immensely from a

one-time $111 million federal grant that was part of a much larger policy response to the Great Recession.[759] This allocation, which was substantially larger on a per capita basis than any other smart grid-related grant made by the federal government, enabled the municipal utility to "build its [fiber-optic communications] system in three years instead of 10."[760] Similarly, the GON in Bristol, Virginia, benefited from the infusion of tens of millions of dollars in grants from the state's Tobacco Commission. In addition, historically low interest rates enabled some municipalities to either refinance outstanding GON debt or issue new bonds with even lower rates.[761] These conditions are unlikely to persist over the long term: interest rates, even on municipal bonds, are expected to begin rising soon,[762] and public funding of all kinds is likely to be cut back substantially in response to calls for deficit reduction and balancing budgets.[763]

Second, many initial successes have not endured. Thus, using a particular municipal broadband project as a model for other cities to replicate should be undertaken with caution. As discussed in **section 2,** municipal Wi-Fi advocates immediately pointed to troubled projects in cities like Philadelphia when making the case for similar projects in other cities. Many of these networks failed, though, either in the near term (e.g., as in Philadelphia and Orlando) or over the long term (e.g., a city Wi-Fi network in Seattle, Washington, was shut down in 2012; policy makers in Riverside, California, are seriously considering cancelling its municipal service[764]). Similar enthusiasm abounded during initial deployment of GONs that eventually faltered in places like Burlington, Vermont;[765] Dunnellon, Florida;[766] Monticello, Minnesota;[767] Quincy, Florida;[768] and the many cities that make up the UTOPIA consortium.[769] Some of these systems were seen as strong evidence that "communities can build a telecommunications network to provide better services at a lower cost while

759 *See supra,* section 4.1, for additional discussion. *See also* Brian Fung, *How Chattanooga Beat Google Fiber by Half a Decade*, Sept. 17, 2013, The Switch, Wash. Post, *available at* http://www.washingtonpost.com/blogs/the-switch/wp/2013/09/17/how-chattanooga-beat-google-fiber-by-half-a-decade/.

760 *See Smart Grid Grant Catapults City into Lead Position*, Nov. 30, 2009, Times Free Press, *available at* http://www.timesfreepress.com/news/2009/nov/30/smart-grid-grant-catapults-city-lead-position/.

761 For an overview of general municipal bond activity in the wake of the Great Recession, *see Understanding the Great Recession's Impact on City Bond Issuances*, Issue Brief, American Cities Project, Pew Charitable Trusts (Aug. 2013), *available at* http://www.pewstates.org/uploadedFiles/PCS_Assets/2013/Municipal_Bonds_Report_Final.PDF.

762 *See, e.g.,* Martin Feldstein, *The Rise and Rise of U.S. Interest Rates*, Sept. 9, 2013, Business Standard, *available at* http://www.business-standard.com/article/opinion/martin-feldstein-the-rise-and-rise-of-us-interest-rates-113090900893_1.html (discussing likely rises in interest rates over the short and long terms); Lisa Lambert, *Talk of Interest Rate Rise Rocks U.S. Municipal Bond Market*, June 20, 2013, Reuters, *available at* http://www.reuters.com/article/2013/06/20/us-markets-municipals-idUSBRE95J19S20130620 (reporting on the relationship between higher interest rates and declines in the municipal bond market).

763 *See supra,* section 3.2.1, for additional discussion and analysis regarding the many pressures on public funding.

764 *See, e.g.,* Brier Dudley, *Seattle Pulls Plug on its Broadband Network*, May 6, 2012, Seattle Times, *available at* http://seattletimes.com/html/businesstechnology/2018149915_brier07.html (describing the city's many failed attempts to construct and support municipally-owned broadband networks, including its Wi-Fi system); Alicia Robinson, *Riverside: Citywide Wireless Internet Service Could End*, Sept. 4, 2013, The Press-Enterprise, *available at* http://www.pe.com/local-news/riverside-county/riverside/riverside-headlines-index/20130904-riverside-citywide-wireless-internet-service-could-end.ece (noting that the city is looking to cancel the service to save money); Colin Wood, *Muni Wi-Fi: Another One Bites the Dust?,* Feb. 4, 2014, GovTech.com, *available at* http://www.govtech.com/network/Muni-Wi-Fi-Another-One-Bites-the-Dust.html (reporting on further discussions around winding down the municipal wireless network).

765 *See, e.g., The Promise of Municipal Broadband.*

766 *See, e.g.,* Lisa Gonzalez, *Dunnellon, Florida's Fiber Dreams Now a Reality,* Aug. 8, 2012, MuniNetworks.org, *available at* http://www.muninetworks.org/content/dunnellon-floridas-fiber-dreams-now-reality (noting that the city was finally moving ahead with plans to "invest in its own fiber network to spur economic development and provide the services Comcast and AT&T considered unprofitable in the rural area."). *Cf. Editorial: Dunnellon's Disastrous Deal*, Oct. 29, 2013, Ocala Star Banner, *available at* http://www.ocala.com/article/2013131029665 ("Greenlight [the name of the city's GON] has only attracted 500 customers, not the 1,700 needed for profitability. Last Wednesday night, the City Council voted to sell Greenlight for $1 million to Florida Cable Inc., a company that operates systems in 17 counties. Mayor Nathan Whitt said before the meeting, "Our goal is to get out of this as quickly as we can. It's crucial to stop the bleeding" — the bleeding being the $60,000 a month Greenlight has been costing the city…But the bleeding is far from stopped. The city must still deal with $7 million in debt, a monumental task for a city of 1,700 people with an annual municipal operating budget this year of $3.1 million.").

767 *See, e.g.,* Tom Meersman, *Monticello's Model Broadband Effort in Peril*, June 7, 2012, Star Tribune, *available at* http://www.startribune.com/local/west/157992065.html (noting that the GON in Monticello was "once seen as a national model" for other municipal broadband projects).

768 *See infra,* section 5.10, for additional discussion.

769 *See, e.g., Broadband Utopia.*

raising revenue."[770] And it appears that support for these systems as possible models for other cities interested in pursuing a GON has persisted even after it became clear these networks failed or were beginning to fail.[771]

Third, for policy making purposes, it is notable that many of the reasons for failure tend to be similar. As discussed in **section 4.1,** many GONs have been plagued with high levels of debt and low levels of consumer demand for and use of municipal broadband services. These two core factors undermine many municipal broadband networks. Such was the case in Groton, Provo, UTOPIA, Dunnellon, Quincy, Monticello, and numerous other cities. These problems were compounded by the local government's general inability to keep pace with other ISPs in the broadband market.[772]

For local and state policy makers considering a municipal network, the experiences of other GONs should be critically examined. Two fundamental questions to ask are—

- Is a success an "enduring" success that can inform future projects?
- Was the success a function of unique factors that cannot be easily replicated?

A healthy degree of skepticism is warranted because, throughout the history of GONs in the United States, proponents have argued that municipal broadband has been fruitful even though there is significant evidence pointing to problems, financial and implementation, encountered by many jurisdictions undertaking a GON.[773]

5.2 Finding Two: Many GONs raise fundamental concerns regarding sustainability, fair competition, and consumer welfare.

The prevailing narrative advanced by supporters of government-owned broadband networks is in large part based on ideas about local self-reliance and a desire to radically reformulate the traditional market-based model of providing Internet access.[774] The rationale is that municipal broadband networks are more attuned to local needs and thus able to achieve specific local goals.[775] But contrary to these assertions, the fact is that many GONs actually arise from "mission creep" of local utilities.

More specifically, many municipal broadband projects represent extensions of existing communications networks built for the exclusive use of municipal utilities. Of the 10 GONs profiled, networks in seven cities—Chattanooga, Bristol, Lafayette, Cedar Falls, Danville, Groton, and Provo—grew out of communications infrastructure (e.g., fiber rings) installed to enhance specific utility functions (e.g., connect electrical substations).[776]

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770 *Burlington Telecom Profits from Fiber* at p. 81.

771 *See, e.g., Burlington Telecom Fact Sheet*, at p. 3, Institute for Local-Self-Reliance (updated: April 2010), *available at* http://www.ilsr.org/wp-content/uploads/files/btfacts.pdf (touting meager cost savings generated by Burlington Telecom despite mounting evidence that the GON was failing due to mismanagement and low levels of consumer demand for and adoption of the service); Christopher Mitchell, *Provo's Publicly Owned Broadband Network Attracts 98 Jobs,* July 13, 2012, Community Broadband Networks, *available at* http://www.muninetworks.org/content/provos-publicly-owned-broadband-network-attracts-98-jobs (arguing that, despite clear evidence that the GON in Provo was a failure, it "Nonetheless [is] making positive contributions to the community"); *Monticello Moves Closer to Settlement with Bondholders* (expressing continued support for the GON in Monticello even after the municipality was unable to make a series of bond payments); Chris Mitchell, *Monticello Fiber Price War Offers Key Lessons for Broadband Competition,* Sept. 19, 2013, Community Broadband Networks, Institute for Local Self-Reliance, *available* http://www.muninetworks.org/content/monticello-fiber-price-war-offers-key-lessons-broadband-competition (trying to make the argument that, "…whatever [the Monticello] network may end up costing city taxpayers, it will likely be less than the savings from all of these lower prices and indirect benefits such as not losing employers that could not be competitive when only having last-generation Internet access from unreliable DSL. That doesn't help the City to make its debt payments, but it sure makes Monticello a better place to live.").

772 *See infra,* section 5.5, for additional discussion.

773 *See, e.g.,* Brian Heaton, *Local Governments Pursue Independent Broadband Despite Challenges,* Nov. 21, 2012, Governing, *available at* http://www.governing.com/blogs/view/gov-local-governments-pursue-independent-broadband.html (discussing how some who support GONs are reframing their advocacy in light of recent municipal broadband network failures) ("*Local Governments Pursue Independent Broadband Despite Challenges*").

774 *See supra,* section 2, for additional discussion. *See also Evaluating the Rationales for Government-Owned Broadband Networks* at p. 9-17 (evaluating and rebutting these and other rationales advanced by GONs supporters).

775 *See, e.g.,* Craig Settles, *Building the Gigabit City*, Ch. 3 (2013), *available at* https://www.smashwords.com/books/download/313806/1/latest/0/0/building-the-gigabit-city.pdf (discussing these and related motivations) ("*Building the Gigabit City*").

776 *See supra,* sections 4.1—4.10, for additional discussion.

Numerous others, including existing networks in Burlington, Vermont,[777] and Chanute, Kansas,[778] as well as a recently approved GON in Longmont, Colorado,[779] have followed or will follow this model. In addition to undermining several core aspects of GONs advocacy, such "mission creep" by local utilities raises a number of concerns regarding sustainability, fair competition, and consumer welfare.

With regard to sustainability, local governments and municipal utilities have poor track records vis-à-vis responding to consumer demand, which bodes poorly for the long-term prospects of any venture in such a dynamic space.[780] Equally important, utilities generally have had limited success with realizing positive returns on investment in new technologies, especially advanced communications services meant to enhance their operations. For example, over the last several decades, utilities of all sizes invested billions of dollars in deploying communications networks and services that have done little to actually drive down rates or strengthen the electric grid.[781] The fact that many utilities have sought to extend these networks for commercial purposes underscores the extent to which these tools have been underused.

Regarding competition policy generally, local utilities that extend proprietary communications networks for commercial purposes have a number of potentially unfair advantages over private service providers. Utilities in some states can explicitly cross-subsidize their communications division with revenues derived from their electric business or implicitly accomplish this via low-interest or interest free inter-divisional loans.[782] In other instances, municipally owned utilities that have deployed GONs have received generous support from local government to prop up networks that might fail on their own. Some combination of these methods has been used in numerous instances, including in Chattanooga,[783] Lafayette,[784] Cedar Falls,[785] Provo,[786] and Burlington,[787] among many others. Such practices are concerning because many operate more as a hidden tax on all residents and businesses than as one-off subsidies aimed at achieving discrete goals (e.g., encouraging economic development).

In sum, there is a wide gap between the rhetoric of many GONs advocates and the details of these networks' actual construction. In many instances, municipal utilities often see these systems as a new line of business, not as a symbol of local self-reliance. Moreover, as regulated monopolists, municipal utilities operate according to a distinct set of incentives relative to private firms in this space, which informs their behavior in ways that, over the long term, tend to result in innovative stagnation and actions that are not always consumer-focused.[788]

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777 *See supra,* section 2.3, for additional discussion.

778 *See, e.g.,* Lisa Gonzalez & Christopher Mitchell, *Chanute's Gig*, at p. 1, Institute for Local Self-Reliance (Oct. 2012), *available at* http://www.ilsr.org/wp-content/uploads/2012/10/Chanute-Muni-BB.pdf.

779 *See Ballot Question 2B: Revenue Bond Funding for Broadband Fiber Optic Network Expansion Throughout Longmont*, Ballot Brochure, Election Day, Nov. 5, 2013, City of Longmont, Colorado, *available at* http://www.ci.longmont.co.us/lpc/TC/documents/ballotbrochure_web2.pdf. This measure was approved by a two-to-one margin. *See Final Official 2013 Coordinated Election Results for Boulder County, City of Longmont Ballot Question 2B*, Nov. 5, 2013, Boulder County, CO, *available at* http://webpubapps.bouldercounty.org/clerk/voterresults2013/IssueResults.aspx?issue=V36.

780 *See infra,* section 5.5, for additional discussion.

781 *See, e.g., Realizing the Smart Grid Imperative* at p. 9-10, 14-22 (discussing some of these services and observing that these investments have done little to bolster reliability or drive down the price of electricity in the U.S.).

782 Several states prohibit this type of cross-subsidization. These include Florida and North Carolina. *See, e.g., Wi-Fi Everywhere* at p. 1768-1769 (providing examples); Jeff Stricker, *Note: Casting a Wider 'Net: How and Why State Laws Restricting Municipal Broadband Networks Must be Modified*, 81 George Wash. L. Rev. 591, 615-616 (2013) (same).

783 *See supra,* section 4.1 (discussing the use of intra-utility loans in support of this GON).

784 *See, e.g., LUS Fiber on its Way to "Self-Sufficiency"*, May 20, 2013, KATC, *available at* http://www.katc.com/news/lus-fiber-on-it-s-way-to-self-sufficiency-/#_ ("Here's how it works: LUS Fiber, because it's a public entity does not pay taxes like private business. Instead, it makes payments to the Lafayette Utilities System. LUS then loans that money back to the fiber operation. It is that loan that helped LUS to be cash positive this year.").

785 *See supra,* section 4.5 (noting a loan from the electric division of the utility in support of the GON).

786 *See supra,* section 4.9 (noting loans from the city in support of this failed GON).

787 *See supra,* section 2.3 (discussing the controversy surrounding improper loans from the city in support of this failed GON).

788 *See, e.g., Realizing the Smart Grid Imperative.*

5.3 Finding Three: Calls for achieving subjective speed benchmarks should not supplant actual consumer demand as the primary driving force shaping the broadband ecosystem.

Calls for achieving subjective speed benchmarks, like universal gigabit broadband connectivity, should be carefully evaluated in the context of actual consumer demand for high-speed Internet access.[789] As noted throughout the case studies, the number of residents and businesses subscribing to gigabit broadband service in the "gig cities"—including Chattanooga, Bristol, Wilson, some of the UTOPIA cities, and Cedar Falls—remains low. More generally, there is scant evidence that such ultra-high-speed services are actually attractive to the vast majority of users, who, as noted in **section 3,** have demonstrated a clear preference for Internet connections in the 5-20 Mbps range.[790] In fact, even though more than half of the U.S. population has access to broadband connections in excess of 100 Mbps,[791] there were only 97,000 residential connections of 100 Mbps (downstream) or more in December 2012.[792] Take-rates for gigabit connections are even lower. By one estimate, there were only about 4,000 such connections in the United States in April 2013,[793] representing a tiny fraction of the nearly 215 million residential high-speed Internet connections in service across the country.[794]

To date, the supply of bandwidth and the speeds of Internet connections have been shaped by consumer demand and actual usage patterns.[795] Surveys measuring customer satisfaction generally confirm the vast majority of users are content with their current broadband connection's reliability and speed.[796] Moreover, there is no evidence demonstrating that ultra-high-speed connections are useful to the average consumer. Conversely, there is considerable skepticism about the extent to which average Internet users can benefit from super-fast connections.[797] Some who have used gigabit connections in the U.S. for example have reported that, in practice, they are "totally unnecessary."[798] Efforts to "max out" gigabit connections have mostly come up empty; even streaming multiple high-definition movies at once leaves significant bandwidth unused.[799] Part of the reason is that most other parts of the Internet ecosystem—from computing devices to routers and other aspects of the physical infrastructure—are incapable of processing such fast speeds, further underscoring that consumer demand has yet to justify enormous investments in upgrading to gigabit speeds.[800]

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789 *See supra,* section 2.3 (noting how GONs advocacy has shifted in recent years to embrace all-fiber gigabit broadband networks and evaluating the motives behind this reframing).

790 *See supra,* section 3.1.1 (observing trends in how consumers are embracing higher-speed Internet connections).

791 *See* National Broadband Map, Summarize: Nationwide (as of Dec. 31, 2012), http://www.broadbandmap.gov/summarize/nationwide.

792 *Internet Access Services: Status as of Dec. 31, 2012* at Table 11.

793 At the time, this was likely an over-estimate. *See* Stacey Higginbotham, *How Many People Have a Gigabit Connection? Fewer Than you Think*, April 23, 2013, GigaOm, *available at* http://gigaom.com/2013/04/23/how-many-people-have-a-gigabit-connection-fewer-than-you-think/ (reporting on data from Ookla and noting that "the numbers provided by Ookla actually measure customers with speeds of above 800 Mbps, which is what it classifies as a gigabit.")

794 *Internet Access Services: Status as of Dec. 31, 2012* at Table 11.

795 *See supra,* section 3.1.1, for additional discussion and supporting data.

796 *See, e.g., Broadband Satisfaction: What Consumers Report* (finding that 91 percent of consumers in 2010 were "very" or "somewhat" satisfied with the speed of their Internet connection); Press Release, *2012 U.S. Residential Internet Service Provider Satisfaction Study,* Oct. 15, 2012, J.D. Power, *available at* http://www.jdpower.com/content/press-release/ogrbZkU/2012-u-s-residential-internet-service-provider-satisfaction-study.htm (finding that customers are generally satisfied with their connections).

797 *See, e.g.,* David Talbot, *Not so Fast: A Google Fiber One-Gigabit Mystery,* Sept. 20, 2013, Tech. Review, *available at* http://www.technologyreview.com/view/519466/not-so-fast-a-google-fiber-1-gigabit-mystery/ ("But what's still far from clear is any of us need gigabit service, how many people are actually taking it, and whether they can do anything with it (after, say, the first 100 megabits, allowing plenty of room for multiple video streams and Wi-Fi losses inside the home).").

798 *See* Farhad Manjoo, *What Do You Do with the World's Fastest Internet Service?* March 12, 2013, Slate, *available at* http://www.slate.com/articles/technology/technology/2013/03/google_fiber_review_nobody_knows_what_to_do_with_the_world_s_fastest_internet.html?fb_ref=sm_fb_share_toolbar.

799 *Id.* ("To be sure, this was pretty cool. And yet it wasn't mind-blowing. Indeed, it felt a little underwhelming. After all, who needs to play five HD videos at the same time? If that's Google's best demo of its superfast service, what does it suggest about what regular people will do with it? What's more, the demo didn't even begin to approach the limits of Google Fiber—with five HD videos playing simultaneously there were still hundreds of megabits left on the pipe. When I got back home a few days later, I replicated the same test on my home broadband line and experienced only a few hiccups."). *See also* Cyrus Farivar, *Ars Asks: Help us Max Out Google Fiber*, Nov. 28, 2012, Ars Technica, *available at* http://arstechnica.com/business/2012/11/ars-asks-help-us-max-out-google-fiber/ ("*Help us Max Out Google Fiber*").

800 *Help us Max Out Google Fiber* ("In other words, so far, it seems like a gigabit connection really only gets close to such high speeds if you have something on the other end to serve it adequately and not throttle or otherwise slow it down.").

Ultimately, calls for achieving subjective speed benchmarks should not supplant actual consumer demand as the primary driving force of innovation in the broadband ecosystem. Such an unrelenting focus on speed obscures more practical assessments made by users, many of whom are focused on whether their connection allows them to accomplish what they want or need to accomplish.[801] Those dismissing the actual needs of consumers as a barrier to realizing amorphous goals around innovation and economic development appear to be more hubristic than futuristic in their thinking, rhetoric, and advocacy.[802]

5.4 Finding Four: The direct economic impact of GONs, especially around job creation, is difficult to measure given the many other contributing factors.

A leading rationale offered in support of GONs is that these networks will have significant, measurable, sustainable impacts on local economic development.[803] In the abstract, GONs advocates assert that municipal broadband networks are uniquely positioned to "help[] local businesses, not extract[] monopoly profits," generating economic gains that can be reaped locally.[804] Projected benefits tend to focus primarily around jobs—GONs are seen as a way to retain and grow local companies, attract new firms, and serve as the foundation for creating entire new industries from scratch.[805] More broadly, some see GONs, and gigabit networks generally, as essential to the long-term economic viability of the United States.[806] To date, there is little credible evidence to support any of these claims.

In many of the case studies—and in numerous other cities across the country that have deployed a GON—the economic gains attributed to a particular municipal network were rarely the result of the type of straightforward cause-and-effect depicted by advocates, i.e., that the mere presence of the network led to specific economic benefits. On the contrary, most benefits, to the extent that any manifested, tend to be the result of numerous other, non-technological factors (e.g., traditional economic incentives to relocate or launch a new business) that, together, subordinate the role the network played in realizing these gains.

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801 *See, e.g., Real Benefits of Gigabit Networks Have Nothing to Do with Speed* at p. 1 (noting that "Speed is but one of many broadband quality attributes" and that "no evidence yet suggests that slow speeds are a barrier to innovation").

802 This analysis is focused on individual consumer demand, which is typically measured at the household level. In other contexts, calls for ultra-high-speed broadband connectivity might be more practical. For example, there is growing support for increasing bandwidth to schools and libraries across the country. To date, even though most schools in the U.S. have broadband access, bandwidth per student is low. For these and many other reasons, the President and the FCC, along with school officials and others, have called for public-private efforts focused on improving broadband connectivity, digital literacy, and professional development resources in schools across the country. For an overview of relevant proceedings and analyses, *see* Press Release, *President Obama Unveils ConnectED Initiative to Bring America's Students into Digital Age*, June 6, 2013, The White House, *available at* http://www.whitehouse.gov/the-press-office/2013/06/06/president-obama-unveils-connected-initiative-bring-america-s-students-di (detailing ConnectED, the President's initiative to bolster broadband connectivity in schools); *In the Matter of Modernizing the E-Rate Program for Schools and Libraries,* Notice of Proposed Rulemaking, FCC 13-100, WC Docket 13-184 (rel. July 23, 2013) (proposing a range of changes to the federal E-rate program in an effort to provide more funding for broadband connections in schools and libraries); *The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs,* SETDA (2012), *available at* http://www.setda.org/wp-content/uploads/2013/09/Broadband_Trifold.pdf (calling for 1 gigabit per second per 1,000 students/staff in every school by 2018); Charles M. Davidson and Michael J. Santorelli, *The Impact of Broadband on Education,* a Report to the U.S. Chamber of Commerce (Dec. 2010), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/ sites/169/2013/08/Davidson-Santorelli-The-Impact-of-Broadband-in-Education-December-2010-FINAL.pdf.

803 *See, e.g., Evaluating the Rationales for Government-Owned Broadband Networks* at p. 13-16; *Local Governments Pursue Independent Broadband Despite Challenges.*

804 *Community Broadband Creates Jobs.*

805 *Id. See also Local Governments Pursue Independent Broadband Despite Challenges* (encouraging GONs advocates and supporters to cite to potential economic development gains when promoting a municipal network); *Building the Gigabit City* at Ch. 16 (describing expected economic gains of gigabit GONs).

806 *See, e.g.,* The Politics of Abundance; Captive Audience. For additional discussion, *see supra*, sections 2.2, 2.3, and 3.1.1.

With regard to job creation, further analysis of employment data—including official data collected by the U.S. Bureau of Labor Statistics (BLS) and unofficial anecdotal data reported by municipal officials—yields a mixed to negative picture regarding the impacts of a GON on job creation in the "information" industries.[807]

- Officials in **Chattanooga** assert the gigabit GON there "created about 1,000 jobs in the last three years."[808] The cost of building the fiber network totals about $390 million, which means it cost the city upwards of $390,000 to "create" each job. Even assuming these data are accurate, the overall trend in job growth in Chattanooga's information industry has been mixed. According to BLS data, the total number of jobs in this sector decreased by 22.2% between 2010, when the GON launched, and 2013.[809]
- In **Lafayette**, a primary goal of the GON was to attract new businesses that would benefit from ultra-high-speed connectivity.[810] BLS data, however, demonstrate the GON did not meet this goal. In particular, employment in the information sector in Lafayette decreased by 24.2 percent between 2008 and 2013.[811]
- Similarly, in **Burlington**, BLS data indicate a 21.4 percent decrease in local information sector employment since 2008.[812]
- In **Provo**, though, the information sector is blossoming despite the significant problems its GON has faced in recent years. More specifically, overall employment in this sector grew by about 20 percent since 2009.[813] This corresponds with robust economic growth across the state,[814] as well as the organic emergence of a vibrant high-tech cluster in what some have dubbed the "Silicon Slopes."[815] It appears that these developments stem primarily from the favorable business climate created by the state, as well as the presence of a major research institution (Brigham Young University).[816]

Nationally, employment in the information sector has been essentially static for the last few years (it decreased by four percent between 2009 and 2013).[817] Even so, one would expect at least some growth in information sector jobs in areas with a GON. Yet much of the sector's job growth is concentrated in areas without a GON: between 2009 and 2013, information sector jobs grew by 18.3 percent in and around Austin, Texas;[818]

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807 The U.S. Bureau of Labor Statistics defines the "information" sector as follows:
"The Information sector comprises establishments engaged in the following processes: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data.
"The main components of this sector are the publishing industries, including software publishing, and both traditional publishing and publishing exclusively on the Internet; the motion picture and sound recording industries; the broadcasting industries, including traditional broadcasting and those broadcasting exclusively over the Internet; the telecommunications industries; Web search portals, data processing industries, and the information services industries.
"The Information sector groups three types of establishments: (1) those engaged in producing and distributing information and cultural products; (2) those that provide the means to transmit or distribute these products as well as data or communications; and (3) those that process data."
See U.S. Bureau of Labor Statistics, Industries at a Glance: Information, http://www.bls.gov/iag/tgs/iag51.htm.

808 *Chattanooga's New Locomotive.*

809 BLS data regarding information sector jobs for Chattanooga, TN, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

810 *See supra,* section 4.3. *See also Louisiana City Blazes High-Speed Web Trail.*

811 BLS data regarding information sector jobs for Lafayette, LA, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

812 BLS data regarding information sector jobs for Burlington, VT, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

813 BLS data regarding information sector jobs for Provo-Orem, UT, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

814 *See, e.g.,* Utah Governor Gary Herbert, *Technology's new home located in 'Silicon Slopes,' Utah,* July 9, 2013, CNBC.com, *available at* http://www.cnbc.com/id/100860405 (discussing the array items—e.g., favorable taxes, streamlined regulatory approach to business, good quality of life, etc.—that has contributed to robust job growth throughout the state) ("*Technology's new home located in 'Silicon Slopes'*").

815 *Id. See also* Jasen Lee, *Salt Lake Metro Becoming Tech Hub,* Jan. 13, 2013, Deseret News, *available at* http://www.deseretnews.com/article/765620136/Salt-Lake-metro-becoming-tech-hub.html?pg=all.

816 *Technology's new home located in 'Silicon Slopes'.*

817 BLS data regarding information sector jobs for the entire U.S. for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

818 BLS data regarding information sector jobs for Austin-Round Rock-San Marcos, TX, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

6.6 percent in and around Boston, Massachusetts;[819] 8.1 percent in New York City;[820] 33.7 percent in Silicon Valley;[821] and 30.8 percent in and around San Francisco.[822] As discussed in more detail below, creating a successful and sustainable high-tech cluster—and a healthy information sector generally—is extremely difficult and involves many more factors than just the presence of an ultra-high-speed broadband network.

In sum, data do not indicate GONs serve as the nucleus of renewed economic activity in cities and towns across the country. On the contrary, they appear to be playing minor roles in creating relatively few new jobs as companies continue to respond more favorably to other more practical and prosaic enticements (e.g., tax breaks). Conversely, the debt burden resulting from many GONs is harming the short- and long-term economic prospects of cities. Indeed, in some cases—e.g., Burlington, Chattanooga, Cedar Falls, Groton, and Monticello—excessive debt generated as a result of building a GON led to credit downgrades, which serve only to increase the costs of borrowing money to finance other, arguably more pressing municipal projects.[823] It can be argued that GONs are seldom the economic panacea that many advocates assert.

5.5 Finding Five: Governments are not well-equipped to compete in dynamic markets.

Governments—and government-run utilities by extension—are ill-equipped to participate in dynamic markets or sectors characterized by constant innovation. Especially with regard to new technologies, municipal governments have a poor record of keeping pace with recent advances and otherwise shaping policies that reflect prevailing consumer preferences. Public schools, for example, remain littered with out-of-date computers and other antiquated technological gadgets that overly enthusiastic government officials purchased with the expectation that their use would improve outcomes.[824] Similarly, many public computing centers in cities across the country, launched in the late 1990s to great fanfare, are still operating with out-of-date computers and inferior Internet connections.[825] Even most voting machines in districts across the country remain analog, despite the emergence of more efficient and cost-effective digital alternatives.[826]

This dynamic is especially evident in the GONs context. Local governments in Groton and the UTOPIA cities, for instance, inaccurately construed consumer demand for new broadband services in advance of building their municipal networks. In the case of Groton, a limited consumer survey about the appeal of a possible municipal network was used to justify the construction of the GON.[827] In the case of UTOPIA, officials put

819 BLS data regarding information sector jobs for Boston-Cambridge-Quincy, MA (NECTA Div.), for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

820 BLS data regarding information sector jobs for New York, NY, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

821 BLS data regarding information sector jobs for San Jose-Sunnyvale-Santa Clara, CA, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

822 BLS data regarding information sector jobs for San Francisco-San Mateo-Redwood City, CA Metropolitan Division, for the period of 2004–2014 (not seasonally adjusted). Data on file with the authors.

823 These other imperatives, in particular the need to shore up crumbling local infrastructure, were discussed *supra,* section 3.2.

824 *See, e.g.,* Debra Donston-Miller, *Common Core Meets Aging Education Technology*, July 22, 2013, Information Week, *available at* http://www.informationweek.com/education/policy/common-core-meets-aging-education-techno/240158684 (observing the difficulty in implementing new education standards with the outdated technology that exists in many schools); *Catching on at Last*, June 29, 2013, The Economist, *available at* http://www.economist.com/news/briefing/21580136-new-technology-poised-disrupt-americas-schools-and-then-worlds-catching-last ("The idea that technology can revolutionise education is not new. In the 20th century almost every new invention was supposed to have big implications for schools. Companies promoting typewriters, moving pictures, film projectors, educational television, computers and CD-ROMS have all promised to improve student performance. A great deal of money went into computers for education in the dot.com boom of the late 1990s, to little avail, though big claims were advanced for the difference they would make.").

825 In recognition of the antiquated nature of many of these facilities, the federal stimulus program for broadband allocated about $200 million to public computing centers across the country in an effort to modernize these facilities and bolster training programs. For an overview, *see* BroadbandUSA, Grants Awarded: Public Computer Center Projects, http://www2.ntia.doc.gov/computercenters.

826 *See, e.g.,* Timothy B. Lee, *Paper Prophets: Why E-Voting is on the Decline in the United States,* Oct. 22, 2012, Ars Technica, *available at* http://arstechnica.com/features/2012/10/paper-prophets-why-e-voting-is-on-the-decline-in-the-united-states/ ("A decade ago, there was a great deal of momentum toward paperless electronic voting. Spooked by the chaos of the 2000 presidential election in Florida, Congress unleashed a torrent of money to buy new high-tech machines. Today, momentum is in the opposite direction.").

827 *See supra,* section 4.7, for additional discussion.

forward overly optimistic estimates for deployment and adoption of the new network that, when viewed in the abstract, seemed to justify the investment of tens of millions of dollars in the FTTH system.[828] In both cases, the projections proved incorrect. More generally, these and other GONs are typically plagued by some combination of poor planning, undisciplined spending, fraud, and a willingness to sacrifice long-term sustainability to realize short-term goals.[829]

In the GONs arena, government entities also face a number of challenges tied to how public services are regulated and delivered. For instance, the electricity sector's prevailing regulatory framework has created an intentionally conservative, risk-averse culture of incremental change.[830] More generally, because of the various interests always at play in government policy making and decision-making and other factors like institutional inertia, government is not well-equipped to act quickly or be a driver of the type of creative destruction evident throughout the broadband ecosystem.[831] Many governments, especially at the local level, still struggle with maintaining their websites and other basic IT infrastructure.[832] For government, even assuming abundant resources, the responsibility of building, maintaining, and upgrading a robust broadband network presents fundamental challenges. Even those that build "future-proof" fiber networks are not immune from the vagaries of the marketplace, as network deployment is only one component associated with operating and maintaining such a complex, multifaceted, and dynamic infrastructure.

Finally, the increasing use of public-private partnerships and the privatization of many municipal functions evince a growing recognition by government entities that there are viable alternatives to "going it alone." Municipalities are increasingly partnering with private entities—in the infrastructure context and elsewhere—to tap into the expertise of these firms and to spread the many risks associated with investing scarce public resources in a major project.[833] Moreover, a growing number of local governments are seeking to privatize government services that could be more efficiently delivered via the private sector. These range from the administration of parking meters to the outsourcing of back-office administrative functions.[834]

These public-private hybrid approaches to delivering core city services have been immensely successful, and, as a result, the "average American city [now] works with private partners to perform 23 out of 65 basic municipal services."[835] With the clear trend toward engaging and collaborating with the private sector on a range of activities, including the deployment of broadband networks to unserved and underserved areas,[836] cities that persist in deploying and maintaining a GON may be assuming significant, unnecessary risk. **Section 6** further discusses the trend toward public-private partnerships and presents a series of examples of such partnerships.

5.6 Finding Six: The substantial costs of building, maintaining, and operating GONs mitigate perceived benefits.

More than a decade into the GONs movement, considerable uncertainty remains regarding whether the benefits outweigh the enormous costs of building and maintaining these networks. Many of the positive economic

828 *See supra,* section 4.8, for additional discussion.

829 Unburdening sectors from these constraints and encouraging the development of a competitive private sector were core animating forces of the campaign to deregulate major industries like trucking, railroads, and the airlines in the 1970s. For an overview, *see generally* Paul A. London, The Competition Solution 78-81 (AEI Press 2005). For a discussion of the negative impacts of government intervention into competitive markets—something that deregulation attempts to correct—*see generally* Clifford Winston, Government Failure Versus Market Failure (2006).

830 *See, e.g., Realizing the Smart Grid Imperative* at p. 14-17 (discussing the framework and the risk-averse culture).

831 *Barriers to Broadband Adoption* at p. 84-99.

832 *Id.*

833 *See supra,* section 3.2.2, for additional discussion.

834 *See, e.g.,* David Segal, *A Georgia Town Takes the People's Business Private*, June 23, 2012, N.Y. Times (discussing the broad privatization efforts of Sandy Springs, Georgia); Ted Mann, *City Explores Private Deal for Meters*, May 13, 2012, Wall St. Journal (discussing how some larger cities have begun to privatize parking meters).

835 *See* Stephanie Rozsa and Caitlin Geary, *Privatizing Municipal Services*, at p. 1, Municipal Action Guide, National League of Cities (2010), *available at* http://www.nlc.org/documents/Find%20City%20Solutions/Research%20Innovation/Economic%20Development/privitizing-municipal-services-gid-10.pdf (quoting a report by the National Council of Public-Private Partnerships).

836 *See infra,* section 6.1, for additional discussion and examples.

impacts claimed by GONs supporters, especially those around job creation, remain questionable.[837] More broadly, there is a dearth of empirical evidence to demonstrate a clear causal relationship between a particular municipal network and distinct economic or social gains that would not have arisen but for the GON.

While GONs supporters offer no shortage of anecdotal evidence about the perceived benefits of municipal broadband, these tend to be easily rebuttable and attributable to other factors. The absence of empirical data raises important questions around the opportunity costs associated with a decision to pursue a GON, namely whether the money spent on the network could have been better spent elsewhere. In the context of working to improve broadband connectivity, an essential inquiry by policy makers weighing a GON proposal is whether public funding could be more wisely invested in either forging a PPP in support of bolstering local broadband infrastructure or supporting targeted demand side activities in an effort to increase adoption rates. These two alternative paths, discussed in greater detail in **section 6,** tend to yield more sustainable benefits than electing to build a municipal broadband network.

Policy makers evaluating GONs proposals should weigh the costs of building a network from scratch against the possibility of using municipal authority to facilitate the deployment of new private networks or encourage incumbent ISPs to upgrade or expand existing infrastructure, or both. Municipalities retain exclusive jurisdiction over local rights-of-way, zoning laws, and related broadband infrastructure inputs to create new incentives or enticements for private firms to enhance their offerings.[838] In addition, the simple act of consulting with ISPs, nonprofits, and other relevant organizations to develop policies that can help realize mutually shared goals vis-à-vis broadband has yielded benefits on both the supply side and demand side in a number of cities across the country.[839] With so many viable alternatives to GONs, municipal leaders—and policy makers generally—should closely examine proposals to build a municipal network by themselves.[840]

5.7 Finding Seven: Pursuit of a GON often diverts scarce public resources from more pressing priorities.

The decision to build a GON locks municipalities into a substantial long-term commitment that can divert resources—monetary and otherwise—from more pressing priorities.

In general, opting to build a GON requires a municipality to assume additional debt (only a small number of networks are built on a pay-as-you-go basis or in a manner that does not result in the accumulation of debt[841]). Many states have laws limiting the amount of debt a municipality can accrue, which means cities contemplating a municipal system will have to determine whether and to what extent debt assumed as a result of a GON will leave room for additional bond issuances in support of other projects.[842] If these limits are reached, municipalities could be forced to use alternative budget measures, including a mix of budget cuts and tax increases, to fund other undertakings. While it is difficult to identify specific trade-offs made in the context of particular GON evaluations, there is evidence that pursuing a municipal network shifted priorities in some cities.[843]

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837 *See supra,* section 5.4.

838 For a discussion of these resources, *see, e.g., Rationalizing the Municipal Broadband Debate*. Specific examples of how a municipality might use these resources for these purposes are provided *infra,* section 6.1.

839 Specific examples are provided *infra,* section 6.1.

840 For a check list to guide policy makers through this process, *see supra.*

841 Danville has used a pay-as-you-go approach to incrementally build out its GON. For additional discussion, *see supra,* section 4.6

842 Most states limit the amount of debt municipalities can accrue. *See, e.g.,* 2005 Illinois 65 ILCS 5, Sec. 8-5-1, available at http://law.justia.com/codes/illinois/2005/chapter14/43597.html ("…no municipality having a population of less than 500,000 shall become indebted in any manner or for any purpose, to an amount, including existing indebtedness in the aggregate exceeding 8.625% on the value of the taxable property therein…"). But many states also have exclusions and methods for exceeding the debt limit, oftentimes by holding a referendum. *See, e.g., id.* at Sec. 8-5-15 (setting forth the process for holding a referendum on exceeding the debt limit); Exclusion From Debt Limit; Broadband Infrastructure, NH Rev Stat § 33:6-f (2012), available at http://law.justia.com/codes/new-hampshire/2012/title-iii/chapter-33/section-33-6-f ("Municipalities may incur debt for broadband infrastructure…by the issue of bonds or notes authorized under this chapter. Any debt incurred for this purpose shall be outside the debt limit prescribed in this chapter").

843 For examples, *see supra,* sections 4.1, 4.3, and 4.5.

Pursuing a GON is not a zero-sum endeavor. Choosing to construct a municipal network by assuming millions in debt does not automatically foreclose other projects that require additional funding. But in light of the complexity inherent in building dynamic broadband infrastructure, as well as the controversy that typically attends even the mere utterance that a city is considering a GON, these particular undertakings necessitate real trade-offs that undermine core aspects of local governance.

5.8 Finding Eight: A GON will not spawn the next Silicon Valley.

Implicit in many of the arguments in favor of GONs—especially those that deliver gigabit speeds—is that these networks will serve as the foundation for new high-tech clusters. Some go further and argue that, "without [such] fast nationwide fiber infrastructure … America will not be the country that produces the next big idea, the next Google."[844] The stakes are thus very high for those communities that rationalize a gigabit GON as necessary to encourage economic development and position their cities as new hubs for high-tech innovation.[845] But despite these lofty expectations for and confidence in municipal networks' ability to realize these ambitious goals, there is much evidence to support the contrary position—that the mere presence of an ultra-fast communications network is not a factor in creating high-tech clusters.

In recent years, policy makers from across the country and around the world experimented with ways to build from scratch or synthesize from existing assets the "next Silicon Valley."[846] These ranged from multi-billion dollar investments in the construction of multiple inputs (e.g., universities and office space) thought to be necessary precursors for general high-tech innovation, to the channeling of hundreds of millions of dollars in public funding to support a particular high-tech industry (e.g., quantum computing).[847] In many cases, these efforts failed to generate expected benefits because of the unpredictable nature of innovation and the uncertainty surrounding the factors that contribute to successful high-tech clusters and startup communities. But one takeaway from these experiences garnered broad support: top-down industrial planning by government tends to impede, rather than foster, growth in this space. It has been observed that, "The problem for governments is that they often try to define where and when innovation will occur."[848] In short, there is no formula that can guarantee success in these industries.

In the United States, there are numerous examples of high-tech clusters sprouting in response to a complex alchemy of public policies, market forces, and luck. Many such clusters emerged in cities with strong research universities that produce deep pools of technical talent. The high-tech corridor in Boston and the startup sector in Austin are two leading examples of the interplay between local universities and a private sector that is eager to commercialize the research emanating from these campuses.[849] The rapidly growing startup sector in New York City—dubbed Silicon Alley—has become a hub for entrepreneurs and innovators interested in applying new technologies in "creative ways to offer new products and services," especially

844 Captive Audience at p. 264.

845 This approach to framing the need for gigabit GONs was evident in the FCC's "Gigabit City Challenge" that was issued in January 2013. *See, e.g.,* Marguerite Reardon, *FCC Pushes for Gigabit Broadband in All 50 States by 2015*, Jan. 18, 2013, CNET News, *available at* http://news.cnet.com/8301-13578_3-57564815-38/fcc-pushes-for-gigabit-broadband-in-all-50-states-by-2015/ (reporting that the goal of the challenge is to encourage cities to deploy gigabit networks in an effort to "turn themselves into innovation hubs that would create valuable jobs for its citizens.").

846 There is also a long history of failed attempts by other states to replicate Silicon Valley. For an overview, *see* Vivek Wadhwa, *Silicon Valley Can't be Copied*, July 3, 2013, Technology Review, *available at* http://www.technologyreview.com/news/516506/silicon-valley-cant-be-copied/.

847 *See* Antonio Regalado, *In Innovation Quest, Regions Seek Critical Mass*, July 1, 2013, Technology Review, *available at* http://www.technologyreview.com/news/516501/in-innovation-quest-regions-seek-critical-mass/ (providing examples of such investments in Russia and Canada) ("*In Innovation Quest, Regions Seek Critical Mass*").

848 *Id.*

849 *See, e.g.,* Paul Judge, *Boston's Route 128: Complementing Silicon Valley*, Aug. 13, 1997, Business Week, *available at* http://www.businessweek.com/1997/34/b354197.htm (discussing the early years of Boston's high-tech corridor); *In Innovation Quest, Regions Seek Critical Mass* (discussing recent startup activity in and around Boston); Pike Powers, *Building the Austin Technology Cluster: The Role of Government & Community Collaboration in the Human Capital,* p. 53-71, Proceedings—Rural Conferences (spring 2004), Federal Reserve Bank of Kansas City, *available at* http://www.kc.frb.org/PUBLICAT/newgovernance04/Powers04.pdf.

in "legacy" industries like fashion, media, and advertising.[850] This has been described as a natural evolution for the city because the startup culture "plays to New York's strengths in part because the city has always been a hub for creating content, designing new things, and marketing products and services."[851] Similar factors have also been pivotal in supporting the development of fledgling startup communities in cities like Boulder, Colorado, and Portland, Oregon.[852]

Although the reasons why these and other cities proved to be fertile ground for a startup community vary widely, they do share a common trait: none resulted from a GON.[853] More broadly, none resulted from a government plan to create a high-tech sector from scratch. Many evolved organically, and while most have benefited greatly from favorable municipal policies aimed at fostering continued growth, success never hinged on the availability of a government-owned broadband network.[854] Such top-down planning is in many ways anathema to the startup ethos that permeates these communities. In fact, the opposite approach tended to work best—having government respond to the needs of entrepreneurs as they arise. This dynamic is evident in how public funding and other resources in many startup cities have been used to support the creation of incubators, mentoring programs for entrepreneurs, shared office space facilities, tax breaks to encourage investment, and affordable housing programs.[855]

In sum, those cities that have successfully nurtured vibrant information sectors, high-tech clusters or startup communities have used public resources to create or enhance the conditions necessary to foster the type of environment that is conducive to these industries. Building a GON has never figured into this calculus.

5.9 Finding Nine: GONs are not optimal remedies for perceived or actual broadband connectivity challenges.

GONs proponents often argue municipal networks will inject competition into the local broadband market. Because existing broadband offerings are, in their view, inadequate, residents and businesses will immediately benefit from the introduction of a competing municipal network.[856] This normative perspective stems from an overly pessimistic view of U.S. broadband and an overly optimistic one about municipalities' ability to correct markets. The rationale offered is that "networks owned by local governments, nonprofit organizations, or cooperatives are structurally responsive to the community first and should own this essential infrastructure."[857] This line of thinking is questionable in a number of ways.

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850 *New Tech City* at p. 16, 17.

851 *Id.* at p. 16.

852 *See, e.g.,* Dane Stangler, *Path-Dependent Startup Hubs*, Kauffman Foundation (Sept. 2013), *available at* http://www.kauffman.org/uploadedFiles/DownLoadableResources/path-dependent-startup-hubs-comparing-metropolitan-performance-high-tech-and-ict-startup-density.pdf (discussing the rise of these and other startup hubs throughout the U.S. and evaluating the factors that influenced their rise) ("*Path-Dependent Startup Hubs*").

853 Numerous surveys have sought to rank cities and regions based on metrics like startup density or using an array of factors like the number of patents filed per capita. In most instances, these surveys have yielded rankings that included cities and regions that have not built GONs, suggesting that these projects do little to improve the chances that a startup community or high-tech cluster will be spawned. For examples, *see id.* at p. 3 (ranking the top 20 large metropolitan areas by startup density, none of which is home to a GON); Richard Florida, *America's Leading High Tech Metros*, June 28, 2012, The Atlantic Cities, *available at* http://www.theatlanticcities.com/technology/2012/06/americas-leading-high-tech-metros/2244/ (ranking the top 20 U.S. metro areas using a technology index that incorporates the concentration of high-tech companies, patents per capita and average annual patent growth. Of these, only one city with a GON—Burlington, VT—makes the list. The author, however, credits the proximity of the University of Vermont as the leading factor for its inclusion.).

854 For a concise yet comprehensive examination of the various public and private sector inputs that are essential to growing these sectors in cities around the world, *see generally A Cambrian Moment*, Special Report on Tech Startups, Jan. 18, 2014, The Economist, *available at* http://www.economist.com/news/special-report/21593580-cheap-and-ubiquitous-building-blocks-digital-products-and-services-have-caused

855 *See, e.g., id.; Path-Dependent Startup Hubs* at p. 12-18 (discussing these and other efforts that have been undertaken by startup cities in recent years); *New Tech City* (recommending that New York City undertake similar initiatives in order to bolster its fledgling startup community).

856 *See supra,* section 2, for additional discussion.

857 *Averting the Looming Broadband Monopoly* at p. 7.

First and foremost, the premise of this particular argument hinges on a very basic understanding of competition, one that is largely inapplicable to the modern context. Specifically, the argument dismisses direct, data-based measures of consumer welfare and competition in favor of more rudimentary measures—e.g., the number of firms in a particular sector and their market shares—which tend to be imperfect indicators that are vulnerable to manipulation.[858] As a result, this perspective can leave out high levels of innovative dynamism throughout the entire broadband sector.[859]

Second, this rationale positions local officials as the judges of whether broadband markets are effectively competitive. The FCC has been tasked by Congress to monitor the national marketplace and undertake certain policy responses based on its analyses;[860] local governments are often ill-equipped to make such judgments.[861] Moreover, even the FCC has had issues with properly measuring and assessing broadband competition and otherwise harnessing the many new metrics for purposes that are emerging in this space.[862] Ultimately, such determinations are best made by observing consumers, who, by and large, are seeing their demands met as a result of intense competitive pressures throughout every segment of the marketplace.[863]

Finally, viewing GONs as a means of promoting competition in a local market means the proposed solution—the construction of a municipal network—risks tilting the playing field against service providers in the private sector. Introducing a "competitor" with a perceived (or actual) competitive advantage because of its affiliation with government could chill or drive away investment, slow innovation, and undermine the very market forces that have fostered a vibrantly competitive environment in this space.[864] For example, in building the infrastructure underlying their GON, some municipal utilities (e.g., EPB in Chattanooga) had the advantage of immediate (and, in some cases, free) access to key inputs like rights-of-way.[865] For private firms, gaining access to these infrastructural inputs is often a complicated and timely procedure fraught with red tape and bureaucratic inefficiency.[866]

The argument that GONs can or should be used to bolster competition in local and national broadband markets continues to be controversial and represents a policy prescription to a problem that objective data indicate does not exist.

858 *See, e.g.*, Thomas W. Hazlett, *The Federal Communications Commission's Excellent Mobile Competition Adventure*, George Mason University Mercatus Center Working Paper No. 11-46 (Nov. 2011), *available at* http://mercatus.org/sites/default/files/publication/FCC_Hazlett.pdf (discussing this in the mobile broadband context).

859 *See supra,* section 3.1, for additional discussion and analysis.

860 In the wireless space, for example, the Communications Act calls on the FCC to "review competitive market conditions with respect to commercial mobile services and shall include in its annual report an analysis of those conditions." 47 U.S.C. § 332(c)(1)(C). In the context of wireline broadband, the Act requires the Commission to determine "whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." 47 U.S.C. § 1301 et seq.

861 *See, e.g., supra,* section 5.5 (providing examples).

862 *See, e.g.,* Larry Downes, *How the FCC Sees Broadband's 95% Success as 100% Failure*, Aug. 23, 2012, Forbes.com, *available at* http://www.forbes.com/sites/larrydownes/2012/08/23/how-the-fcc-sees-broadbands-95-success-as-100-failure/ (observing that a broad array of data support more optimistic conclusions about the U.S. broadband space than have been made in recent years by the FCC).

863 *See supra,* section 3.1.1, for additional discussion and analysis.

864 *Id.*

865 *See, e.g.,* Avrahmi Berkowitz, *If You Build It, They Will Come: Chattanooga's Broadband Leaders Speak*, July 23, 2013, Commercial Observer, *available at* http://commercialobserver.com/2013/07/if-you-build-it-they-will-come-chattanoogas-broadband-leaders-speak/ (quoting an EPB executive as saying "Since EPB already had an electric power distribution system in place, we already had the poles, the rights-of-way, the underground infrastructure…").

866 *See infra,* section 6.2, for additional discussion and examples of how these obstacles might be reduced or eliminated in an effort to encourage more robust deployment of broadband infrastructure.

5.10 Finding Ten: State-level policy makers have important roles to play in the GONs context.

Advocacy of municipal broadband networks continues as supporters increasingly frame these projects as vital to the "national interest."[867] One impact of these efforts has been a subversion of the state-local relationship in GONs advocacy. By attempting to frame GONs as essential inputs to long-term economic prosperity in the United States, proponents have often sought to marginalize the role of state-level officials, particularly state legislatures, in these discussions.[868] As a result, efforts by state legislatures to mediate the exploration of these high-risk and costly municipal projects, typically via legislation to govern the process by which these networks are approved and built, are often dismissed out of hand as intrusive encroachments of municipal authority.[869] Though this perspective attempts to position cities and metropolitan areas as primary drivers of economic development and innovation,[870] these particular arguments, variously framed around notions of local self-reliance and "cooperative localism,"[871] are unpersuasive with respect to GONs.

State-level policy makers and policy making bodies, especially legislatures, have important roles to play.[872] GONs are expensive undertakings, costing anywhere from a few million dollars, as in Groton, to several hundreds of millions of dollars, as in Chattanooga, to nearly half a billion dollars in UTOPIA.[873] In some cases when a network faltered (e.g., Monticello) local government stepped in with funding support to help steady the municipal system. Other failed and failing systems (e.g., Burlington) negatively impacted local credit ratings, which increase borrowing costs and strain local finances even more. As these systems become more complex and ambitious, the costs associated with building and maintaining them rise inexorably, which raises the risk of costly—and potentially devastating—default by local government. Accordingly, states, which maintain ultimate responsibility for the financial health of the cities and towns in their borders, have a clear and compelling interest in overseeing the process by which GONs proposals are vetted and approved.

Well-established legal precedent supports such a close relationship between municipalities and their states. In 1907, the U.S. Supreme Court succinctly summarized this relationship when it ruled that municipalities are "political subdivisions of the state, created as convenient agencies for exercising such of the governmental powers of the state as may be intrusted [sic] to them … The number, nature, and duration of the powers conferred upon these corporations and the territory over which they shall be exercised rests in the absolute discretion of the state."[874] Over the last century, the contours of these relationships have sharpened in some instances by the adoption of "home rule" statutes and other rules that, among other things, provide municipalities with a degree of autonomy to act on certain matters.[875] However, only a small number of states—including Alaska, Iowa, Massachusetts, Montana, New Jersey, New Mexico, Ohio, Oregon, South Carolina

867 These issues were discussed in detail in previous sections. *See supra,* section 2 (discussing the evolution of pro-GONs advocacy), section 3.2 (identifying many competing priorities for municipal focus and resources), and sections 2 & 4.1 (analyzing an array of failed and failing GONs).

868 *See, e.g., National Broadband Plan* at p. 153 (calling on Congress to preempt state-levels attempts to mediate GONs).

869 *See, e.g.,* Olivier Sylvain, *Broadband Localism*, 73 Ohio St. L. J. 796 (2012) (describing state GONs laws as "getting in the way" and articulating a legal and public policy strategy for bolstering local authority to enter the broadband market as service providers) ("*Broadband Localism*").

870 *See, e.g.,* Bruce Katz and Jennifer Bradley, The Metropolitan Revolution: How Cities and Metros are Fixing Our Broken Politics and Fragile Economy (Brookings Press: Washington, DC 2013) (arguing that "Cities and metropolitan areas are the engines of economic prosperity and social transformation in the United States." *Id.* at p. 1).

871 *See* Nestor M. Davidson, *Cooperative Localism: Federal-Local Collaboration in an Era of State Sovereignty*, 93 Va. L. J. 959 (2007) (defining cooperative localism as "direct relations between the federal government and local governments" and arguing that such relationships are playing increasingly "significant role[s] in areas of contemporary policy as disparate as homeland security, law enforcement, disaster response, *economic development*, social services, immigration, and environmental protection, among other areas of vital national concern." *Id.* at p. 959 (emphasis added)). For more on the self-reliance rationale, *see, e.g., supra,* section 2; *Evaluating the Rationales for Government-Owned Broadband Networks* at p. 16.

872 As set forth in section 3, *supra.*

873 *See supra,* section 4.1, for additional data and discussion regarding the cost of certain GONs.

874 *Hunter v. City of Pittsburgh*, 207 U.S. 161, 178 (1907).

875 For an historical overview of how these statutes evolved in the first half of the 20th century, *see* Kenneth E. Vanlandingham, *Municipal Home Rule in the United States,* 10 Wm. & Mary L. Rev. 269 (1968). For a more recent discussion, *see* National League of Cities, Local Government Authority, http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-powers/local-government-authority.

and Utah—have "home rule" statutes, which means that in the vast majority of states in the U.S.—about 39 in all—legislatures continue to exert considerable oversight authority over municipalities and many of their functions.[876] And even in "home rule" states, municipal action is still subjected to close judicial scrutiny.[877]

In the GONs context, state legislatures have broad authority to adopt legislation impacting whether and how a municipality can or cannot offer communications services.[878] The U.S. Supreme Court confirmed this power in 2004 when it upheld a Missouri law that prohibited municipalities from offering telecommunications services.[879] In its ruling, the Court found that relevant sections of the Communications Act precluding certain actions that impeded market entry were inapplicable to a state's subdivisions (i.e., its municipalities), noting that Congress likely did not intend for the statute to support federal preemption in this particular context.[880]

To date, 19 states have adopted laws impacting the ability of municipalities to deploy a GON. Appendix II provides a summary of these statutes. Only a few states (e.g., Nebraska and Texas) imposed outright bans. In most other instances, state legislatures created a road map for municipalities to follow when evaluating a GONs proposal. Many of these involve public participation of some sort—public hearings, referenda, or other activities meant to fully apprise citizens of their local government's intention to invest public resources in a GON. Numerous others require substantial economic and financial analyses to ensure that a particular municipal project does not become a burden on local residents and the state.

Some have decried these laws as unnecessary barriers that serve only to raise the costs of a municipal network and otherwise "stifl[e]" local government experimentation with these types of systems.[881] Others argue that these laws are ultimately inapplicable in the GONs context.[882] Nevertheless, these laws remain in force and represent duly considered interventions by state-level policy makers interested in protecting citizens from waste, fraud, and abuse of public funds. Moreover, like the thousands of other laws passed each year by state legislatures, these particular laws reflect the exertion of legal authority by the legislative bodies responsible for monitoring the subdivisions they have created.

The legislative response to GONs by the Florida legislature provides a compelling case study of how a state might go about calibrating public policy responses in this context.

Florida's Legislative Approach to GONs

In the early 2000s, several municipal broadband projects were planned and deployed throughout Florida; many ultimately failed. In 2003, for example, the city of Quincy issued $3.3 million in revenue bonds to build a fiber-optic network known as NetQuincy.[883] Despite much enthusiasm and optimism about its potential to help the city "tak[e] charge of its [own] future,"[884] the network quickly faltered as expenses far outpaced revenues.[885] Similarly, the city of Orlando in the mid-2000s deployed a Wi-Fi network in parts of the city that failed due to lack of interest by consumers (despite being built to support 200 users, the system was only used by an

876 *See* National League of Cities, Local Government Authority, http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-powers/local-government-authority.
877 *Id.*
878 47 U.S.C. § 253.
879 *Nixon v. Mo. Mun. League*, 541 U.S. 125 (2004).
880 *Id.* at 138.
881 *Death of the Revolution* at p. 111.
882 *See, e.g., id.* at p. 111-112 (discussing whether state statutes prohibiting the provision of "telecommunications services" apply in the GONs context); *Broadband Localism* at p. 812-837 (analyzing the *Nixon* case and evaluating alternative methods and legal justifications for deploying additional GONs).
883 *See City of Quincy, Florida*, *Utility System Improvement and Refunding Revenue Bonds, Series 2003*, p. 45, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Oct 1. 2003), *available at* http://emma.msrb.org/MS216479-MS191787-MD372435.pdf.
884 *See The Case for Municipal Broadband in Florida*, at p. 2, Florida Municipal Electric Association (2005), *available at* http://www.baller.com/pdfs/fmea_white_paper.pdf ("*Case for Municipal Broadband*").
885 *See, e.g.,* Richard Swier, *Failing Government-Owned Networks Examined*, Dec. 3, 2013, Watchdog Wire, *available at* http://watchdogwire.com/florida/2012/12/03/florida-failing-government-owned-networks-examined/.

average of 27 people per day).[886] The network was eventually shut down.[887] Several other initiatives, including a municipal fiber network in Lake County[888] and a small-scale Wi-Fi system in Tallahassee,[889] were viewed as moderately more successful, but they were also significantly less ambitious in size and scope than some of the other GONs that had been built, and they did not compete with private ISPs for residential customers.

These various projects were likely fresh in the minds of legislators who, in 2005, began to develop a legislative framework to guide these and future efforts. The result was a law that set forth a straightforward process for municipalities contemplating a GON. This process includes:

- **Ample notice of public hearings**. Municipalities are required to hold no less than two public hearings, which must be held more than 30 days apart. The municipality is required to provide notice of the hearings 30 days prior to the state's public service commission, and prominently publicize the date in a newspaper of general circulation. The municipality must also provide notice to all broadband service providers in the geographic region.[890]
- **Discussion of numerous aspects of the proposed GON at the hearings**. During the hearing, the municipality must consider whether similar services are already being provided in the area, or if service providers have proposed to offer similar services.[891] The hearing must also address the projected costs for constructing, operating, and maintaining the system, as well as realistic estimates of revenues and expenses.[892] The statute also says that the hearing should weigh the costs and benefits of opting for a municipal solution over a private one.[893]
- **Develop a business plan**. The municipality must also draft and make available to the public a business plan that details: (1) the projected number of subscribers; (2) the geographic area served; (3) the kinds of service offered; (4) a plan to ensure that the proposed network's revenues will exceed operating expenses and debt payments within four years; (5) the estimated capital and operational costs for the first four years; and (6) future network upgrade costs.[894]
- **Financing.** The statute also prohibits cities from cross-subsidizing their networks.[895] If the municipality intends to finance the project using bonds with a maturity period longer than 15 years, the government must hold a public vote.[896] And if the network is not covering operational and borrowing costs after four years, the municipality must hold a public hearing to consider whether to shutter the network, sell it, partner with a private entity, or continue operating the network.[897]

To date, this framework, coupled with a generally deregulatory approach to advanced communications services, contributed to enormous growth and innovation throughout the state's broadband ecosystem. In particular, the broadband market throughout Florida is vibrantly competitive and continues to be fueled by the interrelated forces of sustained levels of investment in network infrastructure by private ISPs and insatiable consumer demand for new services. To these ends, the state quickly emerged as a leader in broadband adoption among the southern states in the late 2000s.[898] Similarly, in the years following passage of the GONs legislation

886 *Golden Gate Lark.*

887 *See supra,* section 2.

888 This system provides broadband access to businesses and municipal institutions, not residents. One study from 2005 concluded that the system had significant positive economic impacts on the municipality. *See* George S. Ford & Thomas M. Koutsky, *Broadband and Economic Development: A Municipal Case Study from Florida,* RURDS Vol. 17, No. 3 (Nov. 2005). Some criticized this particular study as being not sufficiently thorough to account for a range of other factors that might have influenced perceived economic gains stemming from the network. *See, e.g.,* Press Release, *Heartland Statement on Municipal Broadband Studies,* April 26, 2005, *available at* http://heartland.org/press-releases/2005/04/26/heartland-statement-municipal-broadband-studies.

889 This system provides Wi-Fi access in the downtown area and in the local airport. Data from 2009 (the latest available) indicate that an average of 10 people accessed the downtown network on any given day. *See* Digital Canopy, Wi-Fi Statistics, http://wifiservices.hcs.net/.

890 Fl. Stat. § 350.81(2)(a).

891 Fl. Stat. § 350.81(b)(2)&(3).

892 Fl. Stat. § 350.81(2)(b)(4).

893 Fl. Stat. § 350.81(2)(b)(5).

894 Fl. Stat. § 350.81(2)(c).

895 Fl. Stat. § 350.81(2)(f).

896 Fl. Stat. § 350.81(2)(c)(2).

897 Fl. Stat. § 350.81(2)(l)(1)-(4).

898 *See Report on the Status of Competition in the Telecommunications Industry For 2010*, at p. 42, Florida Public Service Commission (Dec. 2010), *available at* http://www.psc.state.fl.us/publications/pdf/telecomm/20110729MasterComp.pdf.

and implementation of other forward-looking policies, increases in broadband adoption outpaced the national average.[899] As of the end of 2012, 74 percent of Florida households had a fixed broadband connection, with millions more accessing the Internet wirelessly.[900] With respect to supply side issues, 99.5 percent of the population had access to a wireline broadband connection by the end of 2012, while 96 percent had access to at least two.[901] Nearly everyone in the state—98.3 percent of the population—had access to at least three wireless broadband providers.[902]

In sum, this type of legislative approach to GONs has played a key role in encouraging the state's broadband marketplace. Equally important, the legislature augmented these policies with an array of other legislative reforms that focused primarily on advancing broadband and modernizing communications regulation.[903] These were developed in close coordination with the governor and other relevant stakeholders, reflecting the type of collaborative, holistic approach to improving broadband connectivity that has yielded positive results across the country.[904]

This dynamic is evident in numerous states that have focused resources on evaluating local broadband markets, assessing needs, and collaborating with stakeholders to craft the most efficient and effective responses possible. GONs legislation represents only one type of policy response that some states have determined best addresses their particular circumstances. Numerous other state legislatures, however, prioritized reforms aimed at recalibrating regulatory frameworks to better reflect the realities of the modern communications marketplace.[905] Regardless of the approach, the primary takeaway remains the same: state policy makers, especially legislatures, have important roles to play not only with respect to GONs but also in the larger broadband context.

899 *See, e.g., Report on the Status of Competition in the Telecommunications Industry For 2006*, p. 48-51, Florida Public Service Commissioner (May 2006), *available at* http://www.psc.state.fl.us/publications/pdf/telecomm/2006CompReportfinal.pdf.

900 *See Report on the Status of Competition in the Telecommunications Industry For 2012*, p. 31, Florida Public Service Commission (Dec. 2012), *available at* http://www.psc.state.fl.us/publications/pdf/telecomm/20130722MasterComp.pdf.

901 *See* National Broadband Map, Summarize: Florida, http://www.broadbandmap.gov/summarize/state/florida.

902 *Id.*

903 This included reform legislation in 2005 that, among other things, deregulated VoIP services and exempted broadband services from state-level regulation. *See* Section 364.01(3), Florida Statutes. Additional reforms were enacted in 2009 and 2011 in an effort to further spur broadband deployment throughout the state by reorienting regulatory policy around advanced communications services. *See* Chap. 2009-226, Laws of Florida, *available at* http://laws.flrules.org/files/Ch_2009-226.pdf; Chap. 2011-36, Laws of Florida, *available at* http://laws.flrules.org/files/Ch_2011-036.pdf.

904 *See infra,* section 6, for additional discussion and examples of the positive impacts of this type of approach to broadband connectivity.

905 For an overview of these efforts and analysis of their impacts on the broadband market, *see, e.g., Telecommunications Deregulation: Updating the Scorecard for 2013; Recalibrating Regulatory Federalism.*

Part III

A Way Forward

6 Roles for Local and State Governments in Enhancing Broadband Connectivity

With high-speed Internet connectivity transforming every aspect of modern life, many compelling motivations exist for public action in the broadband space. Attempting to harness this transformative technology for economic and social gain is a rational response by stewards of the public good, who increasingly understand that broadband connectivity is a vital ingredient to short-term economic revival and long-term prosperity.[906] Policy makers at every level of government have critical roles to play in encouraging broadband connectivity.

This section discusses the roles state and local officials can play in spurring greater broadband connectivity on both the supply and demand sides. As an overview:

- **Section 6.1** offers a general framework for policy makers when developing and implementing strategies to enhance broadband connectivity in their communities. This framework attempts to capture the best practices and lessons learned from programs that have been deployed in cities and states across the country. The section suggests 10 guiding principles to frame supply side endeavors and 10 principles to frame demand side endeavors.
- **Section 6.2** examines an array of successful and unsuccessful approaches on the supply side. The discussion compares PPPs that are "more public than private" **(section 6.2.1)**, PPPs that are "balanced" **(section 6.2.2),** and PPPs that are "more private than public **(section 6.2.3).**
- **Section 6.3** examines a number of approaches on the demand side, including "collaborative" PPPs **(section 6.3.1)** and ineffective "top-down" PPPs **(section 6.3.2).**

A key takeaway is that policy makers have meaningful opportunities to work collaboratively with local stakeholders to:

- Determine the actual state of play in the broadband space; and
- Tailor solutions that reflect and leverage the range of expertise and resources available.

6.1 A Framework for Bolstering Broadband Connectivity at the State and Local Levels

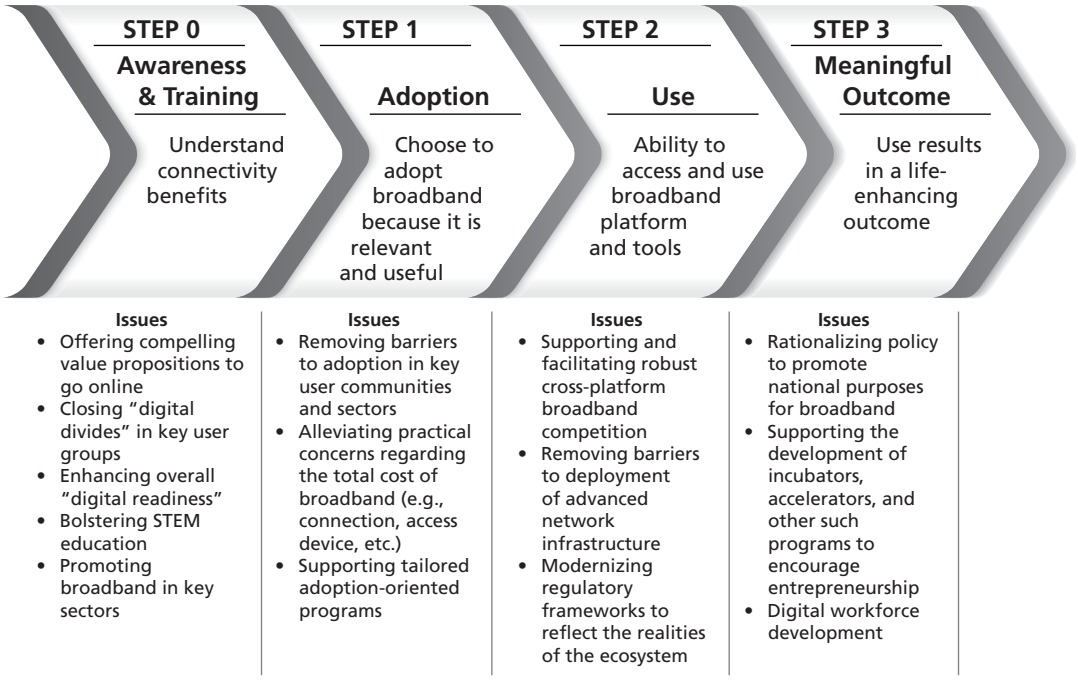
State and local governments are well-positioned to help spur broadband connectivity in a number of ways. Substantial research indicates that the most effective approaches stem from:

- Thinking broadly about broadband connectivity; and
- Appreciating that connectivity encompasses a wide range of activities impacting consumer and service provider decisions on both the supply side and demand side.

906 The clearest recent expression of these myriad public perceptions of the value of broadband to society generally can be found in the *National Broadband Plan.* However, these sentiments extend back to at least the mid-1990s, when the Clinton Administration implemented a number of policy reforms aimed squarely at unlocking the true economic and transformative power of the Internet. *See, e.g.,* Jonathan E. Nuechterlein and Philip J. Weiser, Digital Crossroads: Telecommunications Law and Policy in the Internet Age (2nd Ed.) 177-178 (MIT Press: Cambridge, MA 2013). Subsequent presidents, Congressional officials, FCC members, and other policy makers have also embraced the ability of Internet connectivity to change lives and sectors. *See Supra,* section 2.

Figure 6.1 provides a schematic of the broadband connectivity paradigm and highlights key issues implicated in each step of the process by which individuals and businesses choose to go online and the manner in which they use broadband.

Figure 6.1: Broadband Connectivity Paradigm



The approach to improving broadband connectivity highlighted throughout this paper seeks to reflect the diverse toolkit available to local and state officials and their many core competencies. The approach also encourages the use of resources in a manner reflecting communities' unique needs while respecting the still-tenuous nature of public finances.

Public-private partnerships can effectively address any aspect of the broadband connectivity paradigm depicted in Figure 6.1. Such partnerships are critical because they seek to "apply the resources of the private sector in meeting the needs of the public."[907] These partnerships have been used in an array of contexts over the last few decades, including efforts to enhance public transportation and infrastructure, education, and public safety.[908] More recently, they have become a popular means of "break[ing] the log jam" in an effort to achieve public sector goals during a period of shifting budget priorities.[909] The use of PPPs recognizes that working to improve the supply of broadband is not an all-or-nothing proposition that pits the public sector

907 *See For the Good of the People: Using Public-Private Partnerships to Meet America's Essential Needs*, at 4, National Council for Public-Private Partnerships (2002), *available at* http://www.ncppp.org/presskit/ncpppwhitepaper.pdf.

908 *See, e.g.,* Mark Perlman and Julia Pulidindi, *Public-Private Partnerships for Transportation Projects*, Municipal Action Guide, National League of Cities (May 2012), *available at* http://www.nlc.org/File%20Library/Find%20City%20Solutions/Research%20Innovation/Infrastructure/public-private-partnerships-for-transportation-projects-mag-may12.pdf ("*Public-Private Partnerships for Transportation Projects*").

909 *See* Emilia Istrate and Robert Puentes, *Moving Forward on Public Private Partnerships: U.S. and International Experience with PPP Units*, at p. 1, Brookings-Rockefeller Project on State and Metropolitan Innovation (Dec. 2011), *available at* http://www.brookings.edu/~/media/research/files/papers/2011/12/08%20transportation%20istrate%20puentes/1208_transportation_istrate_puentes.pdf ("*Moving Forward on Public Private Partnerships*").

against the private sector.[910] Rather, there is a broad range of possibilities for engagement between stakeholders throughout this space.

Structurally, PPPs vary widely, but many are forged to spread a project's risks. The amount of risk assumed by the public and by private parties differs depending on a number of variables, the most significant of which is the amount of capital invested. As an incentive for private firms to enter into PPPs and contribute resources at a high level, public entities typically reward private investment with a more tangible ownership stake and control over how the project will be realized.[911] These interests are calibrated via contracts that delineate the scope of rights and duties for public and private partners.[912] In the broadband context, there are numerous ways to structure PPPs to address issues on both the supply side and demand side. Properly implemented, these partnerships prove to be especially effective in achieving core public policy goals, including spurring new network build-out to previously unserved areas and promoting more robust broadband use in under-adopting communities, two core goals of broadband public policy.

The following principles are offered to policy makers and other stakeholders as a checklist of sorts for navigating the many options available on both the supply and demand sides.

Framework for Developing Viable Approaches to Improving Broadband Connectivity

- The most effective approaches are narrowly tailored to address specific problems evident in the locality.
- Policy makers should embrace a broad conception of broadband connectivity, one that does not position GONs as a primary or exclusive means of government action.
- Whenever possible, PPPs should be used to address supply side and demand side issues.
- Policy makers should recognize the broad range of opportunities available beyond PPPs for collaborating with relevant stakeholders.
- Every action in this context should revolve around a desire to maximize opportunities for harnessing the transformative power of broadband.

When addressing supply side issues to bolster broadband development:

1. **Have a clear vision.** Developing a clear vision and mission for new technologies in a municipality is essential to crafting focused, rational roles for local government. Cities that put forward a clear vision for broadband and technology generally have more success forging PPPs with expert firms and otherwise developing realistic strategies that efficiently marshal resources and stakeholders around common goals.
2. **Err on the side of comprehensiveness.** Comprehensive approaches that support forming diverse coalitions to work toward shared broadband goals across key sectors and communities tend to succeed.
3. **Use data to better target policy responses and calibrate partnerships.** Gathering data is an essential exercise that helps better inform policies and provides stakeholders with a clearer picture of the state of broadband connectivity in a given community. Data-centric policy making has proven an expedient means of identifying areas of unmet demand (e.g., rezoned former industrial areas).

910 A general distrust of the private sector is evident in much GONs advocacy. *See, e.g., supra,* section 2.1 (discussing the ideological origins of GONs advocacy); Eric Null, *Municipal Broadband: History's Guide,* 9 ISJLP 21, 53-55 (2013) (arguing that, since a "corporation is accountable to its shareholders," it has incentives to undermine a PPP and thus should be approached with wariness by public sector officials or, in some cases, dismissed outright in favor of a purely public solution, i.e., a GON); *Broadband at the Speed of Light* (generally pitting the interests and resources of "huge corporations" against those of municipalities in an attempt to justify GONs); David Carr, *Telecom's Big Players Hold Back the Future*, May 19, 2013, N.Y. Times (summarizing criticism of the U.S. broadband market that reflects this type of distrust).

911 *See, e.g.,* Fred Becker and Valerie Patterson, *Public-Private Partnerships: Balancing Financial Returns, Risks, and Roles of the Partners*, Public Performance & Management Review, 29 (2) (Dec., 2005) (identifying two basic parameters that should be included in any PPP: "First, a strong, positive association should exist between risks and rewards for the private partner: Higher risk assumed by the private partner deserves the promise of higher rewards, and vice versa. Second, a strong, positive association is necessary between risk and the degree of involvement of the private partner in development, operations, and ownership. A higher degree of managerial involvement by the private partner is warranted in exchange for assuming higher risk in the activity, and vice versa." *Id.* at p. 126).

912 *Public-Private Partnerships for Transportation Projects* at p. 2 (providing examples of three types of basic PPP contracts used in the transportation context).

4. **Be strategic in the use of RFIs and RFPs.** Well-written, concise, and narrowly tailored RFIs and RFPs are useful tools for municipalities to assess the scope of potential PPPs with stakeholders in the private and nonprofit sectors.
5. **Position government as a key funding conduit.** Local and state governments are important funding conduits for channeling limited public resources to private sector firms willing to work in a PPP to achieve well-defined broadband goals.
6. **Tap into government's convening power.** Local and state governments have important convening roles. They are uniquely positioned to bring stakeholders together to identify areas of need and apportion resources accordingly.
7. **Leverage municipal authority to unlock broadband deployment.** Municipalities possess enormous authority to drive broadband build-out. City officials should embrace the task of modernizing legal and policy frameworks to encourage further investment in next-generation broadband networks. Possible activities include rethinking the franchising process, streamlining the administration of local rights-of way, increasing the speed with which permits and siting requests are reviewed and approved, and modernizing zoning policies to better reflect the contours of the marketplace and the technological aspects of modern communications networks.[913]
8. **Leverage state authority to unlock broadband deployment**. Examples of successful actions undertaken in dozens of states include comprehensive regulatory modernization efforts, minimalist regulatory frameworks for advanced communications technologies (e.g., broadband, VoIP, wireless), and the allocation of limited pools of funding to seed PPPs. Together, these types of efforts are essential to unlocking additional investment in next-generation networks.[914]
9. **Maintain a level playing field.** Ensuring parity is essential to fostering continued competition in the broadband ecosystem. Conversely, tipping the playing field by granting a firm a distinct set of incentives undermines this notion. As such, it is essential that policy reforms, concessions, and incentives impacting supply side decisions be made available to all competitors.
10. **Purely public approaches rarely succeed.** The absence of expert private firms from supply side efforts deprives municipalities of innovative, cost-conscious thinking and other critical core competencies that local and state governments typically lack.

When addressing demand side issues to increase broadband adoption:

1. **Appreciate the hyper-local nature of broadband connectivity challenges.** While there are many commonalities across under-adopting groups, barriers to connectivity tend to differ in nuanced ways from state to state, from city to city, and often from neighborhood to neighborhood. Demand side responses should be calibrated accordingly.
2. **Study the relevant community to gather key data and insights.** Components of effective demand stimulation and aggregation strategies include measuring and understanding local demand, identifying and appreciating the many contours associated with barriers to broadband connectivity, and identifying existing resources and assets (e.g., elements of local social infrastructures) that can serve as the core of resulting PPPs.
3. **Effective demand side programs tend to be local in nature.** Whenever possible, outreach and training efforts should be devolved to the local level to ensure more targeted programming. National outreach campaigns can be useful in raising general awareness of the benefits of broadband connectivity, but programs that deliver hands-on training typically thrive at the hyper-local level. Local policy makers are

913 The fallout from recent natural disasters—e.g., network outages—has highlighted a fundamental dissonance between zoning laws and modern communications network requirements. For additional discussion, *see* Charles M. Davidson & Michael J. Santorelli, *Communications Network Outages—Learning from Hurricane Sandy, ACLP Briefing, New York Law School* (Dec. 2012), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/ACLP-Briefing-Network-Outages-December-2012.pdf.

914 By one estimate, updating and removing requirements for ISPs to maintain legacy telecommunications networks (i.e., those that support basic telephone service over the Public Switched Telephone Network) could unlock tens of billions of dollars in additional broadband investment annually. *See* Anna-Maria Kovacs, *Telecommunications Competition: The Infrastructure-Investment Race*, Internet Innovation Alliance (Oct. 2013), *available at* http://internetinnovation.org/images/misc_content/study-telecommunications-competition-09072013.pdf.

especially well-positioned to work with private firms, nonprofit groups, and other stakeholders to spearhead these kinds of approaches.

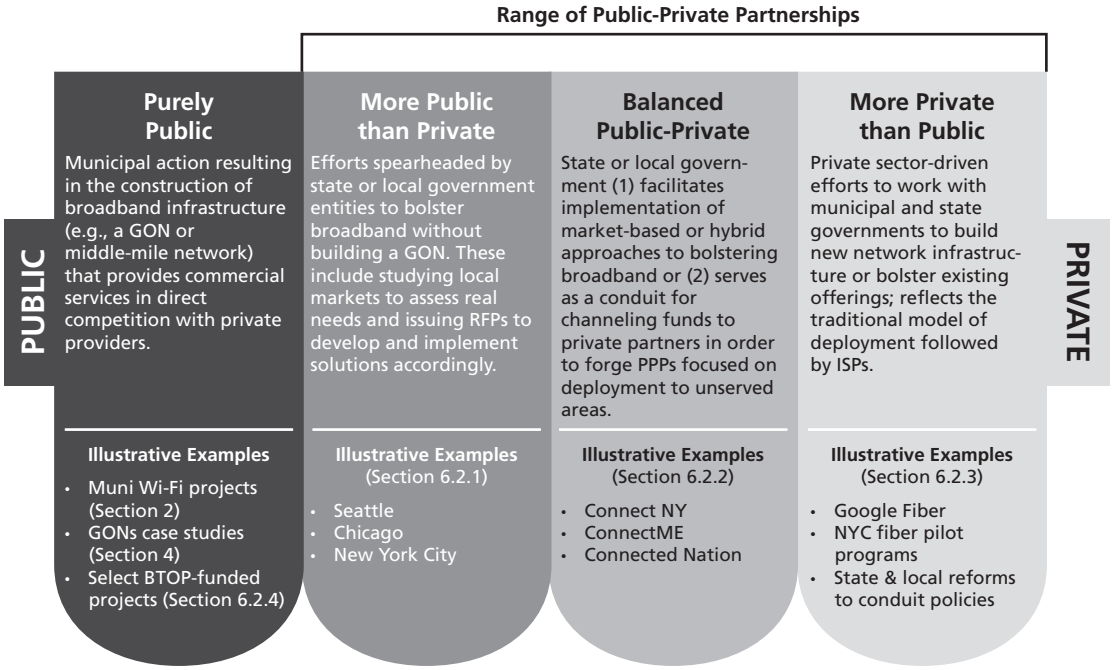
4. **Leverage local social infrastructures**. These networks of expert programs and institutions are key inputs to any demand side PPP. As such, it is essential to understand the characteristics of these local networks, including the capacities and limitations of component organizations. Developing this knowledge base is critical to effective programmatic responses.
5. **Leverage core competencies of policy makers and government institutions at the state and local levels.** Doing so will yield relationships with a broader group of stakeholders, which in turn enhances the ability to not only engage in wide-ranging awareness activities on behalf of a particular PPP (e.g., convening public forums to aid in studying local demand dynamics), but also, in many instances, assist in identifying funding mechanisms for a partnership.
6. **Pair narrowly tailored demand side programs with build-out efforts to unserved areas.** Stimulating and aggregating demand for broadband is a critical aspect of reducing the risk inherent in deploying new networks to "uneconomic" unserved areas.[915]
7. **Local and state governments are well-positioned to help coordinate demand side programs.** Core functions include serving as conduits for channeling funding and other resources to PPPs or as central hubs for facilitating partnerships among members of relevant social infrastructures (e.g., identifying opportunities for collaboration between two nonprofits; assisting interested private firms and philanthropic organizations in identifying nonprofits they can support financially).
8. **Comprehensive planning is essential.** Much like on the supply side, municipalities benefit from comprehensive strategies for addressing broadband connectivity issues. Cities that have undertaken such analyses, and worked with and through local social infrastructures to channel resources and support expert nonprofits, have seen significant progress toward closing gaps in adoption and informed use.
9. **Consider tying demand side initiatives to social service delivery.** Doing so could yield clearer, more compelling value propositions and, eventually, more meaningful uses of the technology. Equally important, PPPs that assist in social service delivery can help municipalities streamline certain administrative functions and otherwise realize a number of cost savings.
10. **Top-down approaches to demand side issues rarely work.** Often these approaches necessitate the integration of existing adoption programs to enhance efficacy. As such, it would be much more efficient and effective to work with these organizations from the start.

6.2 Supply Side PPPs to Bolster Broadband Development: Illustrative Examples

Figure 6.2 delineates the range of ways to structure supply side public-private partnerships. Subsequent subsections provide examples of each approach. The common thread is that, to succeed, each requires roughly equal participation of public and private partnerships. Those that fail tend to follow the less successful, top-down GONs approach to broadband connectivity.

915 *See, e.g., Broadband and the Empire State* (discussing this approach in the context of bringing new broadband networks to unserved parts of New York State). *See also Beyond the Divide: Progress Report*, at p. 11-20, Connected Nation (Fall 2013), *available at* http://www.connectednation.org/sites/default/files/connected-nation/files/cnctd_fall_final.pdf (detailing a similarly holistic approach to working at the community level to stimulate awareness of and demand for broadband and tailoring supply side and demand side responses accordingly).

Figure 6.2: Broadband Deployment Continuum



6.2.1 PPPs that are "More Public than Private"

PPPs that are "more public than private" describe initiatives typically spearheaded by state or local government to bolster broadband without building a GON. These include, for example, launching inquiries to study local markets and assess needs and issuing requests for information or proposals (RFIs or RFPs) to develop and implement solutions accordingly. The scope of these activities varies widely and encompasses activities like gathering data about broadband availability to better inform policy responses and developing formal plans of action that culminate in PPPs. The following examples from Seattle, Chicago, and New York provide further insight into how these types of PPPs might be structured and the various outcomes they can facilitate.

Seattle's Broadband Efforts

In the early 2000s, Seattle, like many other cities in the U.S., explored options for building a municipal network.[916] By 2005, Seattle succeeded in deploying what was eventually described as a "meager" Wi-Fi network in select parts of downtown and in public parks.[917] Also that year, the city released the results of a city-led analysis of "how the city [could] promote deployment of an advanced communications network."[918] This report identified an overarching goal for the city—"Within a decade, all of Seattle will have affordable access to an interactive, open, broadband network"—and put forward a number of recommendations for realizing this vision.[919] In response, city officials explored the feasibility of a more robust and widespread municipal wireline network.[920]

916 Many of these efforts were described *supra*, in section 2.

917 *See, e.g.,* Brier Dudley, *Seattle Pulls Plug on its Broadband Network,* May 6, 2012, Seattle Times, *available at* http://seattletimes.nwsource.com/html/businesstechnology/2018149915_brier07.html ("*Seattle Pulls Plug*").

918 *See Report of the Task Force on Telecommunications Innovation*, City of Seattle (May 2005), *available at* http://www.seattle.gov/cable/docs/SeaBTF.pdf.

919 *Id.* at p. 6-7.

920 *See, e.g.,* Matthew Halverson, *Disbanded: No Broadband Utility for Seattle*, June 20, 2012, Seattle Met, *available at* http://www.seattlemet.com/arts-and-entertainment/articles/disbanded-no-broadband-utility-for-seattle-july-2012/ (describing myriad inquiries made by the city).

By early 2012, however, local policy makers ended both municipal initiatives—the existing Wi-Fi network and fledgling plans for a GON—citing cost concerns.[921] Nevertheless, officials remained focused on encouraging broadband throughout the city and explored a number of avenues for leveraging existing municipal assets for these purposes. Soon after the Wi-Fi network was decommissioned, the city announced it would seek to lease part of its internal fiber network to the highest bidder.[922] In December 2012, the city announced an agreement with a firm to "develop and operate an ultra-high-speed fiber-to-the-home/fiber-to-the-business broadband network."[923] This deal hinged on a promise by the partner firm—a startup called Gigabit Squared—to lease the city's fiber assets and invest tens of millions of dollars in bringing fiber to the home.[924] Despite much fanfare, by the end of 2013 this partnership had unraveled.[925] This was due in large part to what city officials described as an unworkable financial plan implemented by Gigabit Squared.[926] Among other things, this resulted in unpaid bills and little progress toward actually building out the proposed network.[927]

Assessment. Even after determining a GON was not in the best interests of the city, local officials continued down a path that reflected, in many ways, the municipal broadband mindset. That the hybrid approach to bolster broadband connectivity in the city eventually failed is not surprising because it closely mirrored many of the GONs models discussed in **section 4.**

Chicago's Broadband Efforts

Since the early 2000s, Chicago has been attempting to develop and implement a diversified strategy for leveraging municipal assets to increase broadband connectivity throughout the city. Initial efforts centered on studying the feasibility of deploying a citywide Wi-Fi network.[928] By the late 2000s, however, Chicago elected to forego a municipal wireless system because of cost concerns and the general failure of the municipal Wi-Fi model.[929] Thereafter, city efforts focused primarily on studying and understanding the contours of the many demand side issues facing Chicago, especially those related to its digital divide.[930] A renewed focus on supply side issues only emerged after several years of working to boost awareness of and demand for broadband in under-adopting communities.[931]

In 2012, the city launched the "Chicago Broadband Challenge," a program aimed at conducting a holistic assessment of local broadband infrastructure, partnering with private-sector stakeholders to assist the city

921 *Seattle Pulls Plug.*
922 *Id.*
923 *See* Press Release, *City of Seattle, University of Washington, and Gigabit Squared Announce Plan to Develop Ultra-fast Broadband Network*, Dec. 13, 2012, City of Seattle, *available at* http://mayormcginn.seattle.gov/city-of-seattle-university-of-washington-and-gigabit-squared-announce-plan-to-develop-ultra-fast-broadband-network/.
924 *Id.*
925 *See* Todd Bishop, *Gigabit Squared's Legacy in Seattle: Unpaid Bill of $52,250*, Jan. 3, 2014, Geekwire.com, *available at* http://www.geekwire.com/2014/gigabit-squareds-legacy-seattle-unpaid-bill-52250/.
926 *See* Emily Parkhurst, *Seattle's Fiber-Network with Gigabit Squared is Dead*, Jan. 7, 2014, Puget Sound Business Journal, *available at* http://www.bizjournals.com/seattle/blog/techflash/2014/01/seattles-fiber-deal-with-gigabit.html?page=all.
927 *Id.*
928 *See, e.g.,* Esme Vos, *Chicago Resurrects Muni Wi-Fi Plan, Issues RFI*, Sept. 27, 2012, Muni Wireless, *available at* http://www.muniwireless.com/2012/09/27/chicago-resurrects-muni-wifi-plans/ (noting that the city began exploring a citywide wireless system in 2003).
929 *See, e.g.,* Eric Bangeman, *Chicago's Decision to Drop Muni Wi-Fi Symptomatic of a Troubled Sector*, Aug. 29, 2007, Ars Technica, *available at* http://arstechnica.com/uncategorized/2007/08/chicagos-decision-to-drop-muni-wifi-symptomatic-of-a-troubled-sector/.
930 *See, e.g., The City that Networks: Transforming Society and Economy Through Digital Excellence,* Report of the Mayor's Advisory Council on Closing the Digital Divide (May 2007), *available at* http://www.cityofchicago.org/dam/city/depts/doit/supp_info/DEI/CityThatNetworks.pdf (putting forward a number of recommendations for bolstering broadband connectivity across the city); Karen Mossberger and Caroline J. Tolbert, *Digital Excellence in Chicago: A Citywide View of Technology Use*, Report to the Chicago Department of Innovation and Technology (July 2009), *available at* http://www.cityofchicago.org/dam/city/depts/doit/supp_info/DEI/Digital_Excellence_Study_2009.pdf (evaluating technology use in the city and identifying barriers to more robust broadband adoption). For additional discussion, *see infra*, section 6.3.1.
931 In 2009, for example, Chicago receive a sizeable grant from the U.S. Department of Commerce to launch a nonprofit—the SmartChicago Sustainable Broadband Adoption program—focused on "spur[ring] economic development in five disadvantaged neighborhoods in Chicago" via "a comprehensive broadband awareness and adoption program that will include providing computers and training opportunities to more than 11,000 residents and 500 small businesses and not-for-profits." *See* BroadbandUSA, Grantees: City of Chicago, http://www2.ntia.doc.gov/grantees/CityOfChicago.

in "making the investments required to ensure that Chicago is prepared to meet the demands of the modern economy and position Chicago as one of the most connected cities in the world."[932] To meet these goals, the city in September 2012 issued an RFI to "gather ideas and recommendations for developing and expanding citywide broadband infrastructure and improve access to high-speed internet for residents across the City."[933] The city has said it will not attempt to build a GON; instead, it will look to achieve its goals for broadband and its fledgling high-tech sector in close collaboration with private firms.[934] Two dozen organizations, including numerous private firms, responded to the RFI.[935] In addition, the city forged a partnership with Gigabit Squared to deploy FTTH in select parts of the city.[936] Recent troubles in Seattle have cast doubt on the ability of this organization to deliver on its promises.[937] Indeed, in early 2014 the state of Illinois asked Gigabit Squared to return $2 million in grant money because of alleged improprieties by the group.[938]

Assessment. Chicago's many successes on the demand side have not been matched on the supply side. This is due in large part to an inability or unwillingness to engage experts in the private sector regarding their needs vis-à-vis investing more in their networks and working with stakeholders (e.g., via PPPs) to ensure more widespread access.

New York City's Public-Private Approaches on the Supply Side

New York City spearheaded a number of public-private initiatives focused on strengthening broadband infrastructure. In 2005, for example, the city enacted legislation calling for the formation of a broadband advisory committee to "review how to use municipal resources to accelerate the build-out of current, emerging, and newly developed broadband technologies and other advanced telecommunications and information services."[939] Over the next few years, the committee convened public forums to solicit feedback regarding the real needs of residents and businesses throughout the city. These and related efforts informed a number of subsequent policy responses. For instance, the city worked closely with a number of private firms to deploy Wi-Fi networks in dozens of public spaces across the city.[940] The result has been the near blanketing of parks, industrial zones, and tourist areas with privately provided wireless Internet access.

Assessment. Already one of the most robust markets for broadband in the country, New York City has further bolstered availability by successfully forging a diverse array of PPPs.

6.2.2 Balanced Public-Private Partnerships

The balanced approach to structuring PPPs positions state or local government as an intermediary working with partners to realize discrete goals for broadband. In practice, this typically results in a government

932 *See* City of Chicago, The Broadband Challenge, http://digital.cityofchicago.org/index.php/the-broadband-challenge/.

933 *See Request for Information: Broadband Infrastructure Expansion,* Dept. of Procurement Services, City of Chicago (Sept. 2012), *available at* http://www.cityofchicago.org/content/dam/city/depts/dps/ContractAdministration/Specs/2012/Spec111304.pdf.

934 *See, e.g.,* Brian Santo, *Muni Broadband with a Twist*, Nov. 1, 2012, CED Magazine, *available at* http://www.cedmagazine.com/blogs/2012/11/muni-broadband-with-a-twist.

935 *See* City of Chicago, The Broadband Challenge: RFI Respondents, http://digital.cityofchicago.org/wp-content/uploads/2012/09/RFI-Respondents-Contact-List-FINAL.pdf.

936 *See* Kevin Fitchard, *Gigabit Squared Promises Fiber Broadband for Chicago's South Side*, Oct. 16, 2012, GigaOm, *available at* http://gigaom.com/2012/10/16/gigabit-squared-plans-fiber-broadband-for-chicagos-south-side/.

937 *See, e.g.,* Stacey Higginbotham, *Gigabit Squared Co-Founder and Former President Resigns Amid Questions over Seattle Deal*, Jan. 8, 2014, GigaOm, *available at* http://gigaom.com/2014/01/08/gigabit-squared-co-founder-and-former-president-resigns-amid-questions-over-seattle-deal/.

938 *See* Sandra Guy, *State Wants Gigabit Squared to Return $2 million Grant*, March 27, 2014, Chicago Sun-Times, *available at* http://www.suntimes.com/business/26484032-420/state-wants-gigabit-squared-to-return-2-million-grant.html#.U2fC6Ve5I6I (quoting a state official as saying Gigabit Squared had "lied repeatedly" about its intentions and may have spent only $250,000 of the grant money for legitimate purposes).

939 *See* Local Law 126-2005, New York City Council (enacted), *available at* http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=444034&GUID=F0EA8014-69F5-4F7B-AB88-EEF2F394E5BE&Options=ID|Text|&Search=126.

940 *See, e.g.,* NYC Digital, Digital Road Map: Access, http://www.nyc.gov/html/digital/html/roadmap/access.shtml (describing some of these PPPs).

or quasi-government entity either working to implement market-based approaches to bolstering broadband or serving as a conduit for channeling funds to private partners to forge PPPs focused on unserved areas. The benefits associated with the balanced PPP stem primarily from maximizing the core competencies of state and local government. Both entities have the ability to serve as natural conveners and coordinators of broad activities focused on widely shared goals. In addition, the balanced PPP approach often minimizes financial outlays by public entities and seeks instead to forge partnerships that spread the risks associated with building, maintaining, and operating a complex communications infrastructure.

The following examples—of Maine, New York, and Connected Nation—highlight the permutations of this type of PPP, one that has been successful when carefully designed and implemented.

ConnectME

The ConnectME Authority in Maine was created by legislation in 2006 to "facilitate the universal availability of broadband to all Mainers and help them understand the valuable role it can play in enriching their lives and helping their communities and businesses thrive."[941] The Authority has a broad portfolio empowering it to undertake a range of initiatives focused on strengthening both the supply of and demand for broadband services throughout the state.[942]

On the supply side, the Authority possesses significant discretion with regard to awarding grants in support of deployment projects to unserved areas that would not otherwise be attempted in the absence of such funding.[943] These grants, most of which constitute only part of a project's overall cost, are flexible and can be used in support of new network deployments, as matching grants or gap funding, or for "any other necessary activities that are integral and necessary for the development, installation and use of a broadband or mobile communications system."[944] Funding for these grants stems from a "0.25 [percent] surcharge on all communications, video and Internet service bills for retail in-state service," which generates in excess of $1 million each year.[945]

By the end of 2012, 99 total grants had been made, totaling $8 million.[946] The results have been impressive: broadband is available to over 91 percent of households in the state, up from 86 percent when the Authority was first formed.[947] Equally important, the broadband adoption rate increased from 40 percent to 73 percent at the same time, which suggests there was significant demand for these services in unserved areas.[948] Future efforts are being guided by a strategic plan released in 2012.[949] The plan calls for collaboration and cooperation across state and local government, as well as with stakeholders in the private and nonprofit sectors, to bolster broadband connectivity and realize its transformative potential in key sectors like education, healthcare, and government.[950]

Assessment. Maine has struck the right balance between government involvement in the broadband space and private-sector engagement to spur network build-out. This balance hinges on the use of limited public funding to incentivize private deployment efforts in areas that would otherwise be "uneconomic."

941 *See* ConnectME Authority, About, http://www.maine.gov/connectme/about/index.shtml.
942 For an overview of its various duties, *see id.*
943 *See ConnectME Authority Final Adopted Rule*, Section 6(B), http://www.maine.gov/sos/cec/rules/90/99/639/639c101.doc.
944 *Id.* at Section 6(C).
945 *See Annual Report on the Activities of the ConnectME Authority*, at p. 8, Report to the Maine State Legislature Joint Standing Committee on Energy, Utilities, and Technology (Jan. 2013) *available at* http://www.maine.gov/connectme/about/docs/ConnectME-AnnRpt2012.pdf.
946 *Id.* at p. 2.
947 *Id.* at p. 1.
948 *Id.*
949 *See Developing Broadband in Maine: Strategic Plan*, ConnectME Authority (April 2012), *available at* http://www.maine.gov/connectme/grants/ntia/docs/ConnectMEStrategicPlanFinalDraft.pdf.
950 *Id.* at p. 2-3.

Connect NY (Contributed by David Salway, Director, New York State Broadband Program Office[951])

Since being established in 2008, the New York State Broadband Program Office has served as the single point of contact for New York State broadband development and deployment efforts. The Program Office performs a variety of functions to advance Governor Andrew Cuomo's broadband initiatives for the state, with its primary mission being to increase economic and social opportunities through universal broadband deployment. To meet this goal, the Office has worked to (1) research and implement innovative solutions to increase broadband connectivity and boost adoption in underserved and unserved, urban and rural communities throughout the state; (2) support broadband initiatives for the Governor's 10 Regional Economic Development Councils to advance broadband access and adoption; (3) manage state broadband grant programs including Connect NY and the NYS Universal Broadband Grant program; and (4) position New York to maximize available federal funding.[952]

These efforts—and broadband policies generally throughout the state—have been informed by the careful aggregation and analysis of numerous data points about broadband connectivity in New York. Baseline data, collected in 2009 and 2010, provided a detailed overview of the state of broadband availability. On the supply side, as a result of continued strong investment by an array of ISPs (wireline and wireless), broadband became available to the vast majority of residents by 2010.[953] However, pockets of unserved areas remained. More specifically, 520,000 households throughout the state, the equivalent of about 1,000,000 residents, lacked access to broadband at home.[954] Many of these households are situated in areas where it is exceedingly difficult and expensive to build out the "last mile" of broadband service. Indeed, for many unserved areas, extreme geographic conditions (e.g., dense forest or mountainous topography, as in the Adirondacks) have precluded even the deployment of cellular network infrastructure.[955]

In an effort to plug these gaps and ensure every resident in the state has equal opportunity to tap into broadband's transformative power, Governor Cuomo in 2012 launched Connect NY, a $25 million grant program "designed to spur investment by broadband service providers and expand broadband connectivity and economic development in each [of the state's] region[s]."[956] In particular, the program "funded projects which will acquire and install broadband equipment to expand last-mile services to unserved and underserved areas using existing networks, as well as deploying new infrastructure where applicable." The 18 broadband projects selected to receive Connect NY broadband grants were required to provide matching funds, bringing total statewide investment in the program to more than $32 million.[957]

The structure of the grant programs reflects a clear preference for public-private partnerships, with the majority of the grants being "awarded … to Internet service companies and in partnership with local governments and economic development organizations."[958] The virtue of this approach is that state government can use scarce public resources as an incentive for private-sector firms to share the risk in areas long considered

951 The views expressed in this Contribution are those of Mr. Salway only. However, by including the contribution in the main body of the report, the authors wish to demonstrate their support for the Connect NY program, which has emerged as a very successful public-private approach to bringing broadband to unserved parts of New York State.

952 *See The NYS 2013 Annual Broadband Report*, *available at* http://nysbroadband.ny.gov/assets/documents/Annual_Report_7.12.13_WEB.pdf ("*2013 Annual Broadband Report*").

953 *See, e.g., id.; Broadband and the Empire State* (discussing investment levels and network availability). For additional information, *see* New York State, Broadband Mapping Project, http://www.broadbandmap.ny.gov/ (incorporating deployment data as of Dec. 31, 2012).

954 *2013 Annual Broadband Report.*

955 *See, e.g.,* Michael Gormley, *Cuomo Plans $25 Million Boost to Upstate Broadband Access,* March 3, 2012, PostStar.com, *available at* http://poststar.com/news/local/article_4273422a-6577-11e1-a9ba-001871e3ce6c.html. Other factors, notably onerous review processes by entities like the Adirondack Park agency, have influenced infrastructure deployment in these areas.

956 *See* New York State Broadband Program Office, Connect NY Broadband Grant Program 2012, http://nysbroadband.ny.gov/ConnectNY2012.

957 *See Connect NY Broadband Grant Programs Guidelines* at p. 2, NYS Broadband Program Office, *available at* http://nysbroadband.ny.gov/assets/documents/connectnygrantguidelines1.pdf.

958 *See* Press Release, *Governor Cuomo Announces Applications Open for Connect NY Broadband Grants*, Aug. 27, 2012, Office of the Governor of New York, *available at* http://www.governor.ny.gov/press/082272012broadbandgrants.

"uneconomic."[959] This creates a win-win-win situation: the public sector realizes broad economic and public policy imperatives around broadband, the private sector can attract new customers in new areas, and, most important, residents finally gain access to this transformative technology.

Together, the Connect NY projects will bring broadband service to over 153,000 households, 8,000 businesses, and 400 anchor institutions—many without any means to access the Internet—across more than 6,000 square miles of New York State.[960] In addition to the vast economic benefits derived from broadband access, the projects funded by Connect NY will create 1,400 new jobs.[961] To date, the Cuomo administration awarded more than $56 million in funding for broadband projects, representing the largest statewide broadband funding commitment in the nation.[962]

In sum, Connect NY has been enormously successful and stands out as a leading model of an effective and balanced PPP, one where state government helps to create incentives for and align goals of unserved communities and private ISPs to bring much-needed broadband service to every part of the state.

Assessment. New York State's approach to addressing key supply side issues reflects a clear preference for public-private solutions. Governor Cuomo's leadership on these issues has been supported by the allocation of a substantial amount of funding to seed PPPs in an effort to support network deployment to unserved areas.

Connected Nation

The public-private model developed by *Connected Nation*, a national nonprofit organization headquartered in Washington, D.C., and dedicated to improving broadband connectivity in unserved and underserved parts of the county, has been adapted for use in over a dozen states.[963] As an overview, these programs engage in comprehensive broadband planning on behalf of states. Efforts include gathering and analyzing a range of data regarding broadband availability and adoption, the design and implementation of PPPs and other solutions to address shortcomings on both the supply side and demand side, assisting in the development of statewide broadband maps, and an assortment of other consultative services that help state and local policy makers calibrate policy responses to specific needs and resources.[964]

Assessment. Successful public-private solutions to broadband connectivity issues tend to address the unique needs of the states in which they work. Such tailor-made approaches underscore a simple truth of addressing problems on both the supply and demand sides: one size rarely fits all.

6.2.3 PPPs that are "More Private than Public"

"More private than public" PPPs are spearheaded by private-sector firms seeking to work with municipal or state government in either the construction of new broadband networks or the improvement of existing infrastructure. In many ways, this particular form of PPP reflects the prevailing model of network deployment that has been followed by ISPs for many years: companies that wish to build a broadband system

959 For additional discussion of the value of using PPPs in this way, *see generally Broadband and the Empire State.*
960 *See* New York State Broadband Program Office, Connect NY Broadband Grant Program 2013, http://nysbroadband.ny.gov/ConnectNY2013.
961 *Id.*
962 *Id.*
963 These include: Alaska, Colorado, Iowa, Kentucky, Michigan, Minnesota, Nevada, North Carolina, Ohio, Puerto Rico, South Carolina, Tennessee, Texas, and West Virginia. *See* Connected Nation, State Programs, http://www.connectednation.org/programs.
964 For additional information regarding these and other services, *see* Connected Nation, Core Services, http://www.connectednation.org/broadband-core-services.

in a municipality must work with local officials to either secure a franchise or otherwise negotiate access to the public rights-of-way that will support the physical infrastructure of the network.[965]

In general, these PPPs demonstrate there is significant room for experimentation by both the public sector and private sector vis-à-vis facilitating broadband network deployment. Many of the most successful initiatives have been based on a desire to expand upon, rather than replace, the traditional model of infrastructure build-out. Many municipalities have worked with private ISPs to either modernize or replace entirely existing deployment paradigms, all in an effort to assure ubiquitous high-speed Internet connectivity. As such, this particular type of PPP holds much potential for bringing together public and private entities in the pursuit of shared goals for broadband. Examples—from Kansas City, Kansas, and New York City—are provided below.

Google Fiber in Kansas City

In February 2010, Google announced an "experiment." Google proposed to "build and test ultra-high-speed broadband networks in a small number of trial locations across the United States."[966] The company promised to provide 1 Gbps FTTH connections "at a competitive price to at least 50,000 and potentially up to 500,000 people."[967] Previously, during preparation of the *National Broadband Plan,* Google called upon the FCC to "build [such] networks as testbeds" to "help learn how to bring faster and better broadband access to more people."[968] Less than a year later, Google thought it was "important to back up [its] policy recommendation with concrete action" and followed up with the introduction of Google Fiber.[969]

Progress toward its goal was rapid. By the end of March 2010, over 1,100 communities across the country expressed interest in being the first pilot city.[970] In July 2010, Google promised to select a city by the end of the year, but in December it announced it was pushing its decision to early 2011.[971] In March 2011, Google announced it had selected Kansas City, Kansas, as the first city where it would build out its FTTH network.[972] The company explained that its decision was based in large part on a desire to "find a location where [it] could build efficiently, make an impact on the community and develop relationships with local government and community organizations."[973]

Over the course of the next year, Google engaged in numerous activities aimed at facilitating rapid deployment of its fiber network. Immediately following the announcement, Google convened a series of town hall

965 For an overview of this process for wireline broadband networks, *see, e.g., Rationalizing Municipal Broadband* at p. 69, fn. 110 (discussing the local franchising process for cable systems). For an overview of this process for wireless broadband networks, *see, e.g., Petition for Declaratory Ruling To Clarify Provisions of Section 332(C)(7)(B) To Ensure Timely Siting Review and To Preempt Under Section 253 State and Local Ordinances That Classify All Wireless Siting Proposals as Requiring a Variance*, Declaratory Ruling, 24 FCC Rcd 13994 (2009), *recon. denied*, 25 FCC Rcd 11157 (2010), *aff'd sub nom. City of Arlington, Texas v. FCC*, 668 F.3d 229 (5th Cir. 2012), *aff'd*, 133 S.Ct. 1863 (2013) (discussing the wireless tower siting process at the municipal level and implementing a "shot clock" to streamline review and approval processes).

966 *See* Minnie Ingersoll and James Kelly, *Think Big with a Gig: Our Experimental Fiber Network*, Feb. 10, 2010, Google Blog, *available at* http://googleblog.blogspot.com/2010/02/think-big-with-gig-our-experimental.html.

967 *Id.*

968 *See* Richard Whitt, *Experimenting with New Ways to Make Broadband Better, Faster, and More Available,* Feb. 10, 2010, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2010/02/experimenting-with-new-ways-to-make.html ("*Experimenting with New Ways*"). *See also In the Matter of a National Broadband Plan for Our Future,* Comments of Google Inc., GN Docket No. 09-51 (June 8, 2009), *available at* http://static.googleusercontent.com/external_content/untrusted_dlcp/www.google.com/en/us/googleblogs/pdfs/google_noi060809.pdf.

969 *Experimenting with New Ways.*

970 *See* James Kelly, *Next Steps for Our Experimental Fiber Network*, March 26, 2010, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2010/03/next-steps-for-our-experimental-fiber_26.html.

971 *See* Minnie Ingersoll, *Introducing our Google Fiber for Communities Website,* July 13, 2010, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2010/07/introducing-our-google-fiber-for.html; Milo Medin, *An Update on Google Fiber*, Dec. 15, 2010, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2010/12/update-on-google-fiber.html.

972 *See* Milo Medin, *Ultra High-Speed Broadband is Coming to Kansas City, Kansas*, March 30, 2011, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2011/03/ultra-high-speed-broadband-is-coming-to.html.

973 *Id.*

meetings in Kansas City to apprise citizens of their intentions and to answer questions.[974] Construction of the network began shortly thereafter; by April 2012, Google succeeded in stringing about 100 miles of fiber from utility poles in the city.[975] Also during this time, Google conducted a market study and began to develop its service offerings, which were unveiled in July 2012.[976] Google began to connect customers to the network in November 2012.[977]

The speed with which Google was able to deploy its network and begin the process of signing up customers was aided by a unique development agreement it negotiated with Kansas City.[978] Novel terms of this agreement included—

- Free office space and power for its operations.[979]
- Free access to the city's assets and infrastructure, including waiver of fees associated with permitting and inspections processes.[980]
- A range of obligations for the city to streamline deployment of the network, including designation of a single point of contact to "address[] all issues related to the project, provid[e] coordination across City departments and serv[e] as a communications and troubleshooting resource for Google;" promises for "quick, diligent review of all applications for permits;" an "obligation to obtain Google's approval for all public statements or announcements related to the Project;" and numerous other items meant to reduce the bureaucracy typically associated with large municipal projects.[981]
- The ability to "build, operate and maintain the FTTH network, based upon demand by City residents, availability of necessary infrastructure, and appropriate cooperation of Kansas City Power & Light," the local electric utility that owns many of the poles that would support the network's fiber-optic lines.[982]
- The "right to terminate the Agreement for convenience at any time up to two (2) years after actual construction commences on the fiber network."[983]

This agreement was unique because of how fundamentally it differed from the traditional franchise agreements negotiated between municipalities and incumbent ISPs. Many of these include strict build-out requirements that obligate an ISP to provide service to all or most households in a given area.[984] In addition, local franchisees are required to pay a fee, usually a certain percentage of revenues, in exchange for access to local rights-of-way.[985] Numerous other concessions are typically extracted from ISPs during the franchising process, highlighting the enormous power that municipalities typically possess in these negotiations.[986] The Google Fiber agreement represented a significant departure from established practice and raised concerns among

974 *See* Matt Dunne, *Answers to Your Town Hall Questions—Part I*, June 10, 2011, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2011/06/answers-to-your-town-hall-questions.html; Matt Dunne, *Answers to Your Town Hall Questions—Part II*, June 15, 2011, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2011/06/answers-to-your-town-hall-questions_15.html.

975 *See* Rachel Hack, *A Construction Update,* April 4, 2012, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/201/04/construction-update.html.

976 *See* Kenneth Carter, *The State of Broadband Internet Access in Kansas City,* June 22, 2012, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2012/06/state-of-broadband-internet-access-in.html; Kevin Lo, *How Do you Want Your Internet? Your Choose*, July 26, 2012, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2012/07/how-do-you-want-your-internet-you-choose.html.

977 *See* Alana Karen, *Google Fiber Installations Kick Off Today,* Nov. 13, 2012, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2012/11/google-fiber-installations-kick-off.html.

978 *See Development Agreement, Final Execution Version*, Sept. 2012, *available at* http://www.netcompetition.org/wp-content/uploads/Google-Kansas-Agreement1.pdf.

979 *Id.* at § 2 (c).

980 *Id.* at § 3.

981 *Id.* at § 5.

982 *Id.* at § 6 (c).

983 *Id.* at § 12 (d).

984 *See generally* Thomas W. Hazlett, *Cable TV Franchises as Barriers to Video Competition,* 12 Va. J.L. & Tech 2 (2007) (discussing the contours of many local franchise agreements and arguing that they are overly burdensome to many franchisees).

985 *Id.*

986 In New York City, for example, cable franchisees during negotiations with city authorities agreed to invest millions of dollars in support of Wi-Fi deployment throughout the city. *See, e.g.,* Todd Spangler, *NYC Approves Franchises For Time Warner Cable, Cablevision*, Aug. 10, 2011, Multichannel News, *available at* http://www.multichannel.com/content/nyc-approves-franchises-time-warner-cable-cablevision.

competitors that the city, in agreeing to Google's terms, had provided the company with numerous competitive advantages in the local broadband market.[987]

Among the many notable incentives agreed to by Kansas City was the manner in which Google would build its network and sign up customers. As previously noted, the development agreement allowed Google to construct its network in response to consumer demand rather than according to municipal build-out requirements to serve an entire community. In particular, Google developed the concept of "fiberhoods" and called on households in discrete communities across the city to "rally" friends and neighbors in order to demonstrate sufficient demand for the broadband services on offer.[988] Those neighborhoods with insufficient demand, measured by the number of people who pre-registered for Google Fiber service, would be bypassed. Google rationalized this approach as follows: "Google Fiber works better when communities are connected together … We'll install only where there's enough interest, and we'll install sooner in fiberhoods where there's more interest."[989] This approach, while beneficial to Google, raised a number of concerns as to whether all neighborhoods in the city would eventually have equal access to the service.[990] These concerns persisted well after Google began to connect the first fiberhoods in Kansas City.[991]

The relatively quick deployment of Google Fiber demonstrated that many aspects of the traditional model of broadband network deployment are in need of updating. For example, since the details of the Google Fiber development agreement were made public in the fall of 2012, many stakeholders in the broadband space, ranging from ISP executives to FCC officials, have argued that cities participating in these types of "experiments" must ensure regulatory parity among service providers in order to foster sustainable competition.[992] In other words, instead of agreeing to company-specific special incentives, municipalities should strive for across-the-board parity for providers, expediting permitting and lowering entry barriers. Indeed, the speed with which Google has been able to deploy its fiber network has underscored the need for a comprehensive rethinking of how municipalities manage their rights-of-way, structure franchises, and otherwise facilitate network deployment.[993]

The need to resolve these issues and engage in comprehensive regulatory modernization efforts at the municipal and state levels gained additional immediacy in 2013 when Google announced it had begun to expand its Fiber footprint, first into cities and towns surrounding Kansas City,[994] and then into Austin, Texas, [995] and Provo, Utah. [996] In early 2014, Google announced it intended to explore deployment opportunities in dozens of other cities across the country, further heightening the need for such comprehensive reevaluations.[997]

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987 *See, e.g.,* Shalini Ramachandran, *Web Rivals Want What Google Got*, Oct. 2, 2012, Wall St. Journal (noting that local ISPs Time Warner Cable and AT&T were seeking "parity agreements" from Kansas City in order to "compete on a level playing field").

988 *See* Kevin Lo, *How to Get Google Fiber*, July 26, 2012, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2012/07/how-to-get-google-fiber.html ("*How to Get Google Fiber*").

989 *Id.*

990 *See, e.g.,* Marcus Wohlsen, *Google Fiber Splits Along Kansas City's Digital Divide,* Sept. 7, 2012, Wired, *available at* http://www.wired.com/business/2012/09/google-fiber-digital-divide/ (observing that Google's approach to building out its network and enrolling customers could "end up reinforcing the digital divide").

991 *See, e.g.,* Mary Sanchez, *Google Spreads, But Issue of Digital Divide Remains*, March 20, 2013, Kansas City Star, *available at* http://www.kansascity.com/2013/03/20/4133131/as-google-spreads-issue-of-digital.html ("The signups proved difficult in low-income areas, particularly large swaths of Kansas City's east side. It became a public reminder of haves and have-nots in regards to technology.").

992 *See, e.g.,* John Eggerton, *Pai: Rights-of-Way Issues Are Up to Date in Kansas City*, Sept. 5, 2012, Broadcasting & Cable, *available at* http://www.broadcastingcable.com/article/489147-Pai_Rights_of_Way_Issues_Are_Up_to_Date_in_Kansas_City.php (reporting on comments made by FCC Commissioner Ajit Pai to this effect).

993 *See, e.g.,* Rachelle Chong, *Google's Medin Challenges Cities to Lay the Table for Gigabit Cities*, Aug. 1, 2013, Techwire.net, *available at* http://techwire.net/googles-medin-challenges-cities-to-lay-the-table-for-gigabit-cities/ (reporting on comments made by Milo Medin of Google Fiber regarding the need for these sorts of updates).

994 *See, e.g.,* Rachel Hack, *Google Fiber is Coming to Olathe, Kansas*, March 19, 2013, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2013/03/google-fiber-is-coming-to-olathe-kansas.html.

995 *See* Milo Medin, *Google Fiber's Next Stop: Austin, Texas*, April 9, 2013, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2013/04/google-fibers-next-stop-austin-texas_9.html.

996 *See* Kevin Lo, *Google Fiber—On the Silicon Prairie, the Silicon Hills, and now the Silicon Slopes,* April 17, 2013, Google Fiber Blog, *available at* http://googlefiberblog.blogspot.com/2013/04/silicon-slopes.html. *See also supra,* section 4.9, for additional discussion regarding the failed GON in Provo and its sale by the city to Google.

997 *See* Milo Medin, *Exploring New Cities for Google Fiber*, Feb. 19, 2014, Google Blog, *available at* http://googleblog.blogspot.com/2014/02/exploring-new-cities-for-google-fiber.html.

Assessment. The deployment of Google Fiber has underscored that many aspects of the traditional local broadband franchising, permitting and regulatory models need updating. Kansas City demonstrated admirable flexibility in working with Google, a trait that should be adapted by other cities and applied evenly across the competitive landscape. More specifically, to expedite deployment and investment from all broadband players, municipalities should look for ways to expedite processes and lower entry barriers for all service providers. At the same time, municipalities should be wary of granting favors to specific players, while applying more cumbersome and expensive processes to others. Such inequity will tilt the competitive landscape, create economically damaging incentives to curry local favor, and drive away investment from non-favored players. In short, the Google Fiber model evidences admirable strides by a city to lower entry barriers and expedite deployment, but such arrangements should be made available to all comers on a non-discriminatory basis, and should provide all residents within a municipality with equal access to services.

New York City's Fiber Pilots

Over the last several years, New York City government has worked closely with incumbent ISPs to implement several initiatives aimed at supporting deployment of next-generation broadband infrastructure to households and businesses across the city.

In October 2012, former mayor Michael Bloomberg announced the launch of ConnectNYC, "an innovative City-sponsored competition to encourage growing commercial and industrial businesses in New York City to apply for free fiber cable wiring."[998] This particular program was structured to leverage existing core competencies and resources of incumbent ISPs to provide businesses with fewer than 100 employees the opportunity to jump-start growth.[999] Over two years, ConnectNYC hopes to connect over 200 businesses to fiber-optic networks. Funding will come principally from two major cable Internet service providers—Time Warner Cable Business Class and Cablevision—who, together, have pledged a combined $12 million for these purposes.[1000]

The goal of this program is twofold. First, it seeks to facilitate broadband deployment to mostly unserved industrial zones, which are increasingly used by high-tech startups.[1001] Second, and related, the program reflects an attempt by the city to assist ISPs in realizing certain obligations stemming from their franchise agreements.[1002] In particular, the city has developed a demand-driven program that will help ISPs in identifying unserved areas where new services are needed. The criteria for "winning" the competition have been developed to ensure that new broadband networks are deployed as efficiently as possible and in a manner that ensures maximum impact of new connectivity opportunities.[1003]

In April 2013, the city partnered with another local ISP, Verizon, to facilitate a more robust fiber-optic deployment. More specifically, the city launched a "micro-trenching" pilot to "speed the deployment of fiber optic cabling to businesses and residences across the five boroughs while minimizing construction time,

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998 *See* Press Release, *Mayor Bloomberg Launches Competition to Install Free Fiber Cable Wiring in Growing Businesses Across the Five Boroughs,* Oct. 19, 2012, Office of the Mayor of the City of New York, *available at* http://www.nyc.gov/portal/site/nycgov/menu-item.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2012b%2Fpr364-12.html&cc=unused1978&rc=1194&ndi=1.

999 *Id.*

1000 *Id.*

1001 *See, e.g., New Tech City.*

1002 *See, e.g.,* Press Release, *NYCEDC Launches Second Round of ConnectNYC to Construct Free Fiber Cable Wiring For Businesses Across New York City*, July 23, 2013, New York City Economic Development Corporation, *available at* http://www.nycedc.com/press-release/nycedc-launches-second-round-connectnyc-construct-free-fiber-cable-wiring-businesses.

1003 *See, e.g., id.* ("Applications for ConnectNYC Fiber Access will be evaluated based on the potential impact of fiber on the applicant's business and feasibility of fiber construction at the building's location."); ConnectNYC Fiber Challenge, FAQ: What are the Criteria for Choosing the List of Finalists?, http://nycfiberchallenge.challengepost.com/details/faq#criteria (listing three criteria: (1) "Potential Impact of Fiber on Contestant's Business (weighted at 30%). Includes factors such as the Contestant's business activities and job functions at the Location, the number of employees impacted, and the potential for increased productivity and employment at the Location." (2) "Potential to Improve Broadband Infrastructure in Underserved Areas (weighted at 40%) Includes whether the applicant is in an underserved area with limited or non-existent broadband infrastructure." (3) "Potential for Industry Clustering (weighted at 30%) Includes factors such as proximity to other Contestant Locations and the potential for scale economies in wiring a Contestant's building with fiber, and the potential to catalyze new industry clusters by wiring the business and nearby businesses.").

environmental impact and cost."[1004] To do so, the city permitted the use of micro-trenching, a technique for laying fiber-optic cable that minimizes the cost and labor intensity (e.g., digging up streets) often associated with new network construction.[1005] This approach uses "small conduits within the edges of City sidewalks to house fiber optic cabling, which can be used to deliver voice, Internet and cable television service."[1006] In addition, excess capacity—i.e., room for additional cabling—will be made available "for use by other communications industry providers, as well as by City agencies, at no cost for the duration of the pilot [which runs through November 2013].[1007] This type of approach is extremely cost-effective and "allows quick deployment of fiber optics with both minimal disruption to street and roadway traffic and minimal interference with public utility infrastructure."[1008] About a dozen locations were preapproved by the city, mostly reflecting areas where there was sufficient demand for these services.[1009]

Assessment. Together with the Wi-Fi initiatives described above and several other recent programs related to broadband (e.g., WiredNYC), New York City has developed a diverse and compelling public-private approach to boosting high-speed Internet connectivity.

6.2.4 Less Successful Models

The deployment continuum depicted in Figure 6.2 highlights one type of approach that is largely unsuccessful when it comes to addressing core supply side issues in the broadband space: "purely public" actions. In general, these encompass government action—typically at the local level, but also at the state and federal levels—that results in the construction of broadband infrastructure (e.g., a GON or a middle-mile network) that provides commercial services in direct competition with private firms. As discussed at length in **sections 2, 4, and 5,** there are many examples of failed public approaches, including many during the era of municipal Wi-Fi and more recently in cities like Provo, Groton, and Burlington. Additional examples are discussed below.

Broadband Stimulus Spending

The American Recovery and Reinvestment Act provided the National Telecommunications and Information Administration (NTIA), housed in the U.S. Department of Commerce, and the Rural Utilities Service (RUS), housed in the Department of Agriculture, with $7.2 billion to bolster broadband connectivity across the United States.[1010] The vast majority of these funds were earmarked for a range of supply side efforts, including the funding of new middle-mile and last-mile networks in unserved and underserved parts of the country.[1011] A smaller portion was used to address demand side issues, notably efforts aimed at boosting the national adoption rate and improving digital literacy skills.[1012]

1004 *See* Press Release, *New York City Launches Micro-Trenching Pilot to Enable Rapid Deployment of Fiber Optic Cabling Across the Five Boroughs*, April 2, 2013, Office of the Mayor of the City of New York, *available at* http://www.nyc.gov/portal/site/nycgov/menu-item.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2013a%2Fdoitt_04-02-13.html&cc=unused1978&rc=1194&ndi=1 ("*New York City Launches Micro-Trenching Pilot*").
1005 *See* NYC Dept. of Information Technology & Telecommunications, Innovation: Broadband, Micro-Trenching, http://www.nyc.gov/html/doitt/html/business/micro_trenching.shtml ("*About Micro-Trenching*").
1006 *New York City Launches Micro-Trenching Pilot.*
1007 *Id.*
1008 *Id.*
1009 *About Micro-Trenching.*
1010 *See* BroadbandUSA, About, http://www2.ntia.doc.gov/about.
1011 For an overview of broadband grants made via NTIA, *see* BroadbandUSA, All Grants Made, http://www2.ntia.doc.gov/all-recipients. For an overview of broadband grants made via RUS, *see* ProPublica, Recovery Tracker: Rural Utilities Service, http://projects.propublica.org/recovery/gov_entities/12e2.
1012 *Id.*

While many stimulus-funded programs and initiatives have succeeded in enhancing broadband connectivity—funding supported construction or improvement of 110,000 miles of broadband infrastructure[1013]—some have foundered and a few have failed.[1014] Certain aspects of the program have been riddled with waste, fraud, and abuse since it was launched. Over the course of the program, nearly $600 million of the broadband stimulus funds allocated by NTIA have, at some point, been temporarily or permanently halted.[1015] Much of this waste (e.g., using funding to deploy duplicative middle-mile networks) stemmed from programs administered primarily or exclusively by government or quasi-government entities at the state and local levels. The U.S. Government Accountability Office in 2010 observed that such waste might have significant unintended consequences for the broadband market going forward: "funding projects in low-density areas where there may already be existing providers could potentially discourage further private investment in the area and undermine the viability of both the incumbents' investment and the broadband stimulus project."[1016]

The following examples, which stem from the federal broadband stimulus program, illustrate some of the harm that can result from a state or local government entity using public resources to engage in supply side activities in direct competition with private sector service providers.

North Florida Broadband Authority. In 2011, the North Florida Broadband Authority (NFBA), a consortium of 14 communities in North Central Florida, was awarded over $30 million to build an open access middle-mile broadband network capable of linking a group of rural and underserved communities.[1017] The NFBA itself is a government entity that was created specifically for the purposes of overseeing the project.[1018]

By mid-2013, the project had become financially unsustainable, with monthly revenues of $11,000 and monthly expenses estimated at over $250,000.[1019] As a result, the network accumulated over $750,000 in debt.[1020] Previously, in 2011, grant funding was temporarily suspended as a result of NFBA's waste.[1021] Many of the reasons that have been cited for such poor performance by the NFBA echo criticisms typically leveled against public sector entities, including that the NFBA failed to adequately monitor its vendors, resulting in significant cost overruns.[1022] In addition, there has been significant staff turnover and claims of widespread mismanagement.[1023] Some have also argued that the middle-mile network is duplicative and unnecessary in many areas.[1024] For these and many other reasons, several of the original member cities left the consortium.[1025] In October 2013, operation of the NFBA was turned over to a private entity.[1026]

1013 *See The Economic Impact of the American Recovery and Reinvestment Act Five Years Later,* p. 41, Final Report to Congress, Council of Economic Advisors, Executive Office of the President (Feb. 2014), *available at* http://www.whitehouse.gov/sites/default/files/docs/cea_arra_report.pdf.

1014 For examples of successful stimulus-funded programs on the demand side, *see infra,* section 6.3.1.

1015 *See, e.g.,* Edward Wyatt, *Waste is Seen in Program to Give Internet Access to Rural U.S.*, Feb. 11, 2013, N.Y. Times, *available at* http://www.nytimes.com/2013/02/12/technology/waste-is-seen-in-program-to-give-internet-access-to-rural-us.html?pagewanted=all ("*Waste is Seen*").

1016 *See Further Opportunities Exist to Strengthen Oversight of Broadband Stimulus Programs*, at p. 29, GAO-10-823 (Aug. 2010), *available at* http://www.gao.gov/new.items/d10823.pdf.

1017 *See* BroadbandUSA, Grantees: North Florida Broadband Authority, http://www2.ntia.doc.gov/grantees/NorthFLA.

1018 *See* North Florida Broadband Authority, About, http://nfba.net/about.

1019 *See, e.g.,* Stew Lilker, *North Florida Broadband Authority: Stimulus Funded 800 lb. Gorilla Puts Squeeze on Financially Strapped Bradford County Schools*, May 13, 2013, Columbia County Observer, *available at* http://columbiacountyobserver.com/master_files/Florida_News_2013/13_0516_nfba_stimulus-funded-800-lb-gorillia-puts-squeeze-on-financially-strapped-school-district.html ("*North Florida Broadband Authority: Stimulus Funded 800 lb. Gorilla*").

1020 *See* Samantha Bookman, *Report: Bradford County Withdraws from North Florida Broadband Authority,* April 3, 2013, Fierce Telecom, *available at* http://www.fiercetelecom.com/story/report-bradford-county-withdraws-north-florida-broadband-authority/2012-04-03#ixzz2fkT8rbos ("*Report: Bradford County Withdraws from North Florida Broadband Authority*").

1021 *See Letter from Alan Conway, NOAA, to NFBA re Suspension of Grant*, Sept. 21, 2011, *available at* http://www2.ntia.doc.gov/files/grantees/north_florida_amendment4_suspensionletter.pdf.

1022 *Id.*

1023 *See, e.g.,* Stew Lilker, *North Florida Broadband Authority: Wracked by Gross Mismanagement From the Feds on Down, the NFBA has Become the Poster Child for Non-Disclosure*, Dec. 18, 2012, Columbia County Observer, *available at* http://columbiacountyobserver.com/master_files/Florida_News_2012/12_1218_nfba_wracked-by-gross-mismanagement-from-the-feds-on-down.html.

1024 *See, e.g.,* Joseph Fuhr, *Op-Ed: Don't Look to Government for Broadband Access,* Dec. 7, 2012, Tallahassee Democrat, *available at* http://www.theamericanconsumer.org/2012/12/10/joseph-fuhr-op-ed-dont-look-to-government-for-broadband-access/.

1025 *See, e.g., Report: Bradford County Withdraws from North Florida Broadband Authority.*

1026 *See* Karl Burkhardt, Private company takes over North Florida Broadband Authority to resume project to provide Internet, Oct. 16, 2013, Lake City Journal, *available at* http://lakecityjournal.com/main.asp?SectionID=13&SubSectionID=73&ArticleID=10457

West Virginia Statewide Broadband Infrastructure Project. The state of West Virginia was awarded over $126 million in stimulus funds to "bring high-speed Internet access to this vastly underserved region" by "adding about 2,400 miles of fiber" and connecting over 1,000 anchor institutions to the new network.[1027] The project sought to "spur affordable broadband service impacting more than 700,000 households, 110,000 businesses, and 1,500 anchor institutions, by allowing local Internet service providers to connect to the project's open network."[1028]

There are numerous examples of questionable spending practices that have riddled this project. Perhaps the most notorious is the purchase by West Virginia's Homeland Security Office of 1,064 Cisco 3945 routers at a cost of $22,600 each (the total purchase price exceeded $24 million).[1029] These routers, typically used to enable Internet service in sprawling universities or industrial complexes, were purchased by West Virginia for use in one-room public libraries and small schools, locations where a much less expensive router would have sufficed.[1030] The state also improperly inventoried these purchases, running afoul of federal guidelines for safeguarding federal assets.[1031] In addition, many of the institutions that ended up receiving Internet service via this project were never consulted about the type of services they required, an approach that replaced actual demand with a one-size-fits-all, top-down method of meeting the needs of underserved and unserved areas.[1032] An audit conducted by the state in 2013 concluded that the project wasted $14 million to date.[1033]

EAGLE-Net. The Centennial Board of Cooperative Educational Services, a Colorado state agency, received about $100 million in stimulus funds in 2009 to build the Educational Access Gateway Learning Environment Network (EAGLE-Net), a "hybrid [network] of more than 1,600 miles of terrestrial fiber and 3,000 miles of microwave wireless broadband expanding services across each of Colorado's 64 counties."[1034] An ambitious project from the start, EAGLE-Net has failed to meet many of its goals after having spent tens of millions of dollars on either duplicative and unnecessary infrastructure (e.g., a third fiber-optic line into an 11-student elementary school in Agate) or on drastically changing deployment strategies.[1035] As a result, the project quickly went over budget and, by early 2013, had "reached less than 25 percent of the more than 220 school districts and other educational institutions that are supposed to have access to its high-speed Internet network."[1036] NTIA suspended the program in December 2012, but lifted the suspension in April 2013 after numerous managerial issues were addressed.[1037] However, the much-maligned program revealed it needed "$10 million to $15 million in private financing to finish its network."[1038] Moreover, a review of the grant program by the Inspector General of the U.S. Department of Commerce determined that, overall, the grant administrators "experienced numerous challenges" in meeting the original goals of the proposed project.[1039]

1027 *See* BroadbandUSA, Program Overview: West Virginia Statewide Broadband Infrastructure Project, http://www.ntia.doc.gov/legacy/broadbandgrants/factsheets/WV_ExecOfcWestVA_FINAL.pdf.
1028 *Id.*
1029 *See Editorial: Waste: $22,600 Route*rs, May 8 2012, Charleston Gazette, *available at* http://www.wvgazette.com/Opinion/Editorials/201205080082.
1030 *Id.*
1031 *See Letter from Inspector General Todd J. Zinser, U.S. Department of Commerce, to Chairman Walden and Chairman Shimkus, U.S. House of Representatives*, at p. 4, Jan. 23, 2013, U.S. Dept. of Commerce, *available at* http://www.oig.doc.gov/recovery/Documents/OIG-13-012-I.pdf.
1032 *See, e.g.,* Nate Anderson, *Why a one-room West Virginia Library Runs a $20,000 Cisco Router*, Feb. 25, 2013, Ars Technica, *available at* http://arstechnica.com/tech-policy/2013/02/why-a-one-room-west-virginia-library-runs-a-20000-cisco-router/.
1033 *See* David Kerley, *Washington Watchdog: $14M Wasted on Broadband Effort in W.Va. Alone*, Aug. 28, 2013, The Note Blog, ABC News, *available at* http://abcnews.go.com/blogs/politics/2013/08/washington-watchdog-14m-wasted-on-broadband-effort-in-w-va-alone/.
1034 *See* BroadbandUSA, Grantees: Centennial Board of Cooperative Educational Services (CBOCES) transferred to Eagle-Net Alliance, http://www2.ntia.doc.gov/grantee/centennial-board-of-cooperative-educational-services-cboces-transferred-to-eagle-net-allianc.
1035 *Waste is Seen.*
1036 *See* Andy Vuong, *Taxpayer-Backed EAGLE-Net Project May Need More Funds for Broadband Network*, Feb. 27, 2013, Technow BytesBlog,TheDenverPost,*availableat*http://blogs.denverpost.com/techknowbytes/2013/02/27/ntia-eagle-net-broadband-may-need-more-funds-to-complete-network/8630/.
1037 *See* Andy Vuong, *NTIA to Lift EAGLE-Net Suspension, Broadband Project Needs More Money*, April 29, 2013, The Denver Post, *available at* http://www.denverpost.com/ci_23133964/ntia-lift-eagle-net-suspension-broadband-project-needs.
1038 *Id.*
1039 *See Letter from Todd J. Zinser, Inspector General of the U.S. Dept. of Commerce, to Rep. Greg Walden, Chairman of the Subcommittee on Communications & Technology, U.S. House of Representatives,* p. 16, Jan. 23, 2014, *available at* http://www.oig.doc.gov/OIGPublications/OIG-14-011-M.pdf.

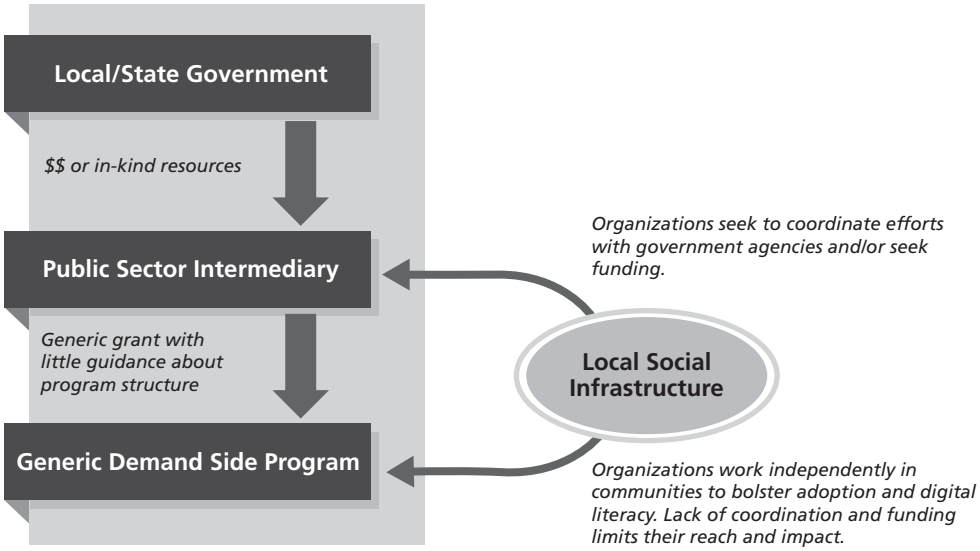
Assessment. Viewed as a whole, the many examples of ineffective government action to address supply side issues in the broadband space constitute a persuasive case that public action has the effect, intended or not, of positioning a city or town as a competitor in the broadband space.

6.3 Demand Side PPPs to Increase Broadband Adoption: Examples

Numerous adoption-related challenges exist across the nation.[1040] In response, a variety of public-private partnerships have been deployed at the state and local levels to spur increased broadband adoption and use in key demographics (e.g., senior citizens, people with disabilities, low income families, etc.) and sectors (e.g., education, energy, healthcare, etc.). While programs vary greatly, two general frameworks—a "top-down" model and a "collaborative" model—capture the broad structural components of each approach.

The top-down model, illustrated in Figure 6.3, positions local and state governments as the primary drivers of broadband connectivity on the demand side.

Figure 6.3: Top-Down Model for Addressing Demand Side Issues



This approach assumes public sector entities possess the expertise to successfully address demand side challenges hindering broadband adoption and utilization. Figure 6.3 depicts the somewhat linear, uncoordinated nature of many top-down efforts and highlights the marginalization of key partners, especially those in local social infrastructures (**Section 6.3.2** examines specific examples of how this model has been deployed). A preference for purely public action in this context tends to foreclose a broader array of PPPs.

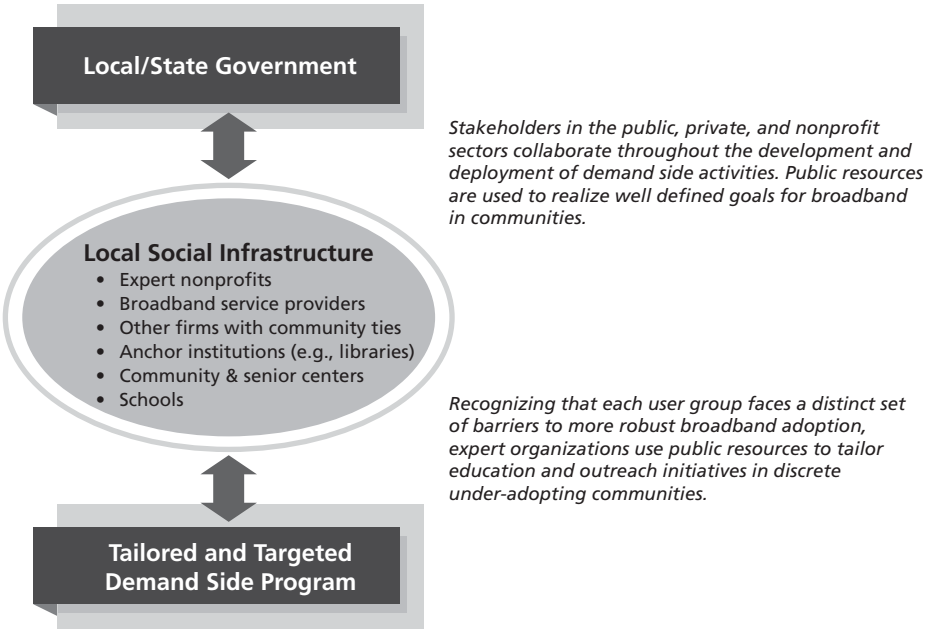
Figure 6.4 depicts an alternative collaborative model, an approach reflected in many effective demand side PPPs operating across the country. This model reveals local and state governments have important supporting roles to play in boosting broadband adoption and enhancing digital literacy.

Effective approaches to addressing lingering demand side challenges embody many of the same principles at the heart of the supply side PPPs discussed in **section 6.2** (specific examples of effective demand side programs are discussed in **section 6.3.1**). Foremost among these is recognition by public sector entities of the wide range of resources and expertise already available in the private and nonprofit sectors. PPPs developed to

1040 *See supra,* section 3.1.2, for additional discussion of these challenges and data regarding their impacts.

address broadband adoption and digital literacy issues also tend to thrive in areas where a strong social infrastructure is already in place.[1041] In the broadband context, there is wide agreement that the institutions and organizations at the heart of these social infrastructures—e.g., community centers, libraries, schools, senior centers, churches, and companies like ISPs, with roots in the municipality—are ideal conduits for channeling education, outreach, and training programs because they have succeeded in engendering high levels of trust with residents and have demonstrated an ability to deliver community-specific services.[1042]

Figure 6.4: Collaborative Model for Addressing Demand Side Issues



In sum, targeted efforts developed and implemented by an expert in the private or nonprofit sector in partnership *with* local or state government (e.g., training courses at senior centers developed specifically for older adults) are typically more effective than training services developed and implemented primarily *by* state or local government (e.g., one-size-fits-all computer training programs at a community center).

6.3.1 Examples of Effective Collaborative Demand Side PPPs

The following examples illustrate a wide range of effective demand side PPPs. These include programs that focus on:

- Education and using new technologies to ensure middle school and high school students are adequately prepared for the 21st century workplace;
- Empowering disadvantaged communities (e.g., low-income areas) with digital literacy skills; and
- Meeting the needs of a particular demographic group (e.g., older adults).

1041 Local social infrastructures include "the activities, organizations, and facilities that support a community's need to form and maintain social interactions and relationships." *See Social Infrastructure*, at p. I.4, Livable New York Resource Manual (Dec. 2011), *available at* http://www.aging.ny.gov/LivableNY/ResourceManual/DemographicAndSocialTrends/I4.pdf.
1042 *See, e.g., National Broadband Plan* at p. 171; *Toward a More Inclusive Measure of Broadband Adoption.*

An expansive menu of options exists for state and local policy makers to effectively engage with private and nonprofit organizations to address barriers to adoption and other demand side issues.[1043] Common across the examples discussed below is having local and state governments engage as conduits for strategically channeling funding or convening groups of expert firms and nonprofits to accurately calibrate outreach and training initiatives. Such approaches are especially instructive at a time when public resources are extremely scarce and the public appetite for significant investments in high-risk ventures is meager.[1044]

Education-Oriented Demand Side Programs

Many of the most effective demand side partnerships position public schools, especially those with large populations of disadvantaged youths, as the nucleus of comprehensive digital literacy programs. Curriculums and other programmatic elements typically revolve around using broadband-enabled education technologies—both in school and at home—to provide more individualized and expansive learning experiences. Some also attempt to inspire students to pursue careers in related information technology or STEM (science, technology, engineering and mathematics) fields. The following examples illustrate the diversity of approaches deployed in this particular context and highlight the key roles local and state government partners have played in their implementation.

Connected Learning. In New York City, the Connected Learning initiative was a PPP wherein the city leveraged federal stimulus funding to forge partnerships with private and nonprofit organizations in an effort to "support highly effective and technology-intensive teaching; deepen the home/school connection; strengthen in-school tech capacity; and narrow the digital divide in underserved communities."[1045] Funds were channeled through the local Department of Education and used to support the provision of free laptops and digital literacy training services to qualifying middle school students and their families.[1046] Local government served as the organizer and coordinator of this initiative, but it outsourced most programmatic duties—from curriculum development to actual training of students, teachers, and parents—to private and nonprofit partners including Time Warner Cable and Cablevision, both of which provided subsidized monthly broadband subscriptions to qualifying families; CFY, a nonprofit that provided free educational software and training to participating families and students (see below for additional information); a collection of organizations that provided in-school training and tech support; and Microsoft and Intel, which provided computing devices and related technical support.[1047]

Over the course of the program, which ran from September 2010 through June 2013, 75 middle schools participated, covering tens of thousands of students throughout the city.[1048] Over 50,000 students and parents participated in Family Learning Workshops, which were convened in order to ensure the parents of participating

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1043 Examples of possible non-traditional ways in which local and state government can help direct funding to demand side programs include experimenting with social impact bonds and conditional cash transfers in the broadband context. Social impact bonds (SIBs) are a new way of approaching the financing of social programs that benefit society. In a nutshell, an SIB represents a "partnership in which philanthropic funders and impact investors—not governments—take on the financial risk of scaling up. Nonprofits deliver the program; the government pays only if the program succeeds." *See From Potential to Action: Bringing Social Impact Bonds to the US,* at p. 4, McKinsey & Co. (May 2012), *available at* http://mckinseyonsociety.com/downloads/reports/Social-Innovation/McKinsey_Social_Impact_Bonds_Report.pdf. To date, there have been only a few pilot programs to test the efficacy of SIBs (e.g., one in Britain attempting to reduce recidivism rates for recently released prisoners). Determining whether and how this particular approach might be viable in addressing demand side issues could be a worthwhile endeavor. With regard to conditional cash transfers (CCTs), these described a means of "direct[ing] funds toward qualified households or individuals based on a conditional behavior, such as children's school attendance." *See Savings-Linked Conditional Cash Transfers: Lessons Challenges & Directions*, at p. 1, New America Foundation (May 2011), http://gap.newamerica.net/sites/newamerica.net/files/program_pages/attachments/SLCCTColloquiumReport.pdf. These are more widely used than SIBs and have proven successful in numerous contexts where goals and funding mechanisms are clearly defined. Adapting CCTs for the purpose of increasing meaningful use of broadband services could also be a worthwhile experiment.

1044 *See supra,* section 3.2.1, for additional discussion and data regarding the volatile state of public finances.

1045 *See* New York City Dept. of Education, Connected Learning—About the Program, http://schools.nyc.gov/community/innovation/ConnectedLearning/about/default.htm ("*Connected Learning—About the Program*").

1046 *Id.*

1047 *Id.*

1048 *See* New York City Dept. of Education, Connected Learning—Participating Schools, http://schools.nyc.gov/community/innovation/ConnectedLearning/schools/default.htm.

students possessed the digital literacy skills needed to reinforce lessons at home.[1049] These participants also benefited from a number of related resources and educational opportunities, including targeted curriculums and software designed to seamlessly integrate new digital tools into classroom learning.[1050] Equally important, participating partners and program administrators worked together to study implementation practices and identify "promising practices" that can be used by any school—in New York City or elsewhere—interested in using new technologies to enhance educational outcomes.[1051] Many of these address key barriers to more robust use of broadband-enabled tools in school (e.g., the need for technology-focused professional development resources).[1052]

MOUSE. The nonprofit MOUSE launched in 1997 to assist in bringing Internet access to public schools across New York City.[1053] However, once most schools were wired, a need for technical support quickly emerged.[1054] MOUSE leveraged its existing apparatus and developed a training program for students to become onsite IT experts.[1055] These groups of students eventually evolved into MOUSE Squads, initially deployed in public—and then charter—schools across New York City.[1056] These Squads represent a "cost-effective solution to the problem of inadequate levels of on-site support in schools and the need to serve the 21st century educational needs of students."[1057] Moreover, participation in these groups "broadens the learning and 'life opportunities' of youth by providing authentic hands-on experiences that build skills and the motivation to succeed in school and life."[1058]

This program has had discernible impacts on both students and schools. The vast majority of MOUSE Squad members—87 percent—reported they were better prepared for college because of the program.[1059] Similarly, 87 percent said that, after participating in the programs, they were "more motivated to pursue a career in [a STEM field]."[1060] In addition, one study of MOUSE found participating students had increased academic performance.[1061] And for schools, these have been fruitful partnerships: a Citibank study found that "schools running the MOUSE program save an estimated $19,000 per year in technology support costs."[1062] As a result of its proven effectiveness, the model has been enthusiastically adopted by school administrators across the country.[1063]

The Learning about Multimedia Project (LAMP). LAMP partners with public schools to teach media and digital literacy skills to students of all ages. To do so, it asks participants to interact with digital media in unique ways (e.g., by "talking back to media" in the form of edited online videos).[1064] The wide range of programs offered by LAMP requires participants to actively engage new media to learn how they work and appreciate the many issues (e.g., privacy, online security) implicated by their use.[1065] Critically important from the standpoint of school officials is the fact that LAMP's programs align with 61 standards of the Common Core initiative.[1066] LAMP also plays a role in local workforce development: in March 2013, it joined with several

1049 *Connected Learning—About the Program. See also* CFY, What We Do—A National Opportunity, http://cfy.org/what-we-do/a-national-opportunity/ (providing a detailed discussion of how and why CFY developed its family workshop approach).
1050 *Connected Learning—About the Program.*
1051 *See* New York City Dept. of Education, Connected Learning—Promising Practices, http://schools.nyc.gov/community/innovation/ConnectedLearning/PromisingPractices/default.htm.
1052 *Id.* Barriers to broadband adoption in the education space were identified in section 3.1.2, *supra.*
1053 *See* MOUSE, About, http://mouse.org/about-mouse; MOUSE, Founders & History, http://mouse.org/about-mouse/founders-history.
1054 *Id.*
1055 *Id.*
1056 *See* MOUSE, MOUSE Squads, http://mouse.org/programs/mouse-squad-0.
1057 *See* MOUSE Squad, About, http://mousesquad.org/about.
1058 *Id.*
1059 *See* Mouse, About—Impact, http://mouse.org/about-mouse/impact.
1060 *Id.*
1061 *Id.*
1062 *Id.*
1063 *See* MOUSE, Programs, http://mouse.org/programs.
1064 *See* The LAMP, About, http://www.thelampnyc.org/about.
1065 *See* The LAMP, Programs, http://www.thelampnyc.org/programs/.
1066 *See* The LAMP, Home, http://www.thelampnyc.org/.

other nonprofits in collaborating with local policy makers in New York City to roll out a number of digital workforce training initiatives.[1067]

CFY. CFY uses new technologies to improve learning environments in school and at home in an effort to strengthen the school-home connection.[1068] Launched in New York City a decade ago, CFY developed a national network of affiliates through which it brings laptops and learning software into schools and homes in low-income areas. Its approach has four core components: (1) supporting school leaders in "driving new instructional approaches and developing deeper school-home connections;" (2) providing professional development to educators and administrators to "help them adopt blended learning strategies within the classroom, extend learning beyond the classroom, and engage families in the learning process;" (3) hosting family workshops where "families and children learn together about a wide range of digital learning activities and experience a learning partnership model that they can continue in the home;" and (4) providing home technology support for families.[1069] Like most nonprofits in this space, the success of CFY's approach hinges on PPPs with local government and private funders.

Assessment. Expert technology-focused nonprofits working in the education space are natural partners for local governments interested in harnessing broadband to improve outcomes and empower students with critical digital literacy skills. At a time when there are numerous imperatives for fostering core technology skills and piquing interest in STEM careers, local governments should engage these groups and design approaches that fit the needs of their particular school system.

Demand Side Programs Focused on Empowering Disadvantaged Communities

Millions of households in disadvantaged communities lack high-speed Internet access.[1070] The reasons for remaining offline are varied, but, as discussed in **section 3.1.2,** the primary impediment is a widespread perception that broadband is not relevant or useful to them.[1071] In response, cities and states are working more and more with private and nonprofit firms to provide the unconnected in these communities with clear and compelling value propositions for going online, as well as the skills needed to use their connections in meaningful ways. Properly designed and implemented, these programs typically succeed in raising broadband adoption rates and empowering new users with critical skills. The following examples highlight several distinct approaches to empowering disadvantaged community members in low income, mostly minority areas.

Internet Essentials. Internet Essentials is a broadband adoption and training program for qualifying low-income households that is administered by Comcast, the nation's largest broadband service provider.[1072] Comcast launched the program in 2011 throughout the company's national footprint.[1073] To qualify for the program, a family must reside in Comcast's service territory and "have at least one child eligible to participate in the National School Lunch Program."[1074] Participating families will be offered discounted Internet service and a low-cost computer.[1075] Enrollees also have access to a broad selection of support and training services, including educational resources for students, training services (in person and online) for families and workforce

1067 *See* Press Release, *Mayor Bloomberg Announces New "link" Initiative To Connect Low-income New Yorkers With Economic Opportunities*, March 25, 2013, Office of the Mayor of the City of New York, *available at* http://www1.nyc.gov/office-of-the-mayor/news/111-13/mayor-bloomberg-new-link-initiative-connect-low-income-new-yorkers-economic#/3.
1068 *See* CFY, What We Do, http://cfy.org/what-we-do/.
1069 *See* CFY, Digital Learning Program, http://cfy.org/what-we-do/the-cfy-digital-learning-program/.
1070 Recent data indicate that about a quarter of households with annual incomes below $30,000 do not use the Internet or email. Similarly, about a quarter of Hispanic adults and 15 percent of Black adults do not use the Internet or email. In addition, 41 percent of those without a high school diploma remain offline. *See* Kathryn Zickuhr, *Who's Not Online and Why*, at p. 5, Pew Internet & American Life Project (Sept. 2013), *available at* http://pewinternet.org/~/media//Files/Reports/2013/PIP_Offline%20adults_092513_PDF.pdf.
1071 *See, e.g., id.* at p. 6 (finding that the primary reason for remaining offline was "relevance," which encompassed a range of reasons and perceptions regarding the Internet, including "not interested," "waste of time," "too busy," and "don't need/want.").
1072 *See* Internet Essentials, Home, http://www.internetessentials.com/. *See also Toward a More Inclusive Measure of Broadband Adoption* at p. 2562-2566 (profiling the program).
1073 *Toward a More Inclusive Measure of Broadband Adoption* at p. 2562.
1074 *See* Internet Essentials, How it Works, http://www.internetessentials.com/how-it-works.
1075 *Id.*

tools for adults.[1076] Through its first two and a half years, Internet Essentials connected over 300,000 low-income households—or about 1.2 million people—to the Internet.[1077] In addition, 23,000 low-cost computers have been distributed, and the program provided support for free digital literacy training for more than 1.6 million people.[1078] Ninety-eight percent of participants use their discounted Internet service for homework, while 59 percent say that "the Internet helped someone in their household find a job."[1079]

Successfully deploying such a program at scale hinged on close coordination between the Internet service provider and local stakeholders in hundreds of cities and schools across the country.[1080] The "cornerstone" of this approach was "extensive partnership with a diverse array of leaders from the education, government, and nonprofit sectors," including more than 2,000 state and local officials, 1,000 community-based organizations (e.g., churches, libraries, and PTAs), and administrators and educators in over 4,000 school districts.[1081] Schools have served as the primary conduit for promoting the program; high levels of engagement (e.g., formal partnerships with Comcast) "clearly resulted in more families participating in Internet Essentials."[1082] Similarly, coordination and collaboration with local and state officials also contributed to strong results. These policy makers "create[d] an atmosphere of support and excitement around [the program] by encouraging local school districts to promote the program as a means of overcoming the achievement gap while providing a call to action for community-based organizations to utilize it as a tool to effect change in their communities."[1083] Testimonials from local policy makers in cities like Chicago, Illinois,[1084] and Aurora, Colorado,[1085] attest to the enormous power municipal officials have to publicize effective demand side programs that help to realize shared goals for technology use and broadband connectivity in disadvantaged communities and cities generally.[1086]

Chicago's Smart Communities Program. The Smart Chicago Collaborative was launched in the late 2000s to help improve the lives of residents in the city through the use of technology.[1087] A core founding principle of this initiative was the value of working with partners in the public, private, and nonprofit sectors to enhance broadband adoption by providing targeted digital literacy training courses in disadvantaged communities.[1088] These efforts were encouraged by a federal stimulus grant in 2009, which supported a program aimed at "spur[ring] economic development in five disadvantaged neighborhoods in Chicago with a comprehensive broadband awareness and adoption program that will include providing computers and training opportunities to more than 11,000 residents and 500 small businesses and not-for-profits."[1089] Programmatic elements of this initiative included plans for creating "public computer centers at six community centers for working families," as well as providing computing devices to "1,500 residents and small businesses who complete a

1076 *See* Internet Essentials, Learning Center, http://learning.internetessentials.com/.
1077 *See* David L. Cohen, *Year Three Internet Essentials Progress Report*, March 4, 2014, Comcast Voices Blog, *available at* http://corporate.comcast.com/comcast-voices/year-three-internet-essentials-progress-report.
1078 *Id.*
1079 *See* David L. Cohen, *Internet Essentials Program Reaches 1 Million Low-Income Families*, Oct. 29, 2013, Comcast Voices Blog, *available at* http://corporate.comcast.com/comcast-voices/internet-essentials-1-million-milestone-blog-post.
1080 To date, the program has been "[p]ublicized…in more than 4,000 school districts and more than 30,000 schools." *Id.*
1081 *See Internet Essentials Launch Report,* at p. 27, Comcast (Jan. 2012), *available at* http://www.internetessentials.com/sites/internetessentials.com/files/reports/launchreport.pdf.
1082 *Id.*
1083 *Id.* at p. 30.
1084 *See* Rahm Emmanuel, Mayor of Chicago, *What Internet Essentials Means to Chicago Families,* Sept. 16, 2013, Comcast Voices Blog, *available at* http://corporate.comcast.com/comcast-voices/what-internet-essentials-means-to-chicago
1085 *See* William Stuart, Deputy Superintendent of Aurora Public Schools, *Breaking Down Learning Barriers with Internet Essentials*, Aug. 28, 2013, Comcast Voices Blog, *available at* http://corporate.comcast.com/comcast-voices/breaking-down-learning-barriers-with-internet-essentials.
1086 *Toward a More Inclusive Measure of Broadband Adoption* at p. 2567 (noting that "the nature of broadband adoption—and the design of successful attempts to promote meaningful uses—is largely community-specific and tends to vary from city to city, and even from neighborhood to neighborhood. The reasons for these differences are myriad and tend to involve a complicated array of social, economic, and political forces that often muddle outreach and training efforts.").
1087 *See* Smart Chicago, What We Do, http://www.smartchicagocollaborative.org/what-we-do/.
1088 *Id. See also* Smart Chicago, Project—Sustainable Broadband Adoption, http://www.smartchicagocollaborative.org/projects/broadband-technology-opportunities-program/sustainable-broadband-adoption/.
1089 *See* Smart Chicago, Project—Sustainable Broadband Adoption, http://www.smartchicagocollaborative.org/projects/broadband-technology-opportunities-program/sustainable-broadband-adoption/ ("*Smart Chicago Broadband Adoption Project*")

multi-session training course."[1090] The structure and scope of this particular initiative was developed collaboratively by nonprofit groups and community partners in close consultation with the city of Chicago.[1091] Smart Chicago worked with the city to administer the grant, while partner nonprofits and community groups assisted in program implementation.[1092] As of the middle of 2013, this demand side program had "cause[d] 11,386 households or businesses to become new broadband subscribers"; related efforts have resulted in thousands of additional new connections across the city.[1093]

Zero Divide. A multifaceted nonprofit, Zero Divide partners with "funders, government entities and businesses … to provide mission-driven consulting services to create social change via the power of technology."[1094] More specifically, the organization works with its partners to design and implement innovative ways to use technology to "achieve three outcomes—civic engagement, economic opportunity, and health."[1095] To date, it administered an assortment of grants from private, nonprofit, and government institutions, including a stimulus grant focused on improving "broadband access for youth with limited or no access to digital and information technology in the home"[1096] and a grant from the Hewlett, Irvine and Packard Foundations to help "20 small-budget, minority-led nonprofits learn how they might better leverage technology to support their day-to-day mission-based work."[1097]

Assessment. Collaborative PPPs spearheaded by leading private and nonprofit organizations and deployed in partnership with local officials prove enormously effective in bolstering broadband use in disadvantaged communities. The most successful efforts position government as a conduit for raising awareness of these programs and facilitating broader outreach in discrete communities.

Demographic-Specific Demand Side Program

There is growing recognition among stakeholders in the broadband space that barriers to connectivity are largely unique to discrete user groups.[1098] In response, community groups and expert nonprofits are increasingly working with local policy makers and private firms to develop group-specific outreach and digital literacy training programs. To date, a number of such demand side programs have emerged and succeeded in tailoring programmatic content to meet the distinctive needs of a particular under-adopting group. This section profiles one of the most successful demographic-specific training organizations in the country: a nonprofit group that has had enormous success in bringing senior citizens online.

Older Adults Technology Services (OATS). OATS is a nonprofit organization that engages, trains, and supports older adults in using technology to improve their quality of life and enhance their social and civic engagement. Founded in 2004, OATS employs a teaching model specifically tailored to seniors. All of its classes are free and made available to older adult students in senior centers across New York City and increasingly in other cities across the country. Classes range from basic introductory courses to advanced computing and workforce development modules.[1099] To date, OATS has taught over 12,000 classes.[1100] Many participants enter the introductory classes as new Internet users; most are wary of the Internet and skeptical of its value.[1101]

1090 *Id.*

1091 *See A Platform for Participation and Innovation: Smart Communities in Chicago Master Plan*, LISC/Chicago et al. (Dec. 2009), *available at* http://www.gagdc.org/uploads/gagdc/documents/smart_communities_in_chicago_master_plan_v8.pdf.

1092 *Smart Chicago Broadband Adoption Project.*

1093 *See* City of Chicago, *Quarterly Performance Progress Report for Sustainable Broadband Adoption—Q2—2013,* at p. 2-3, U.S. Dept. of Commerce, NTIA (Aug. 2013), *available at* http://www2.ntia.doc.gov/files/grantees/17-43-b10507_city_of_chicago_ppr2013_q2.pdf.

1094 *See* Zero Divide, Our Approach, http://www.zerodivide.org/approach.

1095 *Id.*

1096 *See* Zero Divide, Clients, Case Study: National Telecommunication & Information Administration, http://www.zerodivide.org/clients/case-studies/case-study-national-telecommunications-information-administration-ntia.

1097 *See Project Announcement: Community Leadership Project*, Jan. 24, 2013, Zero Divide Blog, *available at* http://www.zerodivide.org/learning/blog/project_announcement_community_leadership_project.

1098 *See supra,* section 3.1.2, for additional discussion. *See also Toward a More Inclusive Measure of Broadband Adoption; Broadband Adoption: Why it Matters & How it Works; Barriers to Broadband Adoption.*

1099 *See* OATS, Curriculum, http://www.oats.org/curriculum.

1100 *See* OATS, Results, http://www.oats.org/results ("*OATS—Results*").

1101 *Toward a More Inclusive Measure of Broadband Adoption* at p. 2560.

The vast majority of students, however, return for additional courses, and many report continued Internet and computer use months after their OATS experience.[1102] Equally important, these classes provide seniors with unique "opportunities to establish community ties," which helps seniors overcome social isolation and "feel … part of a community."[1103] This has been found to "promote[] good mental health and overall well-being," which is "essential to active aging."[1104]

Partnerships and collaborative engagement with stakeholders in the public and private sectors have been essential to OATS's success. For example, OATS worked with and through the New York City Department for the Aging to bolster its training footprint, using city funding to increase the number of classes and trainers available in dozens of senior centers.[1105] OATS also partnered with other nonprofits and anchor institutions to deliver a broad range of social services. A partnership with the nonprofit Per Scholas, for example, allowed OATS to pair its training with free computers, which were given to students who successfully completed a multi-week training course.[1106] Similarly, OATS collaborated with Maimonides Medical Center in New York City on a "pilot project to deliver home-based technology training to a group of patients in collaboration with the Maimonides Department of Geriatrics."[1107]

These efforts were recently strengthened by a federal stimulus grant that was awarded to New York City to provide disadvantaged and under-adopting communities with "an array of new resources for digital literacy, employment support, and other critical services."[1108] From this grant, OATS received over $2 million to build the "country's first—and only—technology-focused community center for those aged 60 and older."[1109] The product of a PPP between "OATS, the federal government, the City of New York and corporate sponsors," this facility features a "state-of-the-art computer lab with 23 high-end workstations, a studio for tablet and smartphone training, video conferencing pods, a video gaming area and an open space for curated exhibitions, presentations and classes."[1110] The goal for this Exploration Center is to further expand the reach of OATS, i.e., by training an additional 10,000 seniors each year; related efforts to enlarge its footprint in New York City include the construction of "23 technology training facilities and a mobile lab."[1111] All of these efforts align with public policy imperatives—in New York City, as well as at the state and federal levels—to prepare public and government infrastructures for a senior population that is expected to almost double in size over the next few decades.[1112]

Assessment. The most effective demand side strategies are those that are tailored to meet the unique needs of under-adopting communities. This is especially true in discrete demographic groups (e.g., seniors; people with disabilities). Partnering with expert organizations with deep roots in these communities ensures better, broader, and more impactful outcomes.

1102 *Id.* at p. 2561 (providing favorable data from surveys regarding the impact of training classes on senior citizen participants). *See also OATS—Results* (same).

1103 *See* Paula Gardner et al., *Getting turned on: Using ICT training to promote active ageing in New York City*, The Journal of Community Informatics 8(1) (2012), *available at* http://ci-journal.net/index.php/ciej/article/view/809.

1104 *Id.*

1105 *See, e.g.,* New York City Department for the Aging, Seniors and the Web, http://www.nyc.gov/html/dfta/html/senior/seniors-and-web.shtml.

1106 *See, e.g., Broadband Adoption: Why it Matters & How it Works* at p. 52.

1107 *See Response to Request for Information: Broadband Initiatives Program and Broadband Technology Opportunities Program*, at p. 2, U.S. Dept. of Commerce, NTIA (Nov. 2009), *available at* http://www.ntia.doc.gov/legacy/broadbandgrants/attachments/rfi2/12C.pdf.

1108 *See, e.g., Statement of Mayor Michael R. Bloomberg on $20 Million in Federal Stimulus Awards for Broadband Adoption and Expansion,* Sept. 13, 2010, Office of the Mayor of the City of New York, *available at* http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2010b%2Fpr388-10.html&cc=unused1978&rc=1194&ndi=1.

1109 *See* Press Release, *OATS Launches Country's First Technology-Themed Community Center for Older Adults*, March 7, 2013, OATS, *available at* http://www.prweb.com/releases/2013/3/prweb10503817.htm.

1110 *Id.*

1111 *Id.*

1112 *See, e.g., See Toward An Age-Friendly New York City: A Findings Report*, N.Y. Academy of Medicine (fall 2008), *available at* http://www.health.state.ny.us/diseases/aids/conferences/docs/nyam_age_friendly_report.pdf (detailing findings and recommendations for making New York City a more age-friendly city); Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Senior Citizens*, at p. 11, Report to the U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/BroadbandandSeniors.pdf (discussing the impact of broadband on senior citizens within the context of a rapidly growing demographic group).

6.3.2 Examples of Ineffective "Top-Down" Demand Side PPPs

Recent examples of demand side programs that have failed are scant. In fact, many demand side programs in operation today evolved from efforts to more fully understand the dynamics of broadband adoption.[1113] As a result, these programs are typically tailored to address the unique needs of a particular user group or are framed as vehicles for removing specific barriers to broadband connectivity. Moreover, they are typically small in scale, working at the community level to engage in more hands-on education and training.[1114]

Initial attempts to address these issues, however, were not as successful and reflected a less nuanced, more homogeneous view of how broadband adoption worked in practice. Early attempts to measure and study technology use among the American public focused almost exclusively on whether and how people were using certain communications inputs (e.g., computers and the Internet).[1115] Formal responses by government to an obvious divide between the digital "haves" and "have nots" generally revolved around channeling funding to local institutions—dubbed community access centers (CACs)—that would serve as forums where the public could freely access computers and the Internet.[1116] These included public schools and libraries, which received funding via an E-rate program that was launched in 1996 and administered by the FCC,[1117] and community technology centers (CTCs), which received funding through direct allocations from the U.S. Department of Education.[1118]

From the specific vantage point of providing key populations with additional opportunities for simply accessing the Internet, these programs were largely successful. For example, in 1994 only 35 percent of public schools were connected to the Internet.[1119] After E-rate was implemented, connectivity increased significantly: the percentage of public schools connected to the Internet reached 95 percent in 1999 and 100 percent in 2003.[1120] Internet at the classroom level also increased exponentially over the same period of time, rising from just three percent of public school instructional rooms in 1994 to 94 percent in 2004.[1121] Similarly, tens of millions of dollars of federal funding supported the deployment of dozens of CTCs across the country, providing new access opportunities for thousands of residents in digitally disadvantaged communities.[1122]

These programs were less successful in addressing key demand side issues—namely, sustainable adoption and informed use—primarily because both were designed to focus primarily on the supply side. Initial successes in boosting access eventually gave way to concern that this type of approach to addressing important Internet connectivity issues—i.e., providing access without a tailored training component—would likely result in suboptimal outcomes vis-à-vis ensuring that new users would be able to fully harness these tools. The CTC

1113 These were discussed in section 3.1.2, *supra.* For additional discussion, *see generally Toward a More Inclusive Measure of Broadband Adoption; Broadband Adoption: Why it Matters & How it Works.*

1114 For example, many recipients of federal stimulus grants in the "sustainable adoption" category were cities or groups working at the city level or in a particular user community. For a listing of all grant recipients, *See* Broadband USA, Grants Awarded: Sustainable Adoption, http://www2.ntia.doc.gov/sustainableadoption.

1115 *See supra,* section 3.1.2.

1116 These were mentioned as early as 1995. *See Falling Through the Net I.*

1117 The E-rate program is financed via the Universal Service Fund. For additional information, *see* FCC, E-Rate—Schools and Libraries USF Program, http://www.fcc.gov/encyclopedia/e-rate-schools-libraries-usf-program ("The schools and libraries universal service support program, commonly known as the E-rate program, helps schools and libraries to obtain affordable telecommunications services, broadband Internet access and internal network connections."); Universal Service Administrative Company, Schools and Libraries (E-rate), http://www.usac.org/sl/default.aspx (providing comprehensive information regarding eligibility and application processes).

1118 For an overview of the CTC program, *see* U.S. Dept. of Education, Community Technology Centers, http://www2.ed.gov/programs/comtechcenters/index.html.

1119 *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* p. 14, The National Center for Education Statistics (November 2006), *available at* http://nces.ed.gov/pubs2007/2007020.pdf.

1120 *Id.*

1121 *Id* at p. 4.

1122 *See* U.S. Dept. of Education, Community Technology Centers: Funding Status, http://www2.ed.gov/programs/comtechcenters/funding.html. *See also* CTCNet, About, http://ctcnet.org/ (noting that this organization, which was established to facilitate construction of these centers and provide a range of support services, has about 175 member programs, many of which received funding from public and private sources).

model, for example, was criticized as being monolithic in its approach to bolstering Internet connectivity.[1123] In particular, by the early 2000s, some argued the CTC approach had largely "failed to address the multifaceted aspects of the digital divide" by focusing solely on providing access.[1124] A proposed solution was to use CTCs and other such programs as forums for training new users and helping them develop digital literacy skills.[1125] In response, a number of approaches were developed to address these gaps on the demand side by, for example, tailoring curriculums and other programmatic elements to the needs and learning styles of discrete user groups.[1126] Over time, successful initial approaches yielded best practices that proved essential to impactful private and nonprofit approaches that emerged in the late 2000s.[1127]

With regard to E-rate, more widespread Internet access in schools and libraries quickly highlighted the dearth of complementary demand side programs to ensure users were able to use these connections meaningfully. For example, one recent survey found that while two-thirds of library patrons had asked library staff for assistance with using the technology services on premise, only 14 percent received formal training.[1128] Nevertheless, many agree that such informal interactions and one-on-one assistance are invaluable secondary benefits that evolved organically from the growth of Internet access in libraries.[1129] Similarly, use of broadband-enabled educational tools in schools across the country lagged in recent years, due in large part to the lack of a comprehensive demand side strategy for leveraging these tools to enhance learning opportunities and outcomes for students.[1130] Recent initiatives, like the development of a national Common Core curriculum[1131] and formal reform of the E-rate program,[1132] as well as federal stimulus funding to support a range of training programs across the country, present unique opportunities to address these issues.

Assessment. Historically, many top-down demand side programs were unsuccessful because they were designed as one-size-fits-all initiatives to address problems that ultimately defied such monolithic approaches. In light of preceding discussions about the effectiveness of ground-up approaches, the success of modern top-down efforts hinges on stakeholders' ability to engage expert organizations in local social infrastructures in an effort to tailor their outreach to meet discrete user groups' unique needs.

1123 *See, e.g.,* Craig Hayden and Sandra J. Ball-Rokeach, *Maintaining the Digital Hub: Locating the Community Technology Center in a Communication Infrastructure*, at p. 243-244 New Media & Society, 9(2) (2007) (discussing criticism of the CTC model) ("*Maintaining the Digital Hub*").

1124 *See* Josh Kirschenbaum and Radhika Kunamneni, *Bridging the Organizational Divide: Toward a Comprehensive Approach to the Digital Divide*', at p. 8, Policy Link (Fall 2001), *available at* http://www.policylink.org/atf/cf/%7B97C6D565-BB43-406D-A6D5-ECA3BBF35AF0%7D/BridgingtheOrgDivide_final.pdf.

1125 *See, e.g., Maintaining the Digital Hub. See also supra,* section 3.1.2, for additional discussion about the shift in focus in the early 2000s away from access and toward the need for improving digital literacy.

1126 *See, e.g.,* Linda Fowells and Wendy Lazarus, *Computers in Our Future: What Works in Closing the Technology Gap? Lessons from a Four Year Demonstration in 11 Low Income California Communities*, Computers in Our Future (2001), *available at* http://research.policyarchive.org/6862.pdf (describing the results of a pilot program designed to provide more individualized digital literacy training in low-income communities in California).

1127 *See supra,* section 6.231, for examples.

1128 *See* Samantha Becker et al., *Opportunity for All: How the American Public Benefits from Internet Access at U.S. Libraries,* at p. 42-45, Institute of Museum and Library Sciences (March 2010), *available at* http://impact.ischool.washington.edu/documents/OPP4ALL_FinalReport.pdf.

1129 *Id. See also National Broadband Plan* at p. 176 (recommending that additional resources be sourced to libraries and other public institutions in an effort to bolster digital literacy training opportunities).

1130 *See, e.g.,* Charles M. Davidson and Michael J. Santorelli, *The Impact of Broadband on Education,* a Report to the U.S. Chamber of Commerce (Dec. 2010), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/Davidson-Santorelli-The-Impact-of-Broadband-in-Education-December-2010-FINAL.pdf (identifying and discussing related impediments to more robust adoption and use of broadband in the education space) ("*Broadband & Education*").

1131 *See* Amber Parks, *Understanding the Central Themes of the Common Core Standards and the Need to Develop Digital Literacy and 21st Century Skills in Today's Classrooms*, Learning.com (Aug. 2013), *available at* http://www.eschoolnews.com/files/2013/08/Digital-Literacy-Common-Core-white-paper.pdf (providing an overview of digital literacy requirements included in the Common Core).

1132 *See Modernizing the E-rate Program for Schools and Libraries,* Notice of Proposed Rulemaking, WC Docket No. 13-184, FCC 13-100 (rel. July 23, 2013), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0723/FCC-13-100A1.pdf (calling for public comment on an array of proposed reforms to the structure and administration of the program). Over the last few years, the FCC has engaged in a number of related reform activities. For an overview, *see Broadband & Education* at p. 67-69.

Part IV
Additional Perspectives

7 Additional Perspectives

The following essays are offered to provide additional perspective on the complex and multifaceted issue of government-owned broadband networks. The authors of these contributions include a diverse array of current and former policy makers, policy experts, and others with a distinct point of view on the many issues implicated by the GONs debate. The views expressed in these essays are those of their author only and do not necessarily reflect those of the authors of the main paper.

Perspectives from State Government Practitioners

7.1 What Drives Economic Development?

Chris Hart, President and CEO, CareerSource Florida; former Interim Director of the Governor's Office of Tourism, Trade and Economic Development; Senior Vice President at Enterprise Florida; member of the Florida House of Representatives, and businessman

As someone who has spent a career working to bolster economic development throughout the state of Florida, via positions in the public, private, and nonprofit sectors, I am intrigued by recent discussions regarding government-owned broadband networks (GONs). What especially piques my interest is that some see these networks as a "silver bullet" for local economic development. In my many years in this field, I can safely say that, much to my dismay, no such "silver bullet" exists. On the contrary, economic development is hard work that requires a wide variety of inputs and efforts to succeed.

While in some cases a broadband network of any kind—public or private—might serve as a catalyst for growth and job creation, the reality is that state and local policy makers work very hard and experiment with a number of different approaches to see what works in a given situation. The most successful approaches to economic development do not artificially choose which technology or platform or sector will be the driving force in a city or region. Rather, policy makers work with local counterparts in the private and nonprofit spaces to determine, in a very practical manner, what the area can reasonably sustain, foster, and grow. We ask questions like:

- What are the area's core strengths and weaknesses?
- Is the population amenable to new types of businesses?
- Do we have a talent delivery system in place to ensure we have the right skills, at the right time, available to support existing, emerging, and evolving business needs?
- How much growth can a town or city or region accommodate?
- Are core public infrastructure inputs—roads, bridges, ports, railways, etc.—reliable and able to support greater use?
- Perhaps most importantly we ask about goals—what does the area want to achieve in terms of quality of life, jobs, economic growth, etc.? Are these goals reasonable and achievable? Will the benefits ultimately outweigh the costs of realizing them?

Once these questions are answered, then it's time to begin developing a plan for achieving specific goals. Successful efforts here hinge on close collaboration with stakeholders in the public, private, and nonprofit

sectors. Whatever policies emerge stand a better chance of succeeding if they are grounded in the real needs and wants of the people they are meant to impact. Major components of the economic development plans that emerge from this type of process typically include:

- **Tax incentives.** At the heart of many economic development efforts are various kinds of tax incentives. These are structured to support growth of new businesses, facilitate continued growth of existing firms or sectors, or encourage the relocation of major new firms to serve as the center of a new sector. More often than not, these types of direct economic incentives are among the most impactful from an economic development standpoint and the most attractive to firms contemplating expansion or relocation.
- **Workforce development.** In addition to creating a hospitable economic and tax climate, it is essential that stakeholders work to ensure there is sufficient human capital to meet today's needs, fuel growth, and seed innovation. Increasingly, most firms, especially those in the manufacturing and "knowledge" industries, require workers with increasing levels of technical competency and industry-recognized credentials. As a result, many cities and regions are working with workforce boards, community colleges, and other demand-driven institutions—public as well as private—to establish in-demand and customized training programs for these very purposes.
- **Regulatory and legislative concessions.** Depending on the industry or sector, it might sometimes also be necessary to ease or remove barriers to entry and otherwise foster a supportive regulatory environment for certain new businesses. The goal is not to give a particular firm or type of firm a leg up on competitors. Rather, the goal is to create conditions that are conducive to more rapid growth across the sector. At times, this might require revisiting older rules and regulations that have resulted, intentionally or not, in insulating a segment from competition or that have created disincentives around investment and innovation.

Infrastructure is also critically important and requires similar creative responses by state and local stakeholders. A new factory, for example, might benefit from easy access to major highways, ports, or railways to transport their goods. Assuring this type of access is among the core competencies of local government—they can either build it themselves or forge a public-private partnership to accomplish the task. Similarly, a new data center or high-tech computing company might require significant electrical inputs to power processors and cooling systems. Local government could work with the appropriate utility to assure delivery of this input. For firms that need robust access to high-speed Internet connectivity, the approach is similar: government can work with existing service providers in the first instance to get where the city or region needs to be in terms of availability, connection speed, etc. In general, this type of approach—leveraging core competencies and working with expert firms to realize common goals—often yields the most productive and cost-effective solutions.

The best economic development plan, ultimately, is the one that best addresses the needs and goals of a specific area. There are no one-size-fits-all solutions when it comes to solving the riddle that is economic development. Because it is so complex and requires so much time and energy to get right, it is critical that state and local policy makers work in concert with counterparts in the private and nonprofit spaces to determine the best path forward.

7.2 Putting Government-Owned Broadband Networks in Proper Context

Ryan Palmer, Commissioner, West Virginia Public Service Commission, and
Luz Weinberg, Commissioner, Aventura, Florida; Board Member, Miami-Dade Expressway Authority

As public officials serving at the state and local levels in West Virginia and Florida, we appreciate the many nuances associated with broadband connectivity and what those nuances mean for our communities. High-speed Internet access is increasingly essential to the communities we serve. Bringing broadband to every part of the country and helping ensure that as many people as possible are using it to improve their lives are important policy priorities. However, several barriers continue to impede progress towards these goals. As a result, much of our concern in this space is focused on addressing practical issues, like promoting the benefits of Internet access to reluctant non-users (for example, older adults, rural users, and so many in minority communities), and working with stakeholders to figure out how to efficiently and effectively bring broadband to unserved and underserved areas.

In many ways, the debate over government-owned broadband networks (GONs) implicates much of our focus on these issues. Some think that local governments are best positioned to provide residents with fast, affordable Internet access. Others think that these services are best provided via a competitive private marketplace. In all truth, both views have merit because different problems often require different solutions. Regardless of who is "right" and who is "wrong," what often gets lost in the heated GONs discussions is a focus on the universe of other critically important public policy issues that compete for the attention as well as the funds of state and local policy makers.

When we think about GONs, we immediately think about infrastructure. Ultimately, that is at the heart of what we do: we work on the public's behalf to make sure that they have access to robust public infrastructure at reasonable rates. That means making sure that our streets are paved, our electricity is reliable, and water is clean and affordable, which have been challenges in both Florida and West Virginia. However, our efforts are ultimately constrained and defined by financial realities.

Budgets are not unlimited, which means public officials must prioritize. There is no getting around that basic fact. The streets will always be paved, but new public works might be delayed. Similarly, a diverse array of economic considerations influences how we manage core public assets like the electric grid and water system. Yet, a significant amount of work remains to be done across the country when it comes to our public infrastructure, much of which is aging and in need of replacement or a significant upgrade. Chronic underinvestment, a function of tight budgets and finite public resources, has resulted in far too many poor roads, unsafe bridges, and antiquated public utility systems.

In short, when considering whether to invest large amounts of public money on GONs, public officials must consider the entire universe of public infrastructure needs. Each state and community has their own unique challenges and must decide how to address all of these challenges with the resources and funds available. As a result, when we are faced with broadband expansion and adoption issues, we focus on fostering an environment and implementing policies that are most impactful given the scope of our authority, the realities of our citizenry and economy, and the needs of our basic public infrastructure. Hopefully, the result is a carefully calibrated and collaborative effort focused on creating favorable conditions to support increased broadband connectivity.

The ultimate goal is for this practical approach to enable us public officials to not just listen to our local communities but to also respond to their needs and keep focused on the undisputed fact that ensuring ubiquitous broadband for all is a legitimate priority, amongst so many that require considerable resources and leadership from both the public and private sectors.

7.3 The Truth About Municipal Broadband in Minnesota

Representative Linda Runbeck, Minnesota State Legislature

My home state of Minnesota is a battleground on the issue of municipal broadband. As a State Representative, I have witnessed a number of communities approach the issue of broadband access with various plans and policies. Some municipalities have incentivized private investment, while others have built their own networks.

As an elected official, I've come to believe that broadband service is beyond the scope of local government's core duties. I oppose municipal broadband not only because it puts government in competition with the private sector, but because local governments are not up to the task of running a municipal broadband network.

I have seen a number of municipalities put the taxpayers at risk based on the assumptions and promises of vendors and consultants. Local officials are sold a "bill of goods" and told that a city-owned broadband network will be an economic savior, will be able to pay for itself and even provide additional revenues to the city.

But local officials rarely take into consideration the fact that these businesses have financial incentives that may be in conflict with the objectives of the municipality. Policy makers rely on their promises to the detriment of constituents and taxpayers.

The decision to enter this competitive market should be made by those who have the most at stake: the taxpayers. Elected officials should acknowledge the complexity of the situation and limit their business interests in competitive markets.

Municipal Broadband Is Beyond the Scope of Government's Core Duties

From a philosophical as well as an economic perspective, I believe that using taxpayer money to further government entrance into the competitive broadband industry represents a misguided understanding of government's role vis-à-vis its citizens.

Local governments are good at a lot of things: building roads, operating utilities and managing professional law enforcement units. But local governments are ill-prepared for operating a complex business model in a highly competitive marketplace.

As a former city councilmember and wife of a current councilmember, I am familiar with the abilities, advantages, constraints and limitations of local government. And as a former small business owner and corporate executive, I am also familiar with the demands and pressures of private industry and market competition.

My time in both worlds leads me to conclude that local governments are just not up to the task of operating a business like broadband in such a competitive market. Local officials are often limited in their time. They do not have the requisite business acumen to accurately assess consumer demand and finance these projects effectively. *A lack of business acumen and experience, coupled with the restraints and limitations of public office, can lead to a high frequency of failure for investors or financial bail-outs by taxpayers.*

Municipalities Are Often Sold a "Bill of Goods"

Local governments often see municipal broadband as an economic savior or a way to boost city revenues in a poor economic climate. They believe that a municipal broadband operation will bring in new employers and generate revenues. Some broadband vendors are eager to reinforce this narrative, even if the numbers and figures demonstrate the opposite.

These vendors often present idealized expectations that omit a true assessment of the risks, the pitfalls and the substantial capital costs of owning and operating a municipal broadband system.

Minnesota has several communities that have bought into these promises, only to find themselves mired in debt with a struggling network. Monticello, a city in Wright County, embarked on building a municipal network hoping it would bolster the city's economy and generate additional revenues for the city. Monticello borrowed more than $26 million to finance the construction and operation of a government-owned network, FiberNet. While the city and the network's developers projected high subscriber rates and a quick return on investment, the outcome could not have been anymore different. FiberNet lost $2.6 million in 2011 and the city defaulted on its bond payments the following year.

Unfortunately for the city and its residents, the competitive broadband market proved difficult to penetrate, and the task of operating the business daunting. The old saying, "if it sounds too good to be true, it probably is," is rarely so applicable. *Communities must be vigilant when examining these kinds of "opportunities" and acknowledge that optimistic facts and figures may be inaccurate as a result of inherent conflicts of interests.*

Hiring an independent financial analyst to advise elected officials is a wise precaution.

Consultants, developers, suppliers, and financiers all have an interest in the sale of their goods or services. *These conflicts can and do result in too-optimistic projections and inflated figures that prevent local officials from fully appreciating the risks and difficulties of operating a broadband network.*

Municipal broadband supporters are often critical of the "bottom-line mentality" of the private sector, but rarely do they acknowledge that this mentality is equally present in the municipal broadband industry. Policy makers must be cognizant of these conflicts when deciding whether to invest in municipal broadband and should make efforts to effectively communicate these concerns to their constituents.

Constituents Must Have Input into a Community's Decision to Build a Network

Residents of municipalities throughout Minnesota can be excluded from the decision-making process when it comes to approving a municipal broadband project. This exclusion is in contravention of the spirit of Minnesota's laws and contrary to the concept of "local self-reliance" — a slogan used to frame the municipal broadband debate as a David versus Goliath struggle. The exclusion of taxpayers who directly and indirectly pay for the cost of the network does not further community involvement or self-reliance.

Minnesota law requires a municipality to hold a referendum before forming a telephone service. These requirements were put into place decades ago to ensure that the formation of a competitive business is in furtherance of the will of the people. Unfortunately the law does not extend to broadband services. Without such protections, the will of the people can be ignored by local governments, the municipality's solvency is risked, and citizens' hard-earned tax dollars at risk.

Lessons Learned

Municipal broadband is beyond the scope of government's role. Governments are intended to represent the will of the people and provide goods and services, but the parameter of that role does not cover instances where those goods and services are being adequately provided by the private sector. In short, local governments are ill-equipped to participate in a competitive market.

Perspectives from Local Government Practitioners

7.4 Beyond GONs: Appreciating the Many Roles that New Technologies Can and Should Play at the Local Level

By Carole Post, Executive Vice President & Chief Strategy and Operations Officer, New York Law School; former Chief Information Officer of New York City and Commissioner of the City's Department of Information Technology & Telecommunications

Local officials, especially those in municipalities with large, diverse populations like New York City, face a daunting array of issues that impact everyday life for thousands or millions of residents. Meeting these many needs typically requires an equally large government infrastructure that can develop and implement policies to affect real change in key communities and sectors. Fortunately, an array of new technologies, from high-speed Internet connections to social media, is helping to improve how officials engage in the day-to-day work of city government and facilitating more direct engagement with residents. While "big" issues like government-owned broadband networks (GONs) are compelling, if not ambitious, initiatives to pursue, "smaller" advances in the use of technology by government are continuing to have profound impacts on how cities serve their residents.

During my time in the administration of former New York City Mayor Michael Bloomberg, I had the privilege of being able to collaborate with an extraordinary group of forward-thinking innovators, both within city government and throughout the city's emerging high-tech ecosystem. Together, we were able to develop a number of creative and impactful solutions that sought to both streamline how government works, so as to be more responsive to citizens' needs, and to make our work more open, which in turn would help fuel further innovation and creativity in the development of citizen-focused services.

A key enabler of these efforts was data, namely the vast trove of information that every city collects in the normal course of delivering services and administering municipal programs. Mayor Bloomberg was a pioneer in harnessing this data to carefully tailor responses to discrete issues. This data-driven ethos pervaded his administration and led to the implementation of a range of incredibly successful programs across every agency, from the Police Department to Sanitation. From the perspective of using data to enhance citizen engagement, the Department of Information Technology & Telecommunications (DoITT) worked to spearhead, among other things, one of the nation's first municipal open data laws. This law facilitated the release of public data sets in an effort to increase transparency and to encourage innovators to develop new tools for our

increasingly tech-savvy population. And unlike many legislative efforts that often result in a congratulatory bill-signing, only to go silent when it comes time to implement, New York City's open data law has been the subject of active and aggressive implementation to meet its required milestones. At the time of this writing, DoITT had published thousands of data sets, a data release plan for when more data would be forthcoming, and an interactive data release progress dashboard. Moreover, the plans will be updated each year and will serve as a roadmap for the eventual publication of all publicly-available data in a single web portal.

Of course, these new tools are only useful to those citizens who are able to access them and who know how to put them to meaningful uses. The real promise of broadband, especially in the context of local government, is that it can support the delivery of critical information and important services in a number of new ways. For many residents, going online via a smartphone or a tablet, at home, in a park, or on the street, is second-hand. This is certainly the case in New York City, which is among the most hyper-connected cities in the world. As a result, our work on broadband issues revolved mostly around helping to enable continued improvements in service and promoting use of new technologies in underserved communities.

From the access side, we forged a number of partnerships with service providers in an effort to speed deployment of Wi-Fi in our city's many parks, to build technology centers in dozens of communities, and to support the continued development of the city's thriving start-up space.

From the use side, we leveraged tens of millions of dollars of federal stimulus funds to forge additional partnerships with private firms and nonprofit organizations and deploy first-in-kind outreach and digital literacy training programs in public middle-schools and workforce development centers across the city.

Together with our work around open data, these efforts constituted a comprehensive yet very practical approach to harnessing new technologies and putting them to work for city government and citizens.

From a governance perspective, it is critical that local officials embrace the many new tools and platforms that are emerging and work with, rather than compete against, the experts that are developing them and making them available. City government doesn't need to be expert in all things tech – and it is probably unwise and futile to attempt to be – but it should strive to be informed and open to new ideas and new ways of doing things.

7.5 Glenwood Springs and Municipal Broadband

David Merritt, Consulting Water Resources Engineer and former City Councilor, Glenwood Springs, Colorado

I served on Glenwood Springs City Council from 2001–2009. One of my very first votes was whether or not to go ahead with a plan to build a municipal broadband network. I was skeptical of the financial viability of the project, but the majority of the city staff and council were in favor of it. We ended up going through with it and building a small fiber network that provides services to municipal buildings and businesses in the core of the city.

At the time, Glenwood Springs was served by Qwest and Comcast, although market penetration was relatively weak. Qwest and Comcast had made statements that they intended to develop the Glenwood Springs market, but they were slow to build out new infrastructure. The city government's dissatisfaction with the pace of broadband development led to a push for a municipal network.

The city borrowed $3.5 million under Glenwood Spring's electrical utility. The network was launched in 2002 and initially provided fiber access to municipal buildings and local businesses, but not consumers. It has only been through third-party contracting that "point to point wireless" was established for residential users and business users outside the central core. The infrastructure has also been used to provide VoIP to businesses located within the central core that is physically connected to the fiber-optic cable.

From an operational standpoint, the network can be construed as successful—the city does have more internet access. But from a financial standpoint, it's not been the success that was anticipated for the city. In the

early years, the network hemorrhaged tax dollars and ratepayer money. The city had used annual cash infusions from the electric utility to keep the network operational, but has now managed to keep operational costs nearly within revenues. However, there will be capital upgrades required which will again stress finances.

My experience as a councilmember at the formation of the network should provide other elected officials with some perspective and insight. There are a number of concerns and unknowns that we in Glenwood Springs faced. I hope that sharing these concerns and experiences with others will help cities decide whether or not to build a municipal network.

Set Realistic Expectations

The City Council and staff believed that the fiber network would provide additional revenue for the electrical utility and the city. Despite optimistic projections, the reality was that the network did not produce a profit during the entirety of my tenure on the City Council. Municipal broadband is too risky to expect profitability, but when necessary should be viewed as providing an essential service

After the network began running on a deficit, the city government reset expectations. Glenwood Spring's City Council realized that the network would not generate the revenue that was initially forecast. The city was forced to accept the fact that the network would require revolving subsidization.

When examining a municipal broadband project, city governments must set realistic expectations. Proper planning requires a careful and measured analysis of all factors. Conservative planning will ensure that a city will lose $10,000 rather than $50,000.

Do Not Invest Good Money after Bad

Cities and towns tend to invest good money after bad when it comes to broadband networks. The logic is based on using sunk costs to justify further spending—if the network is failing, the answer to the problem should not be further investment.

The Glenwood Springs government was tempted to expand into the retail space in 2007, offering cable television and residential telephone service. The thought was that if the network offered more services they could make more money and possibly generate a profit. Supporters of the expansion sought to put good money after bad in an attempt to make the network turn a profit, but this would come at a substantial risk.

The City Council voted against the plan. I think we saved the city from being in the hole for millions. Residential expansion is costly and even more risky. We in the City Council voted to maintain the network's focus on high-value concentrated businesses in the city's core areas rather than building out expansive and expensive infrastructure into the surrounding community.

Involve All Interested Parties in the Process

Taxpayers, elected officials, community organizations and businesses all have a stake in conversations regarding broadband. Accordingly, these individuals and groups should have a hand in the decision-making process.

The city kept the network relatively under the radar. We chose to extend the discussion to the local Chamber of Commerce, but not to citizens and community organizations. In hindsight, this was not the best approach.

It does not matter that the network was not conceived to be a retail broadband provider—it still put taxpayer dollars at risk and the community should have had a say in pursuing the project.

Be Mindful of Those Pushing for a Municipal Network

Cities often rely on consultants to plan and design municipal networks because governments lack the requisite expertise to do so in-house. Though they possess expertise on these issues, these folks are also self-interested because they generally have a stake in an outcome that involves the construction of a government-owned broadband network. Such self-interest can have negative consequences for municipalities.

The consultants arrived into Glenwood Springs like "The Music Man." They overpromised the networks, and many in the city felt like we were over-sold. Many members of the City Council wanted to believe that the consultants' estimates and projections were a guarantee, but they were not.

Elected officials should temper their optimism and recognize that consultants and counterparties have a vested interest in cities and town going ahead with municipal broadband projects.

Investment Invites Competition

While Glenwood Springs's network does not provide direct retail service to citizens, it has facilitated the entry of two ISPs who do provide the connection between the retail consumers and the system. Market competition is a good thing for consumers, but municipalities are often ill-equipped to effectively compete with private firms.

Incumbent providers have continued to build out their networks in Glenwood Springs. Private investment in the area has led to an increase in competition, which in turn has resulted in better services and lower prices. These low prices force Glenwood Springs to keep their own prices low despite the network's need for additional revenue to make the network profitable.

Elected officials should recognize that investment invites competition, and the private sector is in the business of competition. Any municipal plan should take into account that it will likely be in competition with national providers who have numerous advantages over public sector entities, from expertise to economies of scale.

Conclusion

Glenwood Spring's fiber network has had mixed results. It was promised as a business, but functions as a utility. The city has made the best of the situation and minimized the risk by limiting investment. Elected officials should be conservative in their investment, careful with their planning, and tempered in their optimism. Competition, bad investments, and poor planning can easily turn a municipal network into a million dollar loss.

7.6 Lessons Learned from Marietta's Fibernet Failure

Bill Dunaway, former Mayor, Marietta, Georgia

Marietta, Georgia, operates its own utilities and has done so for the past 100 years. When utility companies saw deregulation looming, they wanted to get into the broadband business to make up for what they expected to be a loss of revenues from their core energy business.

The city itself was well served from an Internet perspective. We had incumbent providers offering high-speed service to individuals, businesses, and the city government. The underlying drive for a municipal network was not a lack of service. Rather, Marietta was concerned that their electric utility, which provides a bulk of the city's revenues, would be diminished by deregulation.

The municipal network was originally laid out all over Cobb County and extended into Atlanta. The Cobb County school system was one of the network's biggest customers, along with the county government. The network was exclusively wholesale—we did not provide fiber to the home. We spent about $35 million on building and maintaining the network. But the network was never able to generate sufficient revenues.

I was elected in 2002 on the platform of selling the network. The town had been subsidizing the network with taxpayer money since its inception to the tune of $1 million a year, an amount that was simply unsustainable. In 2004, we were finally able to sell the network at a loss of $11 million. Selling at a loss was necessary to prevent future losses.

Upgrading and Maintaining Municipal Networks are Often Unforeseen and Hugely Expensive

The cost of upgrading and maintaining a network is extensive. When cities discuss broadband, they tend to leave out the future costs created by the network. Technology moves quickly, and cities must keep pace. Elected officials have to realize that a commitment to building a broadband network is ongoing, and upgrades and maintenance will need to be made regardless of the network's profitability.

Marietta was ill-equipped to handle the speed of broadband technology and the rapid degradation of the infrastructure. Year after year, we were forced to divert money to the network for upkeep, despite low subscriber rates and poor performance.

Marietta was not prepared to spend $1 million annually to subsidize the network and keep it maintained. Elected officials have to take into account the extent of their commitment. Infrastructure costs are not a one-time thing; they are ongoing and sometimes unpredictable.

The Risk of Selling at A Loss

We sold the network at an $11 million loss, and that is fortunate. When a network is unprofitable, it becomes a tremendous burden for the city government and taxpayers. In the case of Marietta, the network was such a burden that selling at such a staggering loss was still considered a positive conclusion to the boondoggle. It is not uncommon for a failed network to be worth less than the obsolete infrastructure that it is made of.

The rapid pace of technological advancement not only makes it difficult and costly to keep up with innovation, but it also leads a network to be almost worthless if it fails. Why would a prospective buyer want to purchase equipment and infrastructure that is already outdated? This is the problem I faced as mayor of Marietta.

We ultimately decided that a loss of $11 million was a better option than subsidizing the network with $1 million every year—it was the best and only option we had. No one wanted to buy an outdated network in a saturated market.

Selling a Network Can Be Extraordinarily Difficult

Selling Marietta's Fibernet created a number of obstacles and challenges that I did not anticipate. Handling customer and taxpayer concerns, addressing the media, and dealing with competitive incumbents and prospective buyers makes the process of selling a failed network very difficult.

Prospective purchasers will try to get the lowest price they can, and in order to do so they will gather as much information on the network as possible. The local media was also interested in getting as much information about any impending sale as well. When parties are negotiating a sale, you do not lay all your cards on the table, but Georgia law required that I provide access to any city council discussion of the sale. This made it extraordinarily difficult to find common ground and agreement on a plan. We did not want to give too much information to prospective buyers that would harm our ability to negotiate, but government structure provides that we must be transparent and upfront with our citizens. Elected officials should recognize that the government restrictions may make a potential sale even more difficult.

Even if I was able to convince some of the council members that a sale was necessary, many still resisted the plan. Marietta has a weak-mayor form of government, which limited my ability to unload the network. Some members of the City Council viewed the network as their "baby" and would rather the city continue to prop the network up. Government structure can make getting out from under the network even more difficult than some elected officials realize.

Selling an unprofitable network presents a number of issues and obstacles that make it extraordinarily difficult. Elected officials should take these troubles into account when thinking about investing in a network—it may be easy to get in, but it's very difficult to get out.

7.7 Perspectives on the Davidson, North Carolina Experience

7.7a Lessons from MI-Connection, a GON in Davidson, North Carolina

Laurie Venzon, former Commissioner, Davidson, N.C.

For a long time, the town of Davidson, North Carolina, was a small, sparsely populated community with limited demand for broadband. But as the city began to change and grow, so, too, did its demand for connectivity. Davidson has a long history of poor communications service providers. Lakeside Communications, the original provider, was bought out by Prestige, and Prestige was bought out by Adelphia. During this time, Davidson's population and the population of the surrounding area began to skyrocket. There are currently over 11,000 people in Davidson and over 100,000 people in the Lake Norman region.

When Adelphia took over Prestige, Davidson's government negotiated with Adelphia for a right of first refusal to purchase the network's local assets in the event of failure or bankruptcy. The agreement allowed the town to exercise some control over broadband providers and the town's service. When Adelphia went bankrupt, Time Warner put in a bid for the system. Before the deal was approved, Davidson approached Time Warner and asked if they would honor certain provisions of the current contract with Adelphia. Time Warner Cable declined and indicated they had no intention of upgrading the system or providing the level of service in the Adelphia contract. This fueled Davidson's decision to pursue its right to purchase the system from Adelphia, cutting Time Warner out of the deal. Davidson formed a partnership with four other surrounding communities and began a due diligence process to analyze the viability of the towns running their own broadband network. Unfortunately, this reaction by local government set the stage for a costly investment that is still being paid for to this day.

Poor Planning and Erroneous Assumptions

The communities involved in the municipal broadband project hired consultants to analyze the feasibility of a government-owned network. The consultants found that a municipal network supported by Davidson and four other nearby towns would be successful. This projection was based on a number of assumptions that proved to be inaccurate.

The consultants' assumptions did not consider any competition that might arise in the market, believing that the area's subscriber base would not have any additional options, given the previous lack of interest from any company to invest in the area (not considered dense enough to be profitable). The consultants also included a modest 3–5% customer growth rate in their financial models which proved to be unattainable when the recession hit two years later. Yet, even with its optimistic assumptions, and a five-year payback period, three of the five member-cities backed out of the plan, which dramatically reduced the potential subscriber base.

Davidson should have backed out at that point as well. On paper, the plan worked for five towns, but it would be difficult to succeed with only two. Unfortunately, elected officials in Davidson felt they had come too far to turn back. With Mooresville and Davidson the only remaining towns left, they decided to proceed under the assumption that the network would still grow at a 3 to 5 percent clip annually and they could make up the subscriber base that the other towns represented. Thus, in August of 2007, MI-Connection was born. Eighteen months later, by January 2009, the reality was the network's subscriber base had fallen from 15,000 to 10,000 due to a variety of issues discovered after the purchase was made.

The Risks of Partnerships with Other Municipalities

Municipal networks represent risk. Competitive industries, such as broadband, carry an inherent potential for failure. Davidson believed that a partnership with other nearby communities would reduce the risk and provide a broader subscriber base. While these assumptions may be true in the abstract, they ignore the risks created by community-partnerships. *Every approach to a municipal broadband network comes with its own risks and benefits and needs to be objectively evaluated.*

A municipal network owned by one community provides the government more direct oversight of the network and more insight into the network's operations and subscriber demands. The network infrastructure is also likely to be substantially smaller because the geographic footprint is narrower. There are, however, a number of downsides. The financial risk is solely on the taxpayers of a single community; the network rises and falls with that one community. If the network fails, the debt load is not spread out among several communities; rather, it is placed solely on the backs of a single community.

Multi-town partnerships like MI-Connection, on the other hand, offer the benefits of diversifying risk and reducing overall debt loads. However, they also create a number of risks in the form of information asymmetries, potential conflicts of interest, different priorities between the municipalities, as well as, being susceptible to changing "political winds."

When I was elected Commissioner in November, 2007, I began to examine the network's contracts and our inter-local agreement with Mooresville to better understand the arrangement. The two towns had basically outsourced the operation of the network to Bristol Virginia Utilities while they maintained oversight through a MI-Connection board of directors. By January 2009, when MI-Connection was losing customers and money every month, I began to take a closer look at the situation. I discovered while the infrastructure had been upgraded to a state of the art fiber-optic network, the operations were functioning very poorly. In addition, the business arrangements they had made with other parties were very costly.

Furthermore, when I contacted several commissioners from Mooresville (Davidson's partner in the network), they stated that they were unaware of the network's struggles. Even though we were "partners" in the MI-Connection endeavor, we never discussed the network as a group. Mooresville was receiving information that we did not receive and vice versa. And there was some information that neither of the town boards received. Such an information asymmetry makes it difficult to effectively oversee a network. Once we realized that we had been kept in the dark about several challenges facing the network, the Davidson & Mooresville commissioners set up monthly meetings to address all the issues that had presented themselves and began the years-long process of digging ourselves out of the hole.

Another issue with multi-town partnerships is the likelihood that political differences can lessen the effectiveness of oversight. As the number of individuals tasked with network oversight is increased, the potential for conflict increases which may cause poor management and policy decisions. Add to that the factor of political elections every two years and a government owned network can quickly find itself in the middle of a political crossfire. This does not create the best type of environment in which to run a business.

Market Demand

Municipal broadband networks do not operate in a continuum separate from market forces. Most, if not all, of the problems that municipal broadband providers encounter are the result of local officials' inability or inexperience to examine the market effectively. Typically, when an area is underserved, the market is indicating that the population density is too low for a high-speed broadband network to be profitable. Many elected officials focus on their constituents' request or demand for a network, but don't want to acknowledge that financial infeasibility is the major reason that broadband has not been deployed in a given area. Policymakers must understand that municipally owned networks will often require a large amount of subsidization especially in the early years or whenever infrastructure upgrades require capital infusion.

Concerns and Risks

A municipally owned network failure does not just harm the local government; it harms the taxpayers along with the surrounding communities and the state. *The potential political and economic fallout of a government-owned system's failure must be taken into account by elected officials.*

The political fallout that resulted from MI-Connection's troubles was telling: only one person who authorized the network purchase in 2007 is left either of the Davidson or Mooresville town boards. In the ensuing years after the towns bought the Adelphia system, at every turn, citizens would continue to bring up the failing

network and would often refuse to support current projects as a result of their aversion to the wasteful spending on the MI-Connection endeavor. The damage that was done in terms of the public's trust was immense.

Additionally, in Davidson, the unexpected need to subsidize the network created financial difficulties. The subsidy amounted to 20% of our budget so we had to cut programs, cut staff, reorganize and charge residents a solid waste fee that equaled a 4 cent property tax increase. Needless to say, people were not happy.

The local economy can also be at risk when cities and towns invest in risky broadband networks. Davidson could have easily defaulted on their payments had the network failed. If Davidson was unable to pay its portion of the MI-Connection debt, the State of North Carolina may have been forced (via the Local Government Commission) to take over the town's finances and raise taxes (in the range of 10–12 cents per hundred—a 30% increase in the town's property tax rate). Communities run the risk of losing their autonomy if the town-owned broadband network fails.

Furthermore, the state's bond rating is at risk. If Davidson or any other municipality defaults on a loan or bond, the default could spill over into other cities in the state. Increased rates for other cities that did not invest in such risky endeavors would make it more costly for those governments to borrow money to fund other core needs such as public infrastructure—roads, bridges, sidewalks and water systems.

Solutions and Best Practices

There are a number of mechanisms that elected officials can put into place to minimize risks and costs associated with broadband planning if they believe it is in the best interest of their constituents for their local government to own a broadband network. Referendums and public-private partnerships are options that should be considered versus simply having a board vote to take on the endeavor itself. Both the referendum and a public-private partnership provide municipalities with political capital, expertise, and cost-savings.

Referendums and voter approval should be a requirement for any municipal network. The voters' money is at risk, and they are the network's potential customers. Allowing voters to have a say in the network limits the political risk of building a network. In Davidson and Mooresville, the network's lack of voter support led to a number of elected officials being removed from their positions. If voters are given the opportunity to provide input in the planning stage of the network, they are more likely to "buy-into" the network and assume some of the responsibility to make it successful. With a majority providing front-end support, it is less likely for retaliation against elected officials to occur.

Referendums ensure that there will be an adequate customer base for the network. Cities can use the number of votes as a preliminary indicator of how many subscribers the network has the potential to begin with at inception. While a vote does not necessarily translate into a paying customer, it is an effective means of determining if there is adequate support in the community.

Finally, referendums are an issue of fairness. The municipal governments use taxpayer money and put it at risk. Municipal broadband networks are unlike other government infrastructure in that they are not universally used and they are subject to competition by the private sector. These factors increase the risk of failure and loss of taxpayer money. When elected officials are taking risks above and beyond the risks of what governments typically do, they should be required to seek out the approval of their constituents.

Governments should seek out partnerships with private industry to minimize risk, diversify funding, and provide the network with the expertise that is not usually available to municipal networks. A public-private partnership could create a win-win situation. The private sector is an efficient market that specializes in precisely what the municipality intends to do and will provide the expertise needed for the network to be successful. The public sector/municipality has access to very inexpensive borrowing rates for capital that could ensure financial feasibility of the network that might otherwise be lacking if capital had to be funded at market rates.

Public-private partnerships must mitigate the public information requirements via their partnership arrangement. A government's business is the public's business which creates a huge disadvantage for municipal networks. The requirement to allow public access to a municipality's documents, emails and other information

allows competitors to freely access information regarding the network. This includes operational performance, pricing data, strategic plans and marketing campaigns. Governments and private industry should structure partnerships in such a way as to limit these drawbacks while maximizing the benefits of the partnership.

Conclusion

Municipal broadband networks are risky. Davidson and Mooresville put their towns, their taxpayers, and the state of North Carolina at risk when they devised a network according to a number of faulty assumptions and continued to move forward without the necessary base of subscribers that the financial models required for success. For other communities considering such an endeavor, the best course of action would be to first explore whether a public-private approach is possible. If not, then the municipality should seek a referendum to assure that the will of the people is being acted upon and to gauge market interest in such a service. Otherwise, the potential risks far outweigh any of the benefits.

7.7b Resuscitating a Failed Network

John N. Venzon, Chairman, MI-Connection

As Chairman of MI-Connection, I have seen a municipal network at its lowest point, but I've also been a part of turning the network around. Being part of the network's management team has given me unique insight into the trials and tribulations of running a government-owned broadband network. I believe that these unique experiences will aid others in determining whether or not such a system makes sense in their community.

My first experience with MI-Connection came when my wife, Laurie, was elected a town Commissioner in Davidson, North Carolina. The network had already been bonded by the time of her election. Shortly thereafter, she began to ask questions about MI-Connection's financials. The responses she received from the management were shallow and obscured its financial condition. The evasive nature of these answers only encouraged us to dig deeper.

What we uncovered was shocking. The city had overpaid and over-borrowed, and the network was under-subscribed. The system, in short, was being mismanaged into the ground. The towns worked to revamp the board of directors and when I first joined I became the treasurer and then took over as chairman.

MI-Connection's Problems Began During Planning

The planning stage of a network is vital to long-term success. Our investigation into the planning that went into MI-Connection revealed a number of fundamental problems.

We first determined that Davidson and Mooresville—the two partner cities—had significantly overpaid for the network. The overpayment was a result of events surrounding the previous owner's failure and bankruptcy. During the sale, the network appeared to have significantly more active customers than it actually did. As a result of these inflated subscriber numbers, the cities paid between $5 and $10 million more than the network was worth.

MI-Connection's original management team also outsourced a number of responsibilities that resulted in increased costs. And elected officials and managers were not providing the necessary oversight. We were essentially writing a blank check.

The network was in trouble. We ended up with $92 million in debt, two different financing vehicles, and a network that essentially had $15 million in revenue. When I began to attempt to revitalize the network, I approached both town boards and informed them that the current structure was not a viable business model and that it could not sustain the debt because it had no growth potential. My biggest fear was that we would default on the bond and the state would service the debt for us. If that happened, the state might also take over Davidson's government.

How We Turned MI-Connection Around

Turning MI-Connection around was a herculean task. First, we had to find a way to stem the outflow of cash. To do so, we immediately sought to renegotiate our contracts. This step was extraordinarily difficult because the network had no charter that discussed how we should proceed. What's more, we were very limited in how we could renegotiate because MI-Connection is a government agency. As such, we were required to abide by a number of restrictions. For instance, there were strict limits to how we could borrow funding. Essentially, MI-Connection was barred from every traditional method that the private sector uses to turn a company around.

Second, we had to make sure we had the right people working to solve these complex problems. A strong team is essential in any turnaround. We were fortunate to have a phenomenal staff of hard-working, intelligent people running the network. When I began my tenure at MI-Connection, I focused on recruiting all of the top talent in the area.

We also had to make sure that MI-Connection had a specific objective or goal. Early on, MI-Connection did not have a focus. There was no common set of objectives from a business standpoint. Some officials wanted to get into the broadband business to provide better services to constituents regardless of the system's economic viability. Another group saw broadband as a way for the communities to generate additional revenue. A third group saw the network as a solution to their dissatisfaction with existing service options. And still others believed the municipal system would be good for economic development and would help attract businesses and employers.

While a broadband network has the potential to accomplish many of these objectives, business models must be properly structured and deployed. And local government must buy in and support the objective.

Finally, we had to make sure that there was a clear end game for the network. MI-Connection had no clear exit strategy. As such, one of my top priorities as Chairman was to develop an end game strategy for the network. After careful consideration, we determined that the best course of action would be to stem the bleeding of the network and make the network more appealing for prospective buyers. Once we were able to develop a clear objective and devise an exit strategy, we were able to take the necessary steps to turn the network around and accomplish our goals.

We have made substantial progress towards self-sufficiency, but MI-Connection is not yet out of the woods. We have reduced the network's debt, lowered expenses, and streamlined the network's management structure. These changes have made the network more viable, but they are not lasting solutions. Our policies are designed to make the network more attractive to prospective private buyers, not to foster long-term sustainability as a municipally owned and operated broadband network. Our management's stated goal has always been to turn the network around and divest Davidson and Mooresville of MI-Connection as soon as it is financially prudent to do so. We intend to accomplish this goal in the next five years.

Advice and Best Practices

In light of my experience with MI-Connection, I respectfully offer policy makers the following advice about how best to approach the issue of municipal broadband.

1. **Municipal networks should be community networks.** Make sure proposals pass the broad community consensus test. I went back and interviewed everybody involved in MI-Connection. For the first few months, the towns were meeting clandestinely. These kinds of decisions must be vetted in the light of day. They must be scrutinized to make sure you have support going in beforehand.
2. **Don't just believe the consultants.** When the elected officials were engaged in the planning phase, they hired outside counsel and lawyers who had fairly large fee structures, which generated thousands in income for their services. More importantly, those individuals had a vested interest in running up fees and making this go through. Their financial models had so many assumptions in them that no one stopped to say, "Is this really the right thing to do?" You can plug in an assumption to any business model

and make it work. The real question is what will happen in the real world, and do you have the skill set and discernment to determine whether this is the right thing and whether it will be successful.

3. **"Stick to your knitting."** In the Carolinas we have a saying that originates from the states' textile companies: "Stick to your knitting." If you don't have the expertise, you better find people who are capable of doing it or don't do it at all. Municipalities should stick to what they can do effectively and leave to the experts that which they do expertly.
4. **Identify clear objectives and always have an exit strategy.** If you're going to enter the broadband space, know why you're getting into it and how you're getting out.

Perspectives from Subject Matter Experts

7.8 Municipal Broadband: A Financial Perspective

Anna-Maria Kovacs, Ph.D., CFA, Visiting Senior Policy Scholar at Georgetown University's Center for Business and Public Policy[1133]

Any broadband network has to be well-funded and well-run. That takes deep pockets, scale economies, and experience in network construction and operations as well as in marketing. While municipalities can obtain funding via taxes, tax dollars are limited. Municipalities are unlikely to have either scale in purchasing telecommunications equipment or experience in constructing and running broadband networks. Thus, when a municipality considers building out a broadband network with tax dollars, the first question has to be: "Is there an alternative way to get a private company to do this?"

That is a vital question, because if there is no business case for a private company, it is even less likely that there is a business case for the municipality to build out. If the town decides to proceed anyway, its taxpayers need to understand that they will be paying indefinitely for a project whose benefits are intangible. Were the benefits tangible, they could be incorporated into a viable business case that would attract private investment.

If the community already has at least one broadband provider and is considering funding a competitor, the equation becomes even more complex. Not only must the business case be realistic about the likelihood of winning customers away from the incumbent, it must be realistic about the impact on the incumbent and the incumbent's reactions. Will the incumbent respond by upgrading its existing network and improving service? That's good for the community, but makes it even more likely that the municipal network will be unprofitable and a drain on tax dollars. Conversely, will the incumbent lose market share and leave the community? That may help the municipal network's profitability, but is not necessarily helpful to the community as a whole.

As the ACLP report shows, there are all too many examples of municipalities who have spent taxpayer funds only to discover that the job is more complex or the financials more precarious than they expected. No town wants to see its credit rating damaged, as was Burlington, Vermont's. Nor is it ideal for a city to find itself selling a network in which it invested $39,000,000 for one dollar, as did Provo, Utah.

Fortunately, there are other options for communities that are creative and flexible. Kansas City attracted Google's gigabit network via concessions that include speeding permitting, providing rights of way, and being flexible about build-out requirements. Austin, Texas, has extended flexibility to incumbents as well as to Google. As a result, Austin has persuaded three privately capitalized companies—AT&T, Google, and Grande Communications—to either build or upgrade networks to gigabit speed. Such private solutions allow the community to enjoy the benefits of broadband without saddling the taxpayers with the cost and risk.

1133 © Anna-Maria Kovacs 2014. All rights reserved. Anna-Maria Kovacs is a Visiting Senior Policy Scholar at Georgetown University's Center for Business and Public Policy. She has covered the communications industry for more than three decades as a financial analyst and consultant.

Questions That Communities Should Ask

A community that wants a new or upgraded broadband network needs to ask a series of questions, including:

- What network(s) does the community already have? What does it need today? What will it need over time?
- What will it take to make a broadband network—either private or public—a viable business in this community?
- What is the business case under at least three scenarios: realistic, best-case, and worst-case?
  - What will the capital costs be upfront?
  - What will ongoing operating costs be?
  - Where are revenues coming from? Is the incremental revenue from this project enough to cover costs of operations and capital, or will it require continued taxpayer funding?
- Is this a viable business case for private capital?
- If there is no business case for private investment, why is there a business case for the municipality?
- What can the community do to make this project more attractive to private capital? What can the town do to facilitate the build-out? To lower cost and risk for the provider? To ensure a baseline of revenues?
- If there is a private-public partnership, how are the costs, the risks, and the benefits divided?
- How much is the community willing to lose on this network and for how long? How long will taxpayers be willing to support the network?
- What alternative uses of the taxes being raised for the network is the community forgoing?
- What will the impact of additional debt be on cost of the community's other debt under best-case and worst-case scenarios?
- What is the exit strategy?
- If there is an incumbent, how will this new competition impact the incumbent—best case and worst case? Is the incumbent likely to exit the market, thus eliminating hoped-for competition?

In the vast majority of communities in the U.S., private capital has already built at least one broadband network, and in most of the U.S. it has built several, wired and wireless. For those communities, the Austin, Texas, solution of working with the private entities is both practical and greatly preferable.

Even those communities that still lack a broadband network are best served by finding a private provider. If there is one thing that the examples in ACLP's study show, it is that operating a broadband network is not an amateur sport. It requires capital, experience in operations and marketing, and scale. Only as a last resort should a community build its own network, and even then only if community leaders are certain that the taxpayers are willing to support the municipal network long-term. Far preferable is a flexible and creative approach that makes the project appealing for an experienced, privately capitalized provider.

7.9 Government-Owned Broadband Networks: The View from Utah

Royce Van Tassell, Vice President, Utah Taxpayers Association

Until recently, I hadn't seen the show *Sports Night* since ABC broadcast it from 1998 to 2000. Styled as a half-hour comedy, it broke with many conventions, chiefly by dealing in serious and personal ways with the war on drugs, sexual harassment, doping, and the inherent conflicts between quality programming and attracting an audience.

The characters are warm and engaging, the dialog quick and witty, but many of the props seem remarkably dated. The jeans have that late 1990' "baggy with a belt" look (think Girbaud). My wife hates the hairstyle of every woman on the show (though I'm guessing she sported something similar in the late 1990s).

And then there's the technology. Set on a fictional sports news studio, hundreds of videocassettes are lying around. Cathode ray tube monitors (CRTs) take up half of ever desk. They use fax machines, but cell phones are almost nonexistent. Only the resident nerd uses e-mail (think "You've got mail!").

No newsroom, or office of any kind today, could survive using such outdated technology. But in the late 1990s, our collective expectations for communications made all these tools the norm.

Technology Has Changed Our Expectations

Even as ABC was broadcasting *Sports Night,* Global Crossing, Comcast, AT&T, Nokia and Blackberry (among others) were developing and deploying the technology that makes "Sports Night's" props look quaint today. Now the United States has more smartphones than people. Debates over disposing of CRTs mostly ended about five years ago. DVRs, Roku, Apple TV and Chromecast have already replaced the DVDs that replaced video cassettes.

Technology breakthroughs changed our expectations. In one form or another, all of today's widespread technologies were available in 1998, if you were willing and able to pay for it. Recall that in the 1980s some superstars flaunted their wealth by casually pressing bricklike cell phones to their ear. But the average American, even the average American business, couldn't afford the luxuries in 1998 that we take for granted today, so they didn't expect them.

Cities Get Impatient

Not everyone has been so patient. In scores of cities across the country, mayors and city councils have decided that their cities, their constituents, "need" even faster communications technology now. To meet these "needs," they have built, or are considering building, their own municipal telecom systems.

These cities want to change the expectations of the customers in their area; they sincerely believe that the adage, "if you build it, they will come," applies to telecommunications. Hence, the current trend is to build municipal telecom systems with "fiber to the home" (FTTH).

FTTH allows for blazing fast speeds. Municipal networks in Tennessee, Virginia and Utah now offer speeds of 1 gigabyte per second (gig), and Google Fiber offers a similar gig product in Kansas City, Provo, and Austin. A gig connection allows the user to stream five HD movies simultaneously, and still be able to check e-mail and surf the web without waiting. No doubt, a gig is cool.

Cool as that speed is, municipal telecom systems are also expensive and risky. Quite a few cities have built their own system, only to find large consistent financial losses forcing them to sell the network for pennies on the dollar. And many of the municipal systems touted as "successful" would be financial failures in the private sector. Barely breaking even on the operations side does not lure many investors.

Why Do Municipal Telecom Systems Struggle?

Why is it so difficult to make these systems work? Every analyst offers a different opinion. Some blame elected officials unwilling to spend enough. Others blame Luddite state policy makers who don't recognize that municipal telecom is the only way for their cities to grow. Still others blame competitive responses from incumbent telecom and cable providers.

Undoubtedly all of these factors play some part. For my part, I think two factors are decisive. First, the governance structure of municipal telecom systems virtually guarantees that their boards of directors will know little if anything about how to succeed in the telecom sphere. Second, government of any kind has a very difficult time managing the risks of a highly competitive business.

Who Governs Municipal Telecom Systems?

When a city builds its own telecom system, they need to establish a governing board, and politics nearly always trumps business acumen in selecting those board members. They choose the mayor, members of the city council, the city manager, the city's finance director and other prominent political figures.

These people are all good at what they do, but none of them was selected because they know how to succeed in the telecom business. The ability to win an election signifies nothing about that person's ability to effectively govern or manage a telecom system. In nearly every case, these elected officials are successful in what they do, be that a local activist, philanthropist, small business owner, etc.

But just as it's unrealistic to assume a successful accountant will succeed as a school principal, it's unrealistic to assume that an elected official will succeed at managing a telecom venture. Accountants aren't principals. Mayors aren't heads of telecom companies.

Governments Have Trouble Managing Risk

Another big reason municipal telecom systems struggle is that governments have trouble managing risks. The transparent plodding nature of government combines with the lack of market feedback to give elected officials precious little meaningful feedback about the risks of various options.

Evaluating whether to repave a street, extend a sewer line, or build a new water tower relies almost exclusively on variables City Hall has readily at hand. They know how many building permits they have approved, and the number of cars and water and sewer usage per home are quite stable. The technologies and costs for building, maintaining and operating this infrastructure are similarly predictable.

By contrast, telecommunications absorbs multiple tectonic shifts every decade. Going back to my experience watching *Sports Night* recently, recall that cell phones were unusual, while faxes remained standard. Since ABC pulled *Sports Night,* not only have cell phones become ubiquitous, but several cell phone manufacturers have come and gone as "kings" of cell phones. Nokia gave way to Motorola, which Blackberry crushed, only to be outdone by Apple. While Apple maintains a substantial part of the cell phone market, HTC and LG knocked Apple off its perch, and Samsung is now ascendant.

And that's just in the handset market. Advances in compression technology allow DSL, coax and wireless to carry volumes of data analysts once thought only fiber could carry. Finding a balance in the midst of these technological and consumer preference changes requires a degree of risk-taking to which politics simply isn't well suited.

What Direction Next?

In the ongoing debate over municipal telecom, proponents and opponents of municipal telecom relate competing anecdotes of successful or failing municipal telecom systems. Proponents point to Chattanooga, Tennessee, and Danville, Virginia, while opponents (myself included) point to Groton, Connecticut, Utah's UTOPIA (the Utah Telecommunications Open Infrastructure Agency), or Alameda, California.

Proponents note the benefits of speed, while opponents emphasize that the private sector is more than willing to provide all the speed anyone is willing to pay for. Just like 1980s superstars paid a hefty price to carry their brick-like cell phones, anyone who wants the speed of a fiber optic cable into their home or business can have it, if they're willing to pay the price. No matter who builds these telecom systems, they are expensive.

Building and operating these systems means tearing up roads, digging trenches, laying conduit, pulling fiber, installing and maintaining electronics at the ends of the fibers, providing adequate heating and cooling for the electronics, selling connections to individual homeowners and businesses, dropping and installing lines and electronics from the street to homes and businesses, managing network traffic, etc. If the system offers video, a head-end is necessary, plus purchasing the rights to sell bundles of channels. And public or private systems need a lot of employees to do all of this. When cities build these systems, the real effect is for some taxpayers to subsidize other taxpayers' telecom "needs."

Despite all these risks, dozens of private telecom companies have invested hundreds of billions of dollars into discovering, even creating, consumer preferences, and then meeting them. When cities build and operate municipal telecom systems, political considerations inevitably influence sound business decisions. And only happenstance will align political considerations with the business decisions necessary to succeed amidst the constant changes of communications technology.

Recall that in its infancy, cell phone technology was incredibly expensive. That bricklike cell phone, which was more status symbol than phone, cost thousands of dollars. As private companies have invested billions of dollars, the cost of cell phones has plummeted. The same will continue with telecom technology.

7.10 Crafting Effective Strategies for Effectively Allocating Municipal Resources

By Joseph S. Miller, President and CEO, Washington Technology Project, LLC

Cities across the country are facing increasing inequality on a number of fronts—income, housing, education, healthcare, etc.—and those inequalities should inform policy makers' decisions regarding their allocation of surplus resources, including in the technology arena.

Minorities comprise an ever-increasing majority of the U.S. population, yet Blacks and Latinos continue to struggle for inclusion in the technology sector, both as entrepreneurs and as employees of companies on the leading edge of innovation. These disparities are, to some extent, caused by active, deliberate discrimination by venture capitalists and employers. Achievement gaps in science, technology, engineering and mathematics (STEM) fields also contribute to these trends. While some local governments have made significant investments to alleviate them, additional allocations are desperately needed to improve STEM achievement rates to address the array of out-of-school factors that contribute to STEM disparities.[1134]

All cities have limited resources. In the context of calls for technology expenditures, public officials have to holistically assess such calls in view of other social priorities. Are poverty rates increasing or decreasing? Is healthcare spending sufficient? Is affordable housing available? Is education adequately funded? The answers to these questions matter. Cities like my native hometown of New York have already invested hundreds of millions of dollars to attract technology-based businesses and top tech talent from other regions. New York City has invested heavily over the past five years to build its profile as a world-class technology hub. Notable among these initiatives is the Applied Sciences NYC initiative—a network of "top tier applied sciences and engineering campuses."[1135]

Paradoxically, New York City remains among the top 10 cities in income inequality nationwide. In 2012, according to its analysis of U.S. Census data, Brookings found New York City households just cracking the top 5% in income ($226,675) earn 13.2 times as much as households earning income in the 20th percentile ($17,119).[1136]

If academic achievement gaps are any guide, income inequality in New York City will continue to persist, as many blacks and Latinos in particular will not have the skills to compete for high paying jobs in the city. New York City's black or Hispanic students currently in grades 3 through 8 continue to underperform academically, compared to their Asian or White counterparts.[1137] In 2013, 61.4% of New York City Asian students and 50.1% of White students in grades 3 through 8 performed at or above proficiency on Common Core tests in

1134 *See* David C. Berliner, *Poverty and Potential: Out-of-School Factors and School Success* (Education Public Interest Center: 2009) *available at* http://nepc.colorado.edu/publication/poverty-and-potential.

1135 Applied Sciences NYC website *available at* http://www.nycedc.com/project/applied-sciences-nyc.

1136 http://www.brookings.edu/research/papers/2014/02/cities-unequal-berube

1137 *See* New York City Department of Education, *2013 New York State Common Core Test Results: New York City Grades 3 – 8* (New York City Department of Education: 2013) available athttp://schools.nyc.gov/NR/rdonlyres/8F6125CE-0AF1-4F6F-A109-34F7C27006CA/0/2013MathELAResultsSummary.pdf.

math in New York City, compared to 15.3% of Black students and 18.6% of Hispanic students in the same grades.[1138]

In addition to these pressing social problems, pervasive broadband adoption and usage disparities persist. While access to high speed networks continues to pose a problem in certain remote and rural areas, numerous factors not related to a lack of broadband infrastructure contribute to low broadband adoption rates.[1139] According to a 2013 National Telecommunications and Information Administration report, just 55% of African American and 56% of Hispanic households have adopted broadband, compared to 74% of their White and 81% of their Asian American counterparts.[1140] Forty-three percent of households with incomes of $25,000 or less have adopted broadband, compared to 84% of households with incomes between $50,000 and $74,999.[1141]

Those who have not adopted broadband cite a variety of reasons. The top three reasons include "lack of interest/perceived relevance" (48%), "too expensive" (28%), and "no computer or computer inadequate" (13%).[1142] Notably, none of these factors are related to a lack of broadband infrastructure. In fact, just one percent cited a lack of access to broadband as their primary reason for not adopting broadband (although 2% of rural households stated they have not adopted broadband because it is not available in their areas).[1143]

Conclusion

Municipalities across the nation are grappling with the question of how to allocate scarce resources to address the myriad pressing economic and social issues facing their residents. Many cities are also grappling with the question of how to allocate scarce resources to reduce the socioeconomic disparities affecting large swaths their citizens. Other jurisdictions, such as New York City, boast a surplus of resources and have the luxury of being able to focus on growing their local economies. However, even many of these jurisdictions tend to focus too heavily on making investments to assist those who have already done well, rather than funding programs to alleviate barriers to African Americans, Latinos and other under-adopting demographics being full participants in the technology sector.

1138 *Id.*

1139 National Telecommunications and Information Administration, *Exploring the Digital Nation: America's Emerging Online Experience* (Department of Commerce, June 2013) *available* at http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_-_americas_emerging_online_experience.pdf

1140 *Id.* at 26.

1141 *Id.*

1142 *Id.* at 36.

1143 *Id.*

Appendix I: Notes to Table 4.1

1 *See EPB Increasing Fiber Optic Speeds; Lowering Customer Prices*, Sept. 17, 2013, Chattanoogan.com, *available at* http://www.chattanoogan.com/2013/9/17/259342/EPB-Increasing-Fiber-Optic-Speeds.aspx.
2 *See* Brian Fung, *How Chattanooga beat Google Fiber by half a decade*, Sept. 17, 2013, Washington Post Switch Blog, *available at* http://www.washingtonpost.com/blogs/the-switch/wp/2013/09/17/how-chattanooga-beat-google-fiber-by-half-a-decade/.
3 *See* Kevin E. McCarthy, *Chattanooga High Speed Broadband Initiative*, Dec. 14, 2012, Research Report 2012-R-0515, Office of Legislative Research, Connecticut General Assembly, *available at* http://www.cga.ct.gov/2012/rpt/2012-R-0515.htm ("*Chattanooga High Speed Broadband Initiative*").
4 This figure includes three separate loans: (1) a $50 million loan from the municipality's electric division of the municipal utility to establish the utility's fiber optic division, *Id*. (2) a $19.5 million loan to pay off these electrical division loans. *See Senior Management Report & Financial Information 2012*, at p. 45, EPB (Sept. 2012), *available at* https://www.epb.net/flash/annual-reports/2012/assets/uploads/EPB-Financials.pdf ("*Senior Management Report & Financial Information 2012*"). (3) A $5 million line of credit secured by revenues and assets, *Id.*
5 *Broadband at the Speed of Light* at p. 38.
6 *See EPB Senior Management & Financial Information 2013*, Annual Report 2013, at p. 17, *available at* https://www.epb.net/flash/annual-reports/2013/downloads/EPB_Financials_2013.pdf ("*EPB Senior Management & Financial Information 2013*").
7 *Id.* at p. 20.
8 *Id.*
9 *Id.*
10 *See* James Shea, *Tobacco Dollars Extend Broadband for Southwest Virginia,* Dec. 8, 2013, TriCities.com, *available at* http://www.tricities.com/news/local/article_ea52b42c-6083-11e3-8d56-0019bb30f31a.html ("*Tobacco Dollars Extend Broadband for Southwest Virginia*").
11 *See* Press Release, *BVU Awarded More than 28 Million Dollars in Grant*, July 2, 2013, BVU, *available at* http://www.bvu-optinet.com/data_elements/press_release_DMME_Grant_2010.pdf
12 *Broadband at the Speed of Light* at p. 3. *See also City of Bristol Audited Financial Statement*, at p. 61, June 30, 2012, *available at* http://www.bristolva.org/DocumentCenter/View/246.
13 OptiNet originally borrowed this amount from BVU's electric division. The amount was eventually reconstituted as an investment. *Broadband at the Speed of Light* at p. 7.
14 This figure includes: $50.4 million in federal grant, including a federal stimulus award, and about $40 million in state grants. *Broadband at the Speed of Light* p. 6. *See also* Susan Kendall, *Moody's Assigns A2 Issuer Rating to BVU Authority (VA),* Nov. 9, 2010, Moody's, *available at* http://www.moodys.com/research/MOODYS-ASSIGNS-A2-ISSUER-RATING-TO-BVU-AUTHORITY-VA-Rating-Update--RU_16711855 ("*Moody's Assigns A2 Issuer Rating to BVU*"); *Funding Revitalization and Innovation in the Tobacco Region,* at p. 3, Virginia Tobacco Commission (June 2011), *available at* http://www.tic.virginia.gov/images/VA%20Business%20Magazine%20Ads/Broadband/June%202011%20Virginia%20Business%20Magazine%20Broadband.pdf; *Tobacco Dollars Extend Broadband for Southwest Virginia.*
15 There was no direct cross-subsidization, but certain transactions were dubious. For example, while Virginia's state Corporation Commission was examining the network's cost allocation model, OptiNet booked $23.7 million in funds from the Electric division as debt. Once the model was approved, OptiNet re-characterized the funds as an investment. *Broadband at the Speed of Light* p. 7.

16 Information was not made publically available; attempts to contact BVU Authority's CFO, Stacey Pomrenke, did not receive a response.
17 *Id.*
18 *Id.*
19 *Id.*
20 *See* Richard Burgess, *LUS Announces Number of Subscribers*, May 29, 2013, The Advocate, *available at* http://theadvocate.com/news/6038657-123/lus-announces-number-of-subscribers.
21 *See* Ricky Jervis, *Louisiana City Blazes High-Speed Web Trail*, Feb. 5, 2012, USA Today, *available at* http://usatoday30.usatoday.com/news/nation/story/2012-02-01/broadband-telecom-lafayette/52920278/1.
22 *See Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana,* at p. 42, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2010), *available at* http://emma.msrb.org/EA494408-EA384388-EA781227.pdf ("*Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana*"). *See also* Dan Aschenbach, *Moody's Assigns A1 to Lafayette, Louisiana Combined Utility Revenue Bonds; Outlook Stable*, Nov. 26, 2012, Moody's, *available at* http://www.moodys.com/research/Moodys-Assigns-A1-to-Lafayette-Louisiana-Combined-Utility-Revenue-Bonds-New-Issue--NIR_900823593 ("*Moody's Assigns A1 to Lafayette, Louisiana*").
23 *Utilities Revenue Refunding Bond, Series 2012, City of Lafayette Louisiana* at p. 45.
24 *Broadband at the Speed of Light* at p. 23.
25 *See* Alex Labat, *LUS CPA Explains Fiber* Audit, May 16, 2013, KATC.com, *available at* http://www.katc.com/news/lus-cpa-explains-fiber-audit.
26 *Lafayette City-Parish Consolidated Government Financial Audit* at p. 26.
27 *Id.* at p. 24.
28 *See* Alex Labat, *Video: LUS CPA Explains Fiber Audit*, at 1:50, May 16, 2013, KATC.com, *available at* http://www.katc.com/news/lus-cpa-explains-fiber-audit.
29 *See City of Monticello, Mn, Telecommunications Revenue Bonds, Series 2008 (FiberNet Monticello Project), Quarterly Report for Period Ending March 31, 2013*, at p. 6, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (2013), *available at* http://emma.msrb.org/EA525726-EA409489-EA806402.pdf ("*City of Monticello Quarterly Report for Period Ending March 31, 2013*").
30 *See City of Monticello, Minnesota, Telecommunications Revenue Bonds, Series 2008*, at p. 3, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (June 19, 2008), *available at* http://emma.msrb.org/MS271839-MS268494-MD531794.pdf ("*City of Monticello, Minnesota, Telecommunications Revenue Bonds, Series 2008*").
31 *Id.* at p. i.
32 Roughly $3.4 million in interfund loans were made in 2011. In addition, "management report[ed] that inter-fund loans [grew] to $4.1 million [by September 2012], and expect[ed] additional monthly support of up to $60,000 through the end of fiscal 2012." *See* Tim Hennigar, *FiberNet operating transfers pass Monticello City Council vote*, Dec. 6, 2012, Monticello Times, *available at* http://monticellotimes.com/2012/12/06/fibernet-operating-transfers-pass-monticello-city-council-vote/. *See also* Andrea Stenhoff, *Moody's downgrades to A2 from Aa3 the GOULT rating for City of Monticello (MN); concurrently downgrades lease revenue debt to A3 from A1,* Sept. 28, 2012, Moody's Investors Service, *available at* http://www.moodys.com/research/Moodys-downgrades-to-A2-from-Aa3-the-GOULT-rating-for-Rating-Update--RU_900688861 ("*Moody's downgrades City of Monticello*").
33 This aid was provided by the municipality to shore up the flagging network. Transfers included: an interfund transfer of $322,527 from the general fund to FiberNet; a $3.12 million interfund transfer from the liquor fund; a $377,473 transfer from the city's street reconstruction fund; a $300,000 transfer from the DMV fund; a $200,000 transfer from the street light improvement fund; and another $125,789 transfer from the liquor fund. *Id.*
34 Annualized based on most recent quarterly data. *City of Monticello Quarterly Report for Period Ending March 31, 2013* at p. 3.
35 Annualized based on most recent quarterly data. *Id.* at p. 4.
36 *Id.*
37 Phone conversation with Monticello Assistant Finance Director, Angie McIntire. Monticello does not make any payments in lieu of taxes to the city of Monticello.

38 *See CFU launches gigabit Internet service*, May 28, 2013, Cedar Falls Times, *available at* http://www.communitynewspapergroup.com/cedar_falls_times/news/article_09479d64-c7ca-11e2-80e2-0019bb2963f4.html.

39 *See Fiber Marks a Year of Progress,* at p. 1, Cedar Falls Utilities Online (Oct. 2011), *available at*http://www.pageturnpro.com/Publications/201110/963/31612/pdf/129623134074261250_October2011web.pdf.

40 This figure encompasses both initial build-out costs (i.e., a $3 million bond issued in 1995, which came to maturity in 2008) and recent upgrades to fiber. With regard to the upgrade to fiber and expansion of the network, this was slated to cost $17 million. Cedar Falls began to borrow additional funding in 2009 for deployment purposes, borrowing $2,320,000. The city then borrowed $13,130,000 using communications utility revenue capital loan notes. *See Municipal Communications Utility of the City of Cedar Falls Iowa, $13,130,000 Communications Utility Revenue Capital Loan Notes, Series 2010*, at p. 1, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Sept. 1, 2010), *available at* http://emma.msrb.org/EA404810-EA316792-EA712527.pdf ("*Municipal Communications Utility of the City of Cedar Falls Iowa $13,130,000 Communications Utility Revenue Capital Loan Notes , Series 1995B*").

41 *See Financial Statements of the Municipal Electric, Gas, Water, and Communications Utilities of the City of Cedar Falls, Iowa, For the Year Ending Dec 31, 2011*, at p. 28, Cedar Falls Utility (March 2012), *available at* http://auditor.iowa.gov/reports/1223-0046-C000.pdf ("*Financial Statements For the Year Ending Dec 31, 2011*").

42 *See Advancing Broadband: A Foundation for Strong Rural Communities*, at p. 29, Rural Utilities Service, U.S. Dept. of Agriculture (Jan. 2011), *available at* http://www.rurdev.usda.gov/supportdocuments/RBB_report_whole-v4ForWeb.pdf.

43 See *Financial Statements of the Municipal Communications Utility of the City of Cedar Falls, Iowa*, *Including Independent Auditor's Report, For the Years Ended Dec. 31, 2012 and 2011*, at p. 10, Cedar Falls Utility (April 4, 2013), *available at* http://emma.msrb.org/EP760639-EP589987-EP991542.pdf.

44 *Id.* at p. 10.

45 *Id.* at p. 21.

46 *See generally id.*

47 *See* Andrew Michael Cohill, *Danville Transforms its Economy with Fiber*, Broadband Communities Online Magazine, *available at* http://www.bbpmag.com/MuniPortal/EditorsChoice/1111editorschoice.php.

48 *Id.*

49 *Id.*

50 *See State of the Art Broadband Builds Communities*, p. 69, Broadband Communities Magazine (Nov./Dec. 2012), *available at* http://bbcmag.epubxp.com/i/100321/66

51 From the federal E-rate program. Phone conversation with Jason Grey, Project Manager, nDanville.

52 *See Danville FY 2014 Adopted Budget, Telecommunications Fund*, p. 17-1, City of Danville, VA, *available at* http://www.danville-va.gov/DocumentCenter/View/9715.

53 *Id.* at p. 17-1.

54 *Id.* at p. 17-2.

55 *See* Natalie Crofts, *UTOPIA Courts Potential Investor,* Dec. 23, 2013, KSLNews.com, *available at* http://www.ksl.com/?sid=28129914.

56 Data as of June 2012. *See Utah Telecommunication Open Infrastructure Agency, Financial Statements*, p. 2, June 20, 2012, UTOPIA, *available at* https://web.archive.org/web/20130203105656/http://utopianet.org/uploads/files/177_UTOPIA_Report_2012_-_Final.pdf ("*Utah Telecommunication Open Infrastructure Agency, Financial Statements – June 2012*"). More recent numbers are difficult to come by, but the Salt Lake Tribune puts the number below 10,000. *See* Tony Semerad, *UTOPIA: Fiber-optic Nirvana or a Nightmare with No Way Out?*, Dec. 3, 2012, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/news/55284692-78/utopia-network-fiber-west.html.csp.

57 *Utah Telecommunication Open Infrastructure Agency, Financial Statements – June 2012* at p. 16.

58 *See A Performance Audit of the Utah Telecommunication Open Infrastructure Agency*, at p. i, Report to the Utah Legislature, No. 2012-08 (Aug. 2012), *available at* http://le.utah.gov/audit/12_08rpt.pdf ("*UTOPIA Audit*").

59 This figure reflects amounts owed to pledging members. *See Utah Telecommunication Open Infrastructure Agency, Financial Statements – June 2012* at p. 19.

60 This figure includes: (1) $21 million from the U.S. Rural Utility Services and (2) $16.2 million in federal stimulus funds. *See UTOPIA Audit*, at p. 7. *See also* Cathy McKitrick, *UTOPIA in Layton and Centerville Grows through Federal Funds*, Aug. 3, 2011, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/news/52290138-78/utopia-centerville-layton-fiber.html.csp.

61 It should be noted that $6.5 million of UTOPIA's revenues stem directly from federal stimulus grants. *Utah Telecommunication Open Infrastructure Agency, Financial Statements – June 2012* at pp. 4, 9.

62 *Id.* at p. 9.

63 *Id.* at p. 22.

64 *See Utilities Commission Meeting Minutes*, at p. 11, Nov. 23, 2004, City of Groton, *available at* http://www.cityofgroton.com/docs/minutes/ucommission/2004/ucommission11-23-04.pdf.

65 When contacted by phone, a representative of TVC stated that this information is confidential.

66 *Id.*

67 *See* Deborah Straszheim, *How A Promising Idea Went Terribly Wrong In Groton,* Jan. 6, 2013, Groton Patch, *available at* http://groton.patch.com/groups/politics-and-elections/p/how-a-promising-idea-went-horribly-wrong-in-groton

68 *Id.*

69 The number has not been disclosed by city officials. *See* Vince Horiuchi, *Provo Will be 3rd U.S. Metro Area to Get Speedy Google Fiber*, April 17, 2013, Salt Lake Tribune, *available at* http://www.sltrib.com/sltrib/money/56168330-79/google-provo-network-fiber.html.csp ("Although the backbone of the network is built out to the entire city, wiring from the curb to homes and apartments is completed only in about a third of the city's 35,000 homes, [Provo Mayor John] Curtis said. He would not say how many paying subscribers iProvo has.").

70 The location – and presumably the amount – of fiber used to build the network are currently unknown. The city hired an engineering firm to determine exactly where the fiber-optic cables are buried – a condition of the sale of the system to Google. *See* Vince Horiuchi, *Council Approves iProvo Sale to Google,* April 24, 2013, Salt Lake Tribune, *available at* http://archive.sltrib.com/article.php?id-26443832&itype=storyID.

71 *See City of Provo, Utah, $39,500,000 Sales Tax Revenue Bond, Series 2004 Taxable*, at p. 17, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Feb. 24, 2004), *available at* http://emma.msrb.org/MS217839-MS193147-MD374970.pdf ("*Provo $39,500,000 Sales Tax Revenue Bond, Series 2004*").

72 *See* Tad Walch, *IProvo Debt to Require City Help,* Feb. 22, 2006, Deseret News, *available at,* http://www.deseretnews.com/article/635186518/IProvo-debt-to-require-city-help.html?pg=all.

73 *See iProvo: A Requiem*, May 5, 2013, Utah Taxpayer's Association, *available at* http://www.utahtaxpayers.org/wp-content/uploads/2013/05/20-iProvo.pdf.

74 *See Continuing Disclosure Memorandum, Summary of Debt Structure and Financial Information, SEC Rule 15c2-12, For the City of Provo, Utah*, p. 122, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (Dec. 19, 2012), *available at* http://Emma.msrb.org/EA492788-EA382935-EA779784.pdf.

75 *Id.*

76 *Id.* at p. 82.

77 *See* Press Release, *City of Wilson to Offer Gigabit Internet Service to Customers by July*, April 19, 2013, Greenlight NC, *available at* http://www.greenlightnc.com/gigabit_press_release.php.

78 *See Wilson, North Carolina, Certificates of Participation Series 2008*, Electronic Municipal Market Access, Municipal Securities Rulemaking Board (May 1, 2008), *available at* http://emma.msrb.org/MS273964-MS271292-MD541860.pdf ("*Wilson Certificates of Participation Series 2008*").

79 *See* Todd O'Boyle & Christopher Mitchell, *Carolina's Connected Community: Wilson Gives Greenlight to Fast Internet*, at p. 8, Common Cause and Institute for Local Self Reliance (Dec. 2012), *available at* http://www.ilsr.org/wp-content/uploads/2012/12/wilson-greenlight.pdf.

80 Email from Kim Hands, Wilson, NC, Director of Finance.

81 *Id.*

82 *Id.*

83 *Id.*

Appendix II: State Laws Impacting GONs

State	Overview
Alabama	Alabama requires a municipality to hold a public hearing and referendum (Ala. Code § 11-50B-1 et seq.)
Arkansas	A municipal government cannot offer broadband services unless the municipality already has an electricity or television service. If the municipal government offers either service, a public hearing must be held. (Ark. Code § 23-17-409)
Colorado	Municipalities must hold a referendum unless the area is unserved and incumbent ISPs have refused to provide the requested service. (Colo. Rev. Stat. Ann. § 29-27-201 et seq.)
Florida	Florida requires two public hearings, a feasibility plan, and a requirement that the network be self-sustaining within four years. (Fl. Stat. § 350.81)
Louisiana	The municipality must hold a public hearing. If the proposal is approved, the city must undertake a feasibility study in an effort to determine whether annual revenues will exceed annual costs by the amount necessary to cover debt payments. (Rev. Stat. Ann. § 45:884.41 et seq.)
Michigan	The municipal government must request a bid from private ISPs. The public entity then must submit a sealed bid to provide services. The public entity cannot go outside the municipality's boundaries. (Mich. Comp. Laws Ann. § 484.2252)
Minnesota	A municipality may only operate a telephone exchange or other facilities in support of communications services if they receive a 65% referendum vote. (Minn. Stat. Ann. § 237.19)
Missouri	A municipality cannot sell telecommunications service, but it can offer cable service after a referendum. (Mo. Rev. Stat. § 392.410(7))
Nebraska	A municipal government cannot offer broadband services, but it can sell/lease dark fiber. (Neb. Rev. Stat. Ann. §§ 86-594; 86-575)
Nevada	Municipalities with populations over 25,000 or counties with more than 50,000 people may not offer broadband services. (Nev. Stat. §§ 268.086; 710.147)
North Carolina	The city must create a separate enterprise fund, publish independent annual reports, only operate within the city, and provide nondiscriminatory access to private ISPs. The network cannot be cross-subsidized and services cannot be sold below cost. (N.C. Stat. Ch. 160A, Article 16A)
Pennsylvania	A municipality cannot offer communications services unless the incumbent refuses. (66 Pa. Cons. Stat. Ann. § 3014(h))
South Carolina	A GON may not receive any benefit that is not provided to non-government networks. GONs cannot be cross-subsidized and must be audited. (S.C. Code Ann. § 58-9-2600 et seq.)
Tennessee	Any utility that seeks to provide broadband must receive a resolution from the county's legislative body. The Comptroller must then report to the General Assembly and recommend whether to move forward. (Tenn. Code Ann. § 7-52-601 et seq.)
Texas	Municipalities are prohibited from offering broadband service. (TX Util. Code § 54.201 et seq.)
Utah	Municipalities can provide wholesale services, but in order to retail directly to consumers the network must undergo a feasibility study. (Utah Code Ann. § 10-18-201 et seq.)
Virginia	A municipality with a population of more than 30,000 may offer telecommunications services if the plan is approved by a governing board. The network must also abide by reporting requirements. (VA Code §§ 15.2-2108.6; 56-265.4:4;56-484.7:1)
Washington	Public utilities can only provide telecommunications on a wholesale basis. (Wash. Rev. Code Ann. § 54.16.330)
Wisconsin	Municipalities must hold a public hearing and draft a report on a proposed GON prior to a public hearing. This process does not apply if the private ISPs do not intend to provide services in the area. (Wis. Stat. Ann. § 66.0422)

About the Authors

Charles M. Davidson and **Michael J. Santorelli** are Directors of the Advanced Communications Law & Policy Institute (ACLP) at New York Law School.

The ACLP's mission is to promote robust and solution-focused dialogues among state and federal policy makers, academe, service providers, the financial community, and consumers concerning changes to the state and federal legal, policy, and regulatory regimes. To do so, the ACLP has published papers and hosted an array of interdisciplinary public policy events on key public policy issues impacting stakeholders throughout the advanced communications space.

Davidson previously served as a Commissioner on the Florida Public Service Commission (PSC), the regulatory agency that oversees the state's telecommunications, energy, and water industries. His government work included serving as the Executive Director of Florida's Information Technology Task Force and as the Staff Director of the state's Committee on Information Technology. He previously served as a Special Professor at Hofstra University School of Law. His research interests include studying the antitrust implications of changing communications and utilities marketplaces, identifying necessary policy reforms to spur broadband connectivity across key demographics and sectors of the economy, and developing regulatory and policy reforms in the energy and water spaces. Davidson holds a Masters of Law in Trade Regulation from New York University, a Masters in International Business from Columbia University, and his B.A. and J.D. degrees from the University of Florida, where he served as a fellowship instructor at the College of Law.

Santorelli previously served as the lead staffer for the New York City Council's Committee on Technology. In this capacity, he was responsible for organizing hearings and preparing policy papers on a diverse array of topics. Other duties included drafting legislation and consulting with local stakeholders in the private and nonprofit sectors to develop strategies for spurring use of emerging technologies among underserved populations. His research interests include examining the impacts of new services on existing policy frameworks in the advanced communications and regulated utilities spaces, and considering how to recalibrate regulatory models to accommodate innovation, disruptive technologies, and new business models. Santorelli received his B.A., *cum laude*, from Tufts University, and his J.D., *cum laude*, from New York Law School.

Attachment #3

January 31, 2014

The Honorable Fred Upton
2183 Rayburn House Office Building
Washington, DC 20515

The Honorable Greg Walden
2182 Rayburn House Office Building
Washington, DC 20515

Re: Modernizing the Communications Act – Response to White Paper #1

Dear Chairman Upton and Chairman Walden,

The Advanced Communications Law & Policy Institute (ACLP) at New York Law School respectfully submits the following comments in response to the Committee's white paper titled, "Modernizing the Communications Act." We appreciate the opportunity to weigh in and commend the Committee for launching its inquiry into updating the nation's telecommunications laws.

Should you or your staffs have any questions, please do not hesitate to contact us.

Respectfully submitted,

/s/ Charles M. Davidson
CHARLES M. DAVIDSON, DIRECTOR

/s/ Michael J. Santorelli
MICHAEL J. SANTORELLI, DIRECTOR

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To: The Honorable Chairman Upton and the Honorable Chairman Walden, Energy & Commerce Committee, U.S. House of Representatives

From: Charles M. Davidson & Michael J. Santorelli, ACLP at New York Law School

Re: Foundational Principles for Modernizing the Communications Act

Date: January 31, 2014

The House Energy & Commerce Committee is to be commended for launching its inquiry into updating the nation's telecommunications laws. Such a reassessment is long overdue since, as has been rightly noted, the communications marketplace is fundamentally different today than it was in 1996, when Congress last overhauled the Communications Act.[1] The Committee is also to be commended for engaging interested parties in an open process.

As policymakers, regulators, and others across the country discuss and debate legislative and regulatory modernization, the fact that the U.S. advanced communications sector is thriving should drive the discussion. An abundance of data indicates that consumers are the beneficiaries of significant gains from the increasingly wide range of innovative services, devices, and content being generated by firms throughout a vibrant broadband ecosystem. *These gains have occurred pursuant to a minimalist, bipartisan national policy framework designed to spur a robust advanced communications sector.* In short, Congress succeeded in its approach to advanced communications technologies in the 1996 Act.

As discussed in more detail below, this approach has driven innovation and competition throughout the U.S. advanced communications space. Service providers have invested well over $1 trillion dollars in broadband networks since 1996. Such robust availability of high-speed connectivity has sparked innovation in cutting-edge access devices (e.g., the rise of smartphones and tablets) and content (e.g., the thriving app economy), which in turn has generated enormous economic gains (e.g., thousands of jobs, a larger tax base, and relatively low barriers to entry for entrepreneurs). Equally as important, the innovative ethos that permeates this ecosystem is beginning to seep into key sectors. Broadband and IP-enabled services are poised to fundamentally disrupt not only every segment of the media industry, but also every segment of core sectors of the economy (e.g., education, energy, and healthcare). All consumers, and especially those in key demographic groups (e.g., senior citizens, people with disabilities, minority communities, and low-income households), are poised to benefit profoundly from these disruptions. Indeed, if the transformative potential of broadband networks and IP-enabled services is fully harnessed

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[1] *See Modernizing the Communications Act*, Jan. 8, 2014, Energy & Commerce Committee, U.S. House of Representatives, *available at* http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/analysis/CommActUpdate/20140108WhitePaper.pdf.

in these spaces, consumers will have access to better, more individualized, and more effective education, energy, government, and healthcare services.

To extend this momentum and encourage even more robust experimentation – with business models, service delivery, and every other dimension of the consumer experience – Congress must seize the opportunities afforded by the present inquiry to not only bolster those policies that have shaped our world-leading advanced communications ecosystem, but also to remove antiquated policies that are ill-suited for an era of IP-enabled communications and fast-paced innovation.

To these ends, and in response to the Committee's call for input regarding "thematic concepts for updating the Communications Act,"[2] we respectfully submit the following set of foundational principles, which, in our view, should inform reform efforts going forward. As an overview, these principles are:

1. Reform efforts should be properly contextualized and grounded in objective data. (p. 3)

2. Reform efforts should seek to align legislative and regulatory frameworks with new market realities and orient them around consumer demand. (p. 6)

3. Reform efforts should also focus on establishing policies that help unlock the full transformative potential of broadband and related advanced communications services. (p. 8)

4. FCC authority in the modern communications space should be more precisely delineated and, where appropriate, offset by laws of general applicability. (p. 13)

5. In this context of interstate, if not global, communications networks, the role of the states should be tailored and clearly defined. (p. 14)

Each principle is expanded upon below.

* * * * *

[2] *Id.* at p. 2.

PRINCIPLE #1

Reform efforts should be properly contextualized and grounded in objective data.

Efforts to reassess policy frameworks in the advanced communications arena are too often dominated by:

- Academic debates over the minutia of regulatory theory;
- The contours of pre-existing, platform-specific regulatory frameworks; or
- Subjective preferences for certain regulatory outcomes.

We respectfully suggest that efforts to modernize policy frameworks should be properly contextualized and grounded in objective data.

The Telecommunications Act of 1996 was very much a product of its time. During the mid-1990s, "plain old telephone service" (POTS) remained the primary means of communication. Indeed, the number of basic telephone lines in service increased each year throughout the 1990s and peaked at 192 million lines in 2000.[3] During this same period of time, mobile telephony was ascendant, but the total number of mobile subscribers, while growing exponentially, still paled in comparison to the number of POTS users (by June 1996, there were about 38 million wireless subscribers in the U.S.).[4] Moreover, only one-third of adults in the United States had ever even heard of the Internet by May 1995.[5] As a result, the 1996 Act focused almost exclusively on attempting to "manufacture" competition in the provision of what many predicted to remain the main communications medium: POTS.

Soon after passage of the Act, however, the market began to evolve at a rapid pace. Advanced communications technologies like high-speed Internet access, VoIP, and next-generation mobile telephony quickly emerged in response to the twin forces of (a) consumer demand and (b) the light-touch regulatory framework that Congress had envisioned for these new services. From a policy perspective, the primary impact of these

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[3] *See Local Telephone Competition: Status as of Dec. 31, 2002* (rel. June 2003), at 1, FCC, http://transition.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/lcom0603.pdf ("*Local Telephone Competition: Status as of Dec. 31, 2002*").

[4] *See In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fourth Report, FCC 99-136, Table 1 (rel. June 24, 1999).

[5] *See* Pew Research – Center for the People & the Press, Question Search, Technology And Online Use Survey, May, 1995: Have you ever heard of the Internet?, http://www.people-press.org/question-search/?qid=306323&pid=51&ccid=51#top.

developments was broad recognition that the context had changed in fundamental ways in just a few short years.[6]

Fortunately for consumers, businesses, innovators, and markets, the 1996 Act, while focused primarily on POTS, set forth a foundational principle regarding how new and emerging services like the Internet should be governed. More specifically, Congress provided that it is "the policy of the United States…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, *unfettered by Federal or State regulation*."[7]

The Act also enshrined a critical dichotomy between (i) "basic" services like POTS, which remained highly regulated, and (ii) more interactive "enhanced" services like Internet access, which were understood to, by the very nature of the technology, require a lighter touch.[8] Although a recent interpretation of the statute by a federal appeals court runs counter to the spirit, if not the letter, of this "hands off" national policy,[9] the regulatory framework provided for by Congress has fostered incredible growth in the advanced communications marketplace.

Unlike the POTS-dominant marketplace in 1996, the modern communications sector is characterized by vigorous competition amongst platforms, devices, content, and service providers. The sector evolves on almost a daily basis, driven by an insatiable appetite among consumers for mobile and IP-enabled services. Consumers have made it clear that POTS – highly regulated for well over a century – is not their platform of choice. *In short, the context for legislative and regulatory modernization is significantly different today than it was in the mid-1990s.* A review of recent data and consumer trends offers critical perspective on the scale and scope of these differences.

The total number of POTS lines in service dropped to a modern low of 96 million by the end of 2012,[10] down from its peak at the turn of the 21st century.[11] Of these, less than half – 44.5 million – were residential connections.[12] Meanwhile, the number of interconnected VoIP

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[6] *See, e.g.*, ROBERT W. CRANDALL, COMPETITION AND CHAOS: U.S. TELECOMMUNICATIONS SINCE THE 1996 TELECOM ACT (Brookings Press: Washington, D.C. 2005) (discussing market dynamics in the aftermath of the 1996 Act); JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: TELECOMMUNICATIONS LAW & POLICY IN THE INTERNET AGE 2nd ED. 51(MIT Press: Cambridge, MA 2013) ("DIGITAL CROSSROADS") ("…the 1996 Act has become increasingly anachronistic because its drafters did not fully anticipate, among other developments, the rise of the broadband Internet and its radical reordering of the telecommunications industry.").

[7] 47 U.S.C. § 230 (b) (2) (emphasis added).

[8] DIGITAL CROSSROADS.

[9] Verizon v. FCC, No. 11-1355, slip op. (D.C. Cir. Jan. 14, 2014) (interpreting section 706 of the Communications Act as providing the FCC with broad authority to regulate broadband services).

[10] *See Local Telephone Competition: Status as of Dec. 31, 2012*, at Table 3, FCC (rel. Nov. 2013) (hereinafter "*Local Telephone Competition - Dec. 31, 2012*").

[11] *Local Telephone Competition: Status as of Dec. 31, 2002* at 1.

[12] *Local Telephone Competition - Dec. 31, 2012* at Table 3.

subscriptions rose to nearly 42 million by December 2012, up nearly 50 percent in three years.[13] The vast majority of these – 34 million – were residential.[14] The shift away from POTS has been further hastened by the increasing desire of consumers to use mobile phones as their only means of voice communication. To this end, almost 40 percent of all households had "cut the cord" and gone wireless only by June 2013.[15]

Equally as important has been the growth in use of non-traditional communications services. General Internet use stood at 85 percent of all adults in May 2013,[16] up from 47 percent in June 2000.[17] Broadband adoption reached 70 percent by the middle of 2013.[18] Nearly three-quarters of adults use social networking sites like Facebook and Twitter to communicate for business and pleasure.[19] More than one-third of adults who send text messages on a regular basis prefer to communicate in this way over traditional phone calls.[20] And a rapidly growing percentage of adults use video-calling program like Skype or FaceTime.[21] Table 1 provides a summary of key data points.

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[13] *Id.*

[14] *Id.*

[15] *See* Stephen J. Blumberg and Julian V. Luke, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January–June 2013*, at 1, National Center for Health Statistics, Centers for Disease Control (Dec. 2013), *available at* http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201312.pdf.

[16] *See* Kathryn Zickuhr, *Whose Not Online and Why*, at 2, Pew Internet & American Life Project (Sept. 2013), *available at* http://www.pewinternet.org/~/media//Files/Reports/2013/PIP_Offline%20adults_092513_PDF.pdf.

[17] *See* Kathryn Zickuhr and Aaron Smith, *Digital Differences*, at 5, Pew Internet & American Life Project (April 2011), *available at* http://www.pewinternet.org/~/media//Files/Reports/2012/PIP_Digital_differences_041312.pdf.

[18] *See* Kathryn Zickuhr & Aaron Smith, *Home Broadband 2013*, Pew Internet & American Life Project (Aug. 2013), *available at* http://pewinternet.org/~/media//Files/Reports/2013/PIP_Broadband%202013_082613.pdf.

[19] *See* Maeve Duggan & Aaron Smith, *Social Media Update 2013*, at 1, Pew Internet & American Life Project (Dec. 2013), *available at* http://www.pewinternet.org/~/media//Files/Reports/2013/Social%20Networking%202013_PDF.pdf.

[20] *See* Aaron Smith, *Americans and Text Messaging*, at 8, Pew Internet & American Life Project (Sept. 2011), *available at* http://www.pewinternet.org/~/media//Files/Reports/.

[21] *See, e.g.*, Lee Rainie & Kathryn Zickuhr, *Video Calling and Video Chat*, Pew Internet & American Life Project (Oct. 2010), *available at* http://www.pewinternet.org/~/media//Files/Reports/2010/PIP_Video%20calling%20data%20memo.pdf.

Table 1 – Trends in Consumer Communications Use[22]

	2000	2005	2012/2013*
POTS Lines in Service**	192.5 million 138.9 million residential***	175.3 million 95.8 million residential	96 million 44.5 million residential
Wireless Subscriptions	101 million	203.7 million	326 million
VoIP Subscriptions	<200,000	4.5 million	42 million 34 million residential
High-Speed Lines in Service	7.1 million	43.6 million	262 million
Broadband Adoption Rate	3%	33%	70%

*Most recent available data
**Retail switched access lines
***Also includes small businesses

In sum, these data indicate a vastly different context than what was evident in 1996. As such, it is respectfully submitted that, to the extent possible, discussions going forward revolve first and foremost around how policy can continue to promote more innovation and more investment in this space. How can policy promote more platform, device, and content competition? Ultimately, a "regulate first" mindset is not only data-poor, it is also at odds with current market dynamics, which have generated enormous consumer welfare gains and positioned the United States as a leader in the digital economy.

PRINCIPLE #2

Reform efforts should seek to align legislative and regulatory frameworks with new market realities and orient them around consumer demand.

To preserve the enormous consumer welfare gains being generated in the advanced communications arena – gains that have occurred in response to a bipartisan Congress's call for a mostly "hands-off" approach to regulation – policy should not impede what has become a consumer-driven transition away from POTS and a consumer-driven embrace of lightly regulated, borderless, IP-enabled services and networks. Continued progress hinges on the willingness of policymakers to recognize this new reality of communications in the United States and to structure responses accordingly. To accomplish these goals, reform

[22] *Sources*: FCC Local Telephone Competition Reports for Dec. 31, 2002; Dec. 31, 2005; Jun 30, 2008; Dec. 31, 2011; FCC Internet Access Services Reports for June 30, 2009; Dec. 31, 2012; Pew Internet & American Life; NTIA; Telegeography; CTIA.

efforts should expand policies that have succeeded in driving competition and innovation throughout the U.S. communications space. This will entail: (1) formalizing the minimalist regulatory framework for broadband and extending it to all IP-enabled services; (2) eliminating the "siloes" approach in the current Act; and (3) removing telephone-era laws that are inapplicable in an all-IP world. Taken together, this approach will support further investment in platforms and assure wide latitude for experimenting with new business models and services.

The broadband ecosystem has thrived under a light-touch regulatory framework that was developed in direct response to calls in the 1996 Act for restraint and minimalism.[23] Advanced networks have been deployed to nearly every corner of the United States, providing residents and businesses with numerous options for getting online and using high-speed Internet connections to transform their lives. According to the National Broadband Map, 96.7 percent of the U.S. population had access to at least one wireline broadband provider by the end of 2012, and nearly 90 percent had access to at least two, while about 95 percent of the population had access to three or more wireless broadband providers.[24] Such robust availability is due to more than $1.2 trillion in investment by broadband service providers between 1996 and 2010, and recurring annual investment in excess of $60 billion since 2011.[25]

In light of these continuing developments in the expansion of next-generation broadband networks, Congress should seek to stoke continued investment and foster even more robust intermodal competition and experimentation *by formalizing the current regulatory paradigm for broadband and extending it to all IP-enabled services.*[26] Doing so would protect against regulatory action at the federal or state levels that might undermine or reverse the prevailing model and chill investment and innovation.[27] This model is characterized by the

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[23] *See, e.g.*, William Kennard, Chairman, FCC, *Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at IX-2 (1999), *available at* http://www.fcc.gov/connectglobe/regguide.pdf (observing that "Government policy can have a profound impact on Internet development; it can either foster it or hinder it. To date, the Internet has flourished in large part due to the absence of regulation. A "hands-off" approach allows the Internet to develop free from the burdens of traditional regulatory mechanisms.").

[24] *See* National Broadband Map, Summarize, Analyze: Nationwide, http://www.broadbandmap.gov/summarize/nationwide.

[25] *See* Patrick Brogan, *Updated Capital Spending Data Show Continued Significant Broadband Investment in Nation's Information Infrastructure*, USTelecom Research Brief (April 12, 2012), *available at* http://www.ustelecom.org/sites/default/files/documents/042012_Investment_2011_Research_Brief.pdf.

[26] Even though the FCC has classified all broadband Internet access platforms – DSL, cable, etc. – as lightly regulated "information services," the Commission has still yet to do so for IP-enabled services like VoIP. Indeed, the FCC docket on this particular issue has been open for nearly a decade. *See In the Matter of IP-Enabled Services*, Notice of Proposed Rulemaking, 19 FCC Rcd. 4863 (rel. March 10, 2004).

[27] As discussed below, there are numerous opportunities for federal and state regulators to implement policies that might undermine ongoing progress in the broadband ecosystem. At the federal level, there is a possibility in light of the recent net neutrality decision that the FCC could extend common carrier regulation to broadband and IP-enabled services. *See, e.g.*, Brendan Sasso, *The FCC's Nuclear Option on Net Neutrality*, Jan. 14, 2014, National Journal, *available at* http://www.nationaljournal.com/technology/the-fcc-s-nuclear-option-on-net-neutrality-20140115. At the state level, regulatory commissioners have espoused a desire for a

following elements: a (1) generally deregulatory approach to broadband and IP-enabled services (i.e., the current "information services" paradigm) that is (2) administered at the national level, and that both (3) reflects the intermodal and borderless nature of new services and (4) positions consumer demand (not *ex ante* regulation) as the primary driver of policy in this space.

Implicit in this model is recognition of the converged and dynamic nature of the modern marketplace. With most new communications platforms and services being built around IP, a rigid, formalistic "siloes" approach to regulation no longer makes sense. In many ways, the competitive landscape has been flattened by IP, allowing for robust cross-sector competition that was simply not possible when the original communications laws were drafted and implemented. Indeed, IP-enabled services are disrupting every segment of the U.S. communications space and most sectors of the economy. As such, there are opportunities to not only revise the statute to reflect these new dynamics, which should include the elimination of outdated rules and requirements, but also to integrate modern notions of competition policy and analysis.[28] Doing so would shift the assumptions underlying the statute toward a fuller embrace of the competitive landscape for communications services in the United States. Equally as important, it would also encourage further experimentation in the delivery of key services to consumers (e.g., continued business model innovation; testing the extent to which consumers prefer certain services to be prioritized; etc.).

PRINCIPLE #3

Reform efforts should also focus on establishing policies that help unlock the full transformative potential of broadband and related advanced communications services.

Any rewrite of the Communications Act should also seek to unlock the full transformative potential of broadband and related advanced communications services. Among other things, this will require the development of policies to ensure that demand for and use of vital new communications services, especially in key demographic groups and sectors of the economy, continues to grow.

Over the last decade, there has been significant progress toward empowering all Americans with Internet access and the skills needed to put those connections to meaningful uses.

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more muscular and active state role in the regulation of these services. *See Cooperative Federalism and Telecom in the 21st Century*, Federalism Task Force Report, National Association of Regulatory Utility Commissioners (Nov. 2013) (updating but largely reinforcing NARUC's policies regarding the need for a strong state role in the cooperative model of federalism devised for the telecommunications space under the prevailing communications laws).

[28] For too long, competition analysis has revolved around "simplistic" notions like how many firms are competing in a market. In a converged market characterized by cross-platform competition, such approaches are inadequate. *See generally* Barak Orbach and Grace Campbell Rebling, *The Antitrust Curse of Bigness*, 85 S. Cal. L. Rev. 605 (2012) (describing the historical evolution of this "simplistic" approach to evaluating competition).

Broadband adoption rates have more than doubled over the last eight years, rising to 70 percent in 2013 (see Table 1, above). Yet, despite such promising gains, gaps remain. In particular, large percentages of demographic groups poised to benefit most immediately and profoundly from broadband and IP-enabled services – low-income households, senior citizens, people with disabilities, African Americans and Hispanics – remain unconnected. Table 2 provides a summary.

Table 2– Home Broadband Adoption (Percent of Population): 2009-20013

	2009*	2010**	2011†	2012††	2013†††
All Adults	65	68	69	65	70
Race					
White	69	72	74	70	74
Black	59	55	55	53	64
Hispanic	49	57	56	49	53
Age					
18-29	75	77 (16-44)	77 (16-44)	75	80
30-49	74			75	78
50-64	64	72 (45-64)	73 (45-64)	62 (50-64)	69 (50-64)
65+	35	45	49	41	43
Income					
Low-income	40 (<$20,000)	43 (<$25,000)	43 (<$25,000)	46 (<$30,000)	54 (<$30,000)
High-income	93 (>$75,000)	93 (>$100,000)	93 (>$100,000)	89 (>$75,000)	88 (>$75,000)

* *Broadband Adoption and Use in America*, FCC (2010)
** *Exploring the Digital Nation: Computer and Internet Use at Home*, National Telecommunications & Information Administration, U.S. Dept. of Commerce (Nov. 2011), *available at* http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_computer_and_internet_use_at_home_11092011.pdf
† *Exploring the Digital Nation: America's Emerging Online Experience*, NTIA, U.S. Dept. of Commerce (June 2013), *available at* http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_-_americas_emerging_online_experience.pdf
†† Joanna Brenner & Lee Rainie, *Pew Internet: Broadband*, Pew Internet & American Life Project (Dec. 2012), *available at* http://pewinternet.org/Commentary/2012/May/Pew-Internet-Broadband.aspx
††† Kathryn Zickuhr & Aaron Smith, *Home Broadband 2013*, Pew Internet & American Life Project (Aug. 2013), *available at* http://pewinternet.org/~/media//Files/Reports/2013/PIP_Broadband%202013_082613.pdf

While some continue to insist that the price of broadband is the sole impediment to more robust adoption in these communities, a growing body of research has confirmed that an array of more nuanced and community-specific barriers are in fact the primary obstacles to higher usage rates.[29] Foremost among these barriers is a widely held belief among non-adopters that broadband is not relevant to their lives and thus not worth an investment of

[29] *See, e.g.*, Charles M. Davidson and Michael J. Santorelli, *Barriers to Broadband Adoption: A Report to the FCC*, Advanced Communications Law & Policy Institute, N.Y. Law School (Oct. 2009), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/ACLP-Report-to-the-FCC-Barriers-to-BB-Adoption.pdf ("*Barriers to Broadband Adoption*").

time and money in purchasing the service (and related equipment) and learning how to use it.[30] It is now widely acknowledged that this outlook impacts the perceived affordability of broadband, contributing to a significant number of non-adopters who view the service as too expensive despite the fact that prices have generally declined.[31] Related barriers revolve around a lack of digital literacy skills, which contribute to fears among some around the security and privacy of going online and participating in activities like e-commerce. Table 3 summarizes major barriers impacting broadband adoption by senior citizens, people with disabilities, minority communities, and low-income households.

Table 3– Barriers Impacting Key User Communities[32]

Senior Citizens	People with Disabilities	Minority Communities	Low-Income Households
▪ Lack of awareness regarding the value of using broadband ▪ Usability concerns ▪ Low rate of computer ownership ▪ Security and privacy concerns ▪ Lack of senior-focused training programs ▪ Lack of digital literacy skills	▪ Low levels of computer ownership ▪ Negative perceptions re accessibility of broadband and broadband-enabled services ▪ Affordability concerns ▪ Interoperability of assistive technologies ▪ Lack of digital literacy skills	▪ Lack of awareness regarding the value of using broadband ▪ Low rates of computer ownership ▪ Affordability concerns stemming from lack of perceive relevance ▪ Underdeveloped digital literacy skills	▪ Perception that broadband is not a worthwhile investment of scarce funds ▪ Lack of digital literacy skills ▪ Low rates of computer ownership ▪ Affordability concerns tied to billing issues

Successfully overcoming these barriers requires outreach and training initiatives that are tailored to address the needs of individual communities.[33] Indeed, the ability to calibrate

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[30] *See, e.g.*, Charles M. Davidson, Michael J. Santorelli & Thomas Kamber, *Broadband Adoption: Why it Matters & How it Works*, 19 Media L. & Pol'y 14 (2009), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/Davidson_Santorelli_Kamber-BB-Adoption-Article-MLP-19.1.pdf ("*Broadband Adoption: Why it Matters & How it Works*").

[31] *Id. See also* Charles M. Davidson, Michael J. Santorelli, and Tom Kamber, *Toward an Inclusive Measure of Broadband Adoption*, 6 International Journal of Communication 2555 (2012), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/Davidson-Santorelli-Kamber-Toward-an-Inclusive-Measure-of-Broadband-Adoption-IJOC-2012.pdf ("*Toward an Inclusive Measure*").

[32] These barriers were derived from: *Barriers to Broadband Adoption; Connecting America: The National Broadband Plan*, Federal Communications Commission (March 2010) ("*National Broadband Plan*"); Dharma Dailey et al., *Broadband Adoption in Low Income Communities*, Social Science Research Council (March 2010); Jon Gant et al., *National Minority Broadband Adoption*, Joint Center for Political & Economic Studies (Feb. 2010).

[33] *See, e.g.*, *Toward an Inclusive Measure.*

programmatic responses to non-adoption in distinct communities is essential to not only increasing adoption rates but also to assuring that new users will be able to use their connections in meaningful ways. The most effective approaches in this context are structured as public-private partnerships, which combine public resources with the expertise of private firms or nonprofit groups to deliver key services (e.g., digital literacy training) to non-adopters.[34] Properly structured and deployed, these partnerships have yielded promising gains in many communities across the country.

In the context of broadband use in key sectors like education, energy, and healthcare, numerous barriers also impede further progress towards using new technologies to remake vital segments of the U.S. economy (see Table 4).

Table 4 – Barriers Impacting Key Sectors[35]

Education	Energy	Healthcare
▪ Cost concerns ▪ Outdated E-rate program ▪ Lack of a more targeted strategy for allocating federal funding ▪ Inadequate teacher training ▪ Demographic disparities in technology literacy ▪ Organizational barriers among educators ▪ Lack of adequate bandwidth within schools ▪ Lack of national curriculum standards	▪ Outdated regulatory framework creates little incentive for utilities to innovate ▪ State-by-state patchwork of regulation impedes national-scale deployment ▪ Substantial upfront implementation costs ▪ Lack of demand for smart home services by residential customers ▪ Unresolved data security, cybersecurity, and privacy concerns	▪ Inadequate reimbursement mechanisms for most telemedicine services ▪ Outdated privacy and security policies ▪ State-by-state patchwork of rules regarding physician licensure and credentialing ▪ Cost concerns ▪ Uncertainty regarding the applicability of tort law ▪ Skepticism among healthcare providers and patients regarding the value of using these tools

Removing these barriers will require similarly multifaceted approaches. In many instances, however, major impediments stem from state and federal laws and regulations that are unsuited for the broadband era. For example, state-level physician licensure policies were developed at a time when most doctors provided services only within a small geographic area.[36] Modern telemedicine systems, though, are borderless and allow physicians to

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[34] *See, e.g.*, Charles M. Davidson & Michael J. Santorelli, *Broadband and the Empire State: Toward Universal Connectivity in New York*, Advanced Communications Law & Policy Institute, N.Y. Law School (Sept. 2012), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/ACLP-Report-Broadband-and-the-Empire-State-September-2012.pdf.

[35] These barriers were derived from: *National Broadband Plan; Barriers to Broadband Adoption.*

[36] *See, e.g.*, Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Telemedicine*, Report to the U.S. Chamber of Commerce (April 2009), *available at* http://www.uschamber.com/sites/default/files/about/0904Broadband_and_Telemedicine.pdf.

consult with patients regardless of geographic location.[37] Federal and state policymakers are beginning to address barriers in many sectors. Recent examples include: E-Rate reform in the education space;[38] expanding the scope of reimbursement to cover more telemedicine services;[39] and efforts to modernize the energy regulatory framework to facilitate smart grid deployment.[40] But much remains to be done.

Modernizing the Communications Act provides numerous opportunities to address, both directly and indirectly, these types of critical demand side issues. For example, legislative modernization provides a unique opportunity to revisit existing universal service policies and programs and recalibrate them to more explicitly address lingering demand side issues (e.g., by shifting subsidies to consumers). Congress could also articulate a preference – and create mechanisms – for public-private models aimed at bolstering broadband connectivity.

Reform efforts could also address major barriers impeding greater use of broadband in certain sectors. These could include solutions to specific issues (e.g., calling for the implementation of a national physician licensure framework in the telemedicine space) as well as the articulation of general principles in support of further experimentation and innovation in the provision of key services. Ultimately, as innovators continue forward in their work to harness the transformative power of broadband and IP-enabled services in critical sectors, it is vital that they have sufficient latitude to calibrate delivery methods and business models according to organic consumer demand, not artificial regulatory or legislative mandates.

In short, Congress is respectfully encouraged to consider how to integrate comprehensive demand side policies into an updated Communications Act in a manner that maximizes existing resources (and shrinks obligations over time) while also furthering national imperatives for advanced communications technologies.

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[37] *Id.*

[38] *See, e.g.*, *Fact Sheet: Update of E-Rate for Broadband in Schools and Libraries*, FCC (July 2013), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0719/DOC-322288A1.pdf.

[39] *See, e.g.*, *Expansion of Medicare Telehealth Services for CY 2014*, Centers for Medicare & Medicaid Services (Jan. 6, 2014), *available at* http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNMattersArticles/downloads/MM8553.pdf (detailing expansion of Medicare coverage for new telehealth services); Eric Wicklund, *More States Take to Telehealth Expansion*, July 17, 2013, Healthcare IT News, *available at* http://www.healthcareitnews.com/news/more-states-take-telehealth-expansion (reporting on efforts in various states to "mandate that private insurers reimburse healthcare providers for telehealth services on the same basis that they would for in-person services, while also prohibiting them from denying coverage for telehealth services.").

[40] For an overview, *see generally* Charles M. Davidson & Michael J. Santorelli, *Realizing the Smart Grid Imperative: A Framework for Enhancing Collaboration Between Energy Utilities & Broadband Service Providers*, Time Warner Cable Research Program on Digital Communications (Aug. 2011), *available at* http://www.nyls.edu/advanced-communications-law-and-policy-institute/wp-content/uploads/sites/169/2013/08/TWC_Davidson.pdf.

PRINCIPLE #4

FCC authority in the modern communications space should be more precisely delineated and, where appropriate, offset by laws of general applicability.

Modernizing the Communications Act will entail at least some recalibration of the FCC's mandate as the primary regulator of the U.S. communications space. To the extent possible, it is respectfully submitted that Congress should make every effort to more precisely define the contours of FCC authority in this highly dynamic sector and, where appropriate, offset narrower FCC oversight with laws of general applicability (e.g., antitrust, consumer protection laws).

Specificity in the statute, of course, does not automatically assure regulatory certainty (see, for example, the extended legal and regulatory battles that emerged in the aftermath of the 1996 Act, especially in the context of FCC implementation of Congressional mandates regarding telephone network access by competitive providers). Even so, precision in statutory grants of authority is increasingly essential in a highly dynamic marketplace because broad "catchall" provisions could eventually be used in ways that contravene Congressional intent. The recent kerfuffle over the legality of the FCC's network neutrality rules offers an illustrative example of how vague or seemingly innocuous provisions could blossom into broad regulatory power.

The Commission's latest attempt to justify imposition of network neutrality rules hinged on a broad reading of section 706 of the Telecommunications Act.[41] Although an appeals court vacated some of the rules, it also interpreted this particular section as possibly authorizing nearly limitless authority by the FCC to regulate broadband services.[42] Key to this reading was a questionable determination by the FCC that broadband was not being deployed in a "reasonable and timely" manner.[43] According to the court, this conclusion is likely sufficient to support broad interventions into the marketplace, so long as those interventions constitute "immediate action to accelerate deployment of [broadband] capability."[44] Previously, the FCC had rarely invoked section 706 except as the basis for issuing reports on the deployment status of "advanced telecommunications services" (i.e., broadband). The current interpretation – first advanced by the FCC and subsequently accepted the appeals court – not only broadens significantly the prevailing understanding of the meaning of this provision, it also undermines well over a decade of regulatory restraint by an agency that, for many years, grounded its approach in what it interpreted as a clear call by Congress to

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[41] A previous attempt by the FCC to implement similar rules was struck down by a federal court because the Commission failed to justify that the Communications Act granted it authority to carry out its proposed censure of a broadband service provider. *See* Comcast v. FCC, 600 F.3d 642 (D.C. Cir. 2010).

[42] Verizon v. FCC, No. 11-1355, slip op. at 22 (D.C. Cir. Jan. 14, 2014).

[43] *Id.* at 27-28.

[44] *Id.* (citing 47 U.S.C. § 1302 (b)).

exercise caution in the regulation of dynamic services.[45] (Moreover, that such broad regulatory authority was unlocked by a new interpretation of data regarding broadband availability in the U.S. raises important questions about data gathering and analysis techniques at the FCC – questions that ought to be addressed during the present Congressional inquiry.)

At a time when the courts are increasingly deferential to agency interpretations of the outer bounds of their jurisdiction,[46] precision in any Congressional grant of authority to an entity, including the FCC, which operates in a sector undergoing constant creative destruction, is critical. To the extent possible, Congress should thus specify the FCC's reach on key issues like regulating broadband and IP-enabled services. As discussed above, an optimal path forward would be formalizing the regulatory framework that fostered such incredible growth in this space over the last decade.

Similarly, Congress should seize the opportunity afforded by the present inquiry to undertake a fundamental reexamination of the efficacy of locating primary oversight authority for broadband and IP-enabled services at the FCC. Some have argued in favor of eliminating or sharply reducing FCC authority in this space and replacing it with antitrust enforcement by other federal authorities like the FTC.[47] Others have called for systemic deregulation in light of current market forces and dynamics in the broadband ecosystem.[48] A middle ground approach would narrow FCC authority along the lines discussed above and supplement it with laws of general applicability (e.g., antitrust principles and consumer protection laws) that are enforced in appropriate venues (e.g., the FTC). At a minimum, Congress's efforts here should be guided by modern notions of innovation and competition that are reflective of the broadband ecosystem.

PRINCIPLE #5

In this context of interstate, if not global, communications networks, the role of the states should be tailored and clearly defined.

The historical balance of federal-state regulation in the telecommunications space evolved out of a very specific context: the development of the telephone network. Initially, telephone networks and POTS were almost exclusively local in nature. The formal

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[45] *See, e.g.*, *Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, 17 FCC Rcd 4798 (2002), *aff'd* Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv., 545 U.S. 967 (2005).

[46] In City of Arlington v. FCC, 133 S. Ct. 1863 (2013), the Supreme Court held that courts should defer to an agency's interpretation of its own jurisdiction so long as that interpretation is reasonable. This adds to a long line of case law around judicial deference to agencies when interpreting their enabling statutes. The landmark case here was Chevron v. Natural Resources Defense Council, 467 U.S. 837 (1984).

[47] *See, e.g.*, Jonathan E. Nuechterlein, *Antitrust Oversight of an Antitrust Dispute: An Institutional Perspective on the Net Neutrality Debate*, 7 J. on Telecomm. & High Tech. L. 19 (2009) (discussing the need for antitrust enforcement in the context of net neutrality disputes).

[48] *See, e.g.*, Christopher S. Yoo, *Deregulation vs. Reregulation of Telecommunications: A Clash of Regulatory Paradigms*, 36 J. Corp. L. 847, 866-867 (2011).

regulatory responses that eventually emerged at the state level echoed those that had been developed for services like the railroads and other services with natural monopoly characteristics. Regulation was exacting in nature and focused almost exclusively on achieving two related goals: assuring universal service and keeping local rates low. A state-centric approach was especially apt during this early era because most telephone calls were intrastate in nature. Indeed, as late as the 1910s, less than two percent of telephone calls were interstate.[49]

Even so, Congress recognized that the still-fledgling telephone sector was of national significance and crucial to bolstering economic activity. As a result, policymakers on several occasions acted to assert the primacy of *national policy* – i.e., policy for the benefit of all states – in the regulation of POTS. Examples included the assignment of regulatory jurisdiction over interstate aspects of POTS to the Interstate Commerce Commission in 1910; the Kingsbury Commitment of 1913, which served to sanction AT&T's monopoly in exchange for regulation and the realization of certain social goals (e.g., universal service); and the enactment of the Communications Act of 1934, which enshrined a model of dual federalism in the regulation of POTS.

The role that was eventually carved out for the states was not forged to uphold academic notions of federalism; rather, it was developed in recognition of the clearly identifiable intrastate and interstate elements of POTS. Some have argued that "Because every aspect of telecommunications can be characterized as an instrumentality of interstate commerce, Congress could have preempted all state regulation in this area under the Commerce Clause of the U.S. Constitution and placed the entire industry within the exclusive province of a federal regulator."[50] Instead, Congress, given the unique facts and circumstances at hand, developed a model of dual federalism and permitted the states to share some of the burden in realizing certain policy imperatives for the telephone network, namely universal service and low local rates.

The facts and circumstances of today are materially different. Today's communications space is dominated by inherently borderless that lack clearly identifiable intrastate characteristics. The clearest expression of this principle came in a 2007 case upholding FCC preemption of an attempt by a state PUC to regulate VoIP. There, the court held that the FCC can "preempt state regulation of a service which would otherwise be subject to dual federal and state regulation where it is impossible or impractical to separate the service's intrastate and interstate components, and the state regulation interferes with valid federal rules or policies."[51] While some state actors were upset with the FCC's approach, it was ultimately grounded in the reality of VoIP technology.

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[49] *See* Eli Noam, *Federal and State Roles in Telecommunications: The Effects of Deregulation*, 36 Vand. L. Rev. 949, 954 (1983).

[50] *See* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE 1ST ED. 47 (MIT Press: Cambridge, MA 2005).

[51] Minn. Pub. Utils. Comm'n. v. FCC, 483 F. 3d 570, 576 (8th Cir. 2007).

In short, modern market conditions demand a new balance of regulatory federalism in the advanced communications space. Recent trends in state-level legislation to deregulate communications services,[52] coupled with federal actions to streamline local processes impacting the deployment of broadband networks (e.g., a "shot clock" for wireless tower siting approvals[53]), support a fundamental reassessment of the formal regulatory role that states should play going forward. Failure to do so could invite additional attempts by state regulatory entities to explore the boundaries of their existing authority in this space. Without clearer federal guidance, this could lead to the creation of a patchwork of state-level regulations impacting various aspects of the communications market. Such would risk enormous consumer welfare losses in the form of higher prices and fewer competitive choices. This approach also might foreclose opportunities to collaborate with federal counterparts and stakeholders in industry to develop more consistent regulatory frameworks that include narrower but more well-defined roles for the states.

This is not to say that states have no role to play in the modern communications space. On the contrary, there are numerous roles that state actors – Governors, legislatures, regulators, etc. – can and should play going forward. Increasingly, many different state-level entities are working to fulfill new mandates for broadband set forth by the legislative and executive branches.[54] In particular, state authorities are embracing broadband as an essential tool for economic transformation and for remaking government. State legislators and executives are thus well positioned to set statewide goals for broadband and allocate funding and regulatory authority accordingly. Similarly, state regulators have also proven to be important actors in realizing state and national goals for broadband. For example, several state PUCs were tasked with overseeing broadband mapping initiatives, which were launched as a result of federal legislation.[55] Moreover, state PUCs have the ability to convene hearings and deploy public awareness campaigns in furtherance of federal and state public policy goals. Adapting these non-regulatory approaches in the broadband connectivity context could be a natural expansion of core competencies.

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[52] For an overview of recent actions by state legislatures, *see* Sherry Lichtenberg, *Telecommunications Deregulation: Updating the Scorecard for 2013*, National Regulatory Research Institute (May 2013), *available at* http://nrri.org/documents/317330/0e3a5988-6f57-492d-8ce5-70926cfe68f4.

[53] *See In the Matter of Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and to Preempt Under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance*, Declaratory Ruling, 24 FCC Rcd 13994 (2009), *aff'd* City of Arlington v. FCC, 133 S. Ct. 1863 (2013).

[54] *See, e.g.*, NCSL, Broadband Statutes (last updated: Dec. 16, 2013), http://www.ncsl.org/issues-research/telecom/broadband-statutes.aspx (providing an overview of dozens of broadband-related state laws that have been considered in recent years).

[55] For an overview of state-level mapping programs, *see* National Broadband Map, About: State Broadband Programs, http://www.broadbandmap.gov/about/state-broadband-programs.

Attachment #4

Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century

Charles M. Davidson[†] & Michael J. Santorelli[‡]

I. INTRODUCTION

Communications services have consistently played an important role in U.S. economic development.[1] Characterized by economies of scale and exhibiting network effects,[2] these services have welfare-enhancing benefits that spur in-

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[1] For example, the telegraph is often credited with laying the foundation for modern commerce. Robert Horwitz observed, "[t]he telegraph was instrumental in the rise of the large corporation. Instantaneous communication greatly lowered information and transaction costs for many firms, enabling them to widen their markets. This had the effect of increasing their size and scale…Geographically dispersed operations and agents could be brought under centralized supervision." ROBERT BRITT HORWITZ, THE IRONY OF REGULATORY REFORM 92-93 (Oxford Univ. Press 1989) [hereinafter IRONY OF REGULATORY REFORM]. More recently, innovation in the communications sector—e.g., widespread use of information technologies—has had a direct impact on facilitating rapid globalization of a number of key industries. *See, e.g.*, MARTIN WOLF, WHY GLOBALIZATION WORKS 119-120 (Yale Univ. Press 2004); ERIK BRYNJOLFSSON & ADAM SAUNDERS, WIRED FOR INNOVATION: HOW INFORMATION TECHNOLOGY IS RESHAPING THE ECONOMY xi (MIT Press 2009) ("[I]nformation technology has been responsible, directly or indirectly, for most of the resurgence of productivity in the United States since 1995.").

[2] *See* Lars-Hendrik Röller & Leonard Waverman, *Telecommunications Infrastructure and Economic Development: A Simultaneous Approach*, 91 AMER. ECON. REV. 909, 911 (2001) ("One seemingly important characteristic of telecommunication technologies, which is not present in other types of infrastructure, is *network externalities*: the more users, the more value is derived by those users.").

novation in other sectors by virtue of a spillover effect.[3] While the full range of communications services has exhibited such impacts throughout the industry's long history, broadband, the newest of the communications technologies, has quickly become the most robust platform to facilitate economic development, enable new business models and stimulate innovation across innumerable sectors.[4]

The recent economic downturn highlights the critical role broadband will play in the recovery and future gains of the U.S. economy.[5] In early 2009, at the trough of the recession, the U.S. Congress passed the American Recovery and Reinvestment Act ("ARRA"),[6] enacted to "jump-start the economy to create and save jobs."[7] A key part of this initiative is broadband as a means to stimulate economic activity and serve as the primary vehicle to realize the goals of ARRA.[8] To this end, ARRA allocated over $7 billion for broadband deployment to unserved areas of the United States.[9] ARRA also called upon

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[3] *See, e.g.*, IRONY OF REGULATORY REFORM, *supra* note 1, at 92 ("In tandem with the railroads, the telegraph forged extra-local links among merchants, shippers, bankers, and brokers, and thus facilitated regional (as opposed to local) commerce."); SUSAN E. MCMASTER, THE TELECOMMUNICATIONS INDUSTRY 6-11 (Greenwood 2002) (discussing the emergence of the telephone as a preferred means of communications over the telegraph and providing an example of stockbrokers preferring to conduct business over the phone rather than via the slower telegraph).

[4] EXEC. OFFICE OF THE PRESIDENT, THE RECOVERY ACT: BUILDING A PLATFORM FOR PRIVATE SECTOR INNOVATION: INVESTMENTS IN BROADBAND, SMART GRID, AND HEALTH INFORMATION TECHNOLOGY 27-30 (Aug. 2010), *available at* http://www.whitehouse.gov/sites/default/files/microsites/Recovery_Act.pdf.

[5] For example, one study suggests that, absent new regulations that discourage investment in networks, broadband is expected to create or sustain 500,000 jobs through 2015. *See* ROBERT W. CRANDALL & HAL J. SINGER, THE ECONOMIC IMPACT OF BROADBAND INVESTMENT 3 (Feb. 23, 2010), http://www.ncta.com/PublicationType/ExpertStudy/The-Economic-Impact-of-Broadband-Investment.apx. Conversely, the introduction of new regulations could deter capital expenditures in broadband networks, which could in turn result in the loss or failed creation of at least 500,000 jobs through 2015 and the loss of tens of billions of dollars in economic output. *See* CHARLES M. DAVIDSON & BRET T. SWANSON, ADVANCED COMMC'NS L. & POL'Y INST., NET NEUTRALITY, INVESTMENT & JOBS: ASSESSING THE POTENTIAL IMPACTS OF THE FCC'S PROPOSED NET NEUTRALITY RULES ON THE BROADBAND ECOSYSTEM i-ii (2010), http://www.nyls.edu/user_files/1/3/4/30/83/Davidson & Swanson - NN Economic Impact Paper - FINAL.pdf [hereinafter NET NEUTRALITY, INVESTMENT & JOBS].

[6] American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

[7] *FAQs for Citizens*, Recovery.gov, http://www.recovery.gov/FAQ/Pages/ForCitizens.aspx (last visited Jan. 1, 2011).

[8] *See* 155 CONG. REC. H1048 (daily ed. Feb. 9, 2009) (statement of Rep. Christensen); 155 CONG. REC. H1558 (daily ed. Feb, 13, 2009) (statement of Rep. Waxman); U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-823, RECOVERY ACT: FURTHER OPPORTUNITIES EXIST TO STRENGTHEN OVERSIGHT OF BROADBAND STIMULUS PROGRAMS 30 (2010).

[9] American Recovery and Reinvestment Act, Pub. L. No. 111-5, 123 Stat. 115, 118,

the FCC to undertake an extensive review of the current broadband sector and issue a national plan to ensure the deployment and usage of broadband "technology . . . intersects with just about every great challenge facing our nation."[10] The FCC's *National Broadband Plan* was issued in March 2010.[11]

A close look at the ARRA legislation and other supporting legislative and regulatory initiatives seeking to bolster economic activity, however, reveals that, while wired broadband deployment (e.g., build-out of existing cable or fiber networks) is important, it is wireless broadband that is vital to realizing the myriad goals of policymakers at the state and federal levels.[12] Indeed, as discussed in this article, wireless broadband will be indispensible to key gains in the public safety, healthcare, energy, and education arenas.[13] The portability and flexibility inherent in wireless broadband facilitates a wider array of applications and uses than are possible via purely wired networks. For example,

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119, 128, 512-516 (2009).

[10] *In re* A National Broadband Plan for Our Future, *Notice of Inquiry*, 24 F.C.C.R. 4342 ¶¶ 2, 6 (Apr. 8, 2009).

[11] Press Release, Fed. Commc'ns Comm'n, FCC Sends National Broadband Plan to Congress (Mar. 16, 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296880A1.pdf. *See generally* FED. COMMC'NS COMM'N, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN (2010), *available at* http://www.broadband.gov/download-plan [hereinafter NATIONAL BROADBAND PLAN].

[12] *See, e.g.*, Julius Genachowski, Chairman, Fed. Commc'ns Comm'n, Prepared Remarks at the International CTIA Wireless I.T. & Entertainment: America's Mobile Broadband Future 2-3 (Oct. 7, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf (highlighting the "promise of mobile broadband") [hereinafter Genachowski Wireless Remarks—Oct. 7, 2009]; Julius Genachowski, Chairman, Fed. Commc'ns Comm'n, Prepared Remarks at the International Telecommunications Union Global Symposium for Regulators: ICT: Global Opportunities and Challenges 3-4 (Nov. 10, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-294594A1.pdf (commenting that the FCC believes that "broadband is the future of mobile, and also that mobile is a key part of the strategy for broadband"); Julius Genachowski, Chairman, Fed. Commc'ns Comm'n, Prepared Remarks at the New America Foundation: Mobile Broadband: A 21st Century Plan for U.S. Competitiveness, Innovation and Job Creation 2 (Feb. 24, 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296490A1.pdf ("No area of the broadband ecosystem holds more promise for transformational innovation than mobile.") [hereinafter Genachowski Remarks—Feb. 24, 2010]; NATIONAL BROADBAND PLAN, *supra* note 11 at 9-10 (noting that a core goal of the NBP is to ensure that the "United States should lead the world in mobile innovation").

[13] *See, e.g.*, Julius Genachowski, Chairman, Fed. Commc'ns Comm'n, Prepared Remarks at the NAB Show 2010, 3 (Apr. 13, 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-297469A1.pdf ("Mobile Internet access can be not only a powerful platform for substantial 21st century job and business creation, but also a critical part of the solution to pressing national challenges like education, health care, energy, and public safety.") [hereinafter Genachowski Remarks—April 13, 2010].

while robust wired broadband networks are essential for backhaul content transport, wireless connections at network's edge enable cutting-edge telemedicine applications like real-time in-home monitoring of a patient's vital signs.[14] Similarly, wireless sensors are being used to make the electric grid more intelligent by monitoring the transmission of energy and providing customers and service providers with real-time usage data.[15] These are but a few examples of the growing role that wireless broadband is playing in efforts to spur economic growth and modernize antiquated industries.

Yet unlike wired broadband, wireless broadband development is dependent upon a scarce, finite public resource: spectrum.[16] Indeed, it is this distinguishing characteristic that makes the wireless sector uniquely vulnerable to regulatory adjustments regarding the allocation of this critical element.[17] To date, the wireless sector has flourished under a regulatory framework that makes spectrum available in a relatively efficient manner.[18]

This article argues that, in order to realize further economic and social gains that are enabled by wireless broadband, innovators must have consistent access to additional, unencumbered spectrum resources. As a result, policymakers must implement policies that make additional swaths of the airwaves available to those innovators that are willing to risk capital in developing and deploying advanced services via wireless broadband.

Part II provides an analysis of the current wireless marketplace and highlights the increasingly indispensible role that mobile technology is playing in everyday life. Consumers use their wireless devices to make calls, send emails, surf the Internet, and participate in an array of activities that were impossible only a few years ago. Part II also describes how wireless broadband is used to deploy cutting-edge services and applications in a variety of industries that, traditionally, have had little interaction with the wireless sector. Examples of new wireless services and applications in the public safety, telemedicine, education, and energy sectors are provided to demonstrate that wireless broadband is beginning to drive innovation across the entire economy.[19] These and other

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[14] *See* discussion *infra* Part II.B.2.

[15] *See* discussion *infra* Part II.B.3.

[16] Fed. Commc'ns Comm'n, *Strategic Plan: FY 2003 – FY 2008* 14, http://www.fcc.gov/omd/strategicplan/strategicplan2003-2008.pdf; Office of the Press Sec'y, Exec. Office of the President, Fact Sheet: Doubling the Amount of Commercial Spectrum to Unleash the Innovative Potential of Wireless Broadband (Jun. 28, 2010), http://www.whitehouse.gov/the-press-office/fact-sheet-doubling-amount-commercial-spectrum-unleash-innovative-potential-wireles.

[17] *See* discussion *infra* Part III.

[18] *Id.*

[19] *See* discussion *infra* Part II.; NAT'L ECON. COUNCIL, EXEC. OFFICE OF THE PRESIDENT, RECOVERY ACT INVESTMENTS IN BROADBAND: LEVERAGING FEDERAL DOLLARS TO CREATE

examples represent the results, to date, of a relatively forward-looking and market-driven spectrum allocation regime at the FCC. This regime, which has historically been reactive to market dynamics and consumer demand, is essential to fostering a vibrant wireless sector.

Part III discusses the evolution of the FCC's spectrum allocation policy in order to highlight best practices for developing and implementing effective policies going forward. Historically, the FCC has responded to increased consumer demand for advanced wireless services by making additional spectrum available for auction. However, on a few occasions over the last several years, the FCC has strayed from this approach by, among other things, encumbering spectrum with conditions that sought to ensure specific policy outcomes. At this critical moment in the evolution of both the broadband and wireless markets, it is incumbent upon policymakers to adhere to a regulatory approach that is responsive to market conditions and conducive to the type of experimentation that has positioned wireless broadband to be a key enabler of life-enhancing, and increasingly lifesaving, services and applications.

Part IV draws upon previously discussed best practices to articulate a set of recommendations to modify the spectrum allocation policy framework. As a first step, policymakers must acknowledge the looming gap between the spectrum resources that innovators need and the spectrum resources likely to be made available, and act swiftly to implement a policy framework that makes these necessary raw materials immediately available. A key tool will be creating and maintaining an inventory that catalogues current spectrum uses and identifies under- and un-used swaths of the airwaves. Understanding how the airwaves are being used is essential to determining whether and how to reallocate spectrum resources to innovators that need them most. Finally, Part IV discusses the importance of providing network owners with wide latitude to employ network management techniques that enable new business models to be deployed.

Foundational Principles

Policymakers have premised many assumptions about future economic growth on the wide availability of advanced broadband networks.[20] Wireless

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JOBS AND CONNECT AMERICA (2009), *available at* http://www.whitehouse.gov/sites/default/files/20091217-recovery-act-investments-broadband.pdf.

[20] *Id.*; Memorandum from the Exec. Office of the President, Office of the Press Secretary, Unleashing the Wireless Broadband Revolution, to Heads of Executive Departments and Agencies (Jun. 28, 2010), *available at* http://www.gpoaccess.gov/presdocs/2010/DCPD-201000556.pdf [hereinafter Unleashing the Wireless Broadband Revolution].

broadband will be a key enabler of many of these anticipated gains. The foundational principles underlying the policy framework outlined in this article provide policymakers with a sufficiently flexible and forward-looking approach to providing additional spectrum for further innovation and to overseeing the continued evolution of the wireless market. These principles include:

Consumer demand for mobile broadband services and devices—including advanced smartphones and netbooks—is increasing rapidly each year. Innovators across the wireless broadband value chain—from device manufacturers to content developers to service providers—continue to provide new tools and applications in order to satisfy a seemingly insatiable demand for these services.

Mobile broadband is driving innovation across the entire wireless ecosystem and increasingly being used to deliver new services in a wide array of industries, including the healthcare, energy, public safety and education sectors. Over the course of the last two decades, the wireless sector has evolved at a rapid pace. As a result, sweeping or monolithic policies that seek micromanage market dynamics are insufficiently rigid and burdensome for a sector that changes daily.

The wireless sector has thrived under a regulatory approach that has implemented policies in reaction to, and not in anticipation of, consumer demand and market dynamics.

Spectrum is the lifeblood of the wireless industry. Without readily available spectrum resources, innovators are unable to deploy next-generation networks. Thus, additional spectrum is needed to continue fueling innovation and competition across the entire sector.

The spectrum that underlies all wireless broadband networks is a unique, finite resource that must be carefully monitored to ensure a consistent user experience. As such, wireless service providers require wide latitude to manage their networks in order to prevent congestion, delays, and outages.

In light of a looming gap between the amount of spectrum needed to support continued growth and innovation in the wireless sector and the relatively paltry amount that is likely to be made available in the short-term, policymakers should implement policies that facilitate a more streamlined process for reallocating underused or unused spectrum and that bolster a more robust secondary market for trading existing spectrum assets. In the longer-term, policymakers should develop a sufficiently flexible regulatory framework that permits regulators to make additional spectrum resources available to innovators in a more predictable and consistent manner.

II. INNOVATION UNSTRUNG: CURRENT AND FUTURE USES OF WIRELESS BROADBAND

The wireless marketplace has fundamentally changed over the last several years.[21] Whereas the primary use of a cellphone was once restricted to calling, a growing number of consumers use advanced handsets—also known as smartphones—to send and receive text messages and email, surf the Internet, and enable a universe of add-on applications that allow users to participate in a seemingly endless range of activities.[22] This section assesses the current marketplace and analyzes recent trends in investment, innovation, and usage. It concludes that competition in the wireless marketplace drives a significant amount of innovation and enables the deployment of widely available wireless broadband networks.

A. A Mobile Society: An Overview of the Current Wireless Marketplace

The United States is fast becoming a society defined by its level of productivity regardless of location.[23] Indeed, the concept of mobility has begun to

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[21] *See* Gary E. Salazar, *25 Years: Generational Changes Highlight Evolution of Wireless Technology*, RCRWIRELESS NEWS (Oct. 14, 2008, 6:00 AM), http://www.rcrwireless.com/article/20081014/WIRELESS/810139976/-1/25-years-generational-changes-highlight-evolution-of-wireless (last visited Jan. 1, 2011).

[22] For example, a recent Pew report noted a thirty-three percent increase from 2007 to 2009 in the percentage of adults who have used a mobile device to access the Internet. Over this same period of time, Pew observed a similar increase (thirty-two percent) in the percentage of users who have sent and received email via a wireless device. *See* JOHN HORRIGAN, PEW INTERNET & AMERICAN LIFE PROJECT, WIRELESS INTERNET USE 16, 23 (2009), http://www.pewinternet.org/~/media//Files/Reports/2009/Wireless-Internet-Use-With-Topline.pdf [hereinafter PEW WIRELESS STUDY 2009]. A 2010 study by Pew found that "[fifty-five percent] of American adults connect to the internet wirelessly, either through a Wi-Fi or WiMAX connection via their laptops or through their handheld device like a smart phone." *See* LEE RAINIE, PEW INTERNET & AMERICAN LIFE PROJECT, INTERNET, BROADBAND, AND CELL PHONE STATISTICS 1 (2010), http://www.pewinternet.org/~/media//Files/Reports/2010/PIP_December09_update.pdf.

[23] One study estimates that "by 2016, the value of the combined mobile wireless voice and broadband productivity gains to the U.S. economy [is estimated to be] $427 billion per year . . . ." *See* ROGER ENTNER, OVUM, THE INCREASINGLY IMPORTANT IMPACT OF WIRELESS BROADBAND TECHNOLOGY AND SERVICES ON THE U.S. ECONOMY 2 (2008), *available at* http://files.ctia.org/pdf/Final_OvumEconomicImpact_Report_5_21_08.pdf. Another study has linked investment in wireless infrastructure with economic gains. It estimated:

> [N]ew wireless broadband investments of $17.4 billion will, within twenty-four months of making this additional investment, increase gross domestic product (GDP) by 0.9% to l.3%, which translates into dollar terms to $126.3 billion to $184.1 billion, and will result in an increase of between 4.5 million and 6.3 million jobs.

See Alan Pearce & Michael S. Pagano, *Accelerated Wireless Broadband Infrastructure Deployment: The Impact on GDP and Employment*, 18 MEDIA L. & POL'Y 105, 105-106

inure itself into a growing segment of the population,[24] driven by the wide availability of robust networks and a range of wireless devices, pricing plans and add-on services, all of which are changing the way Americans live and work.[25] These trends have accelerated in recent years, due mostly to intense competition and innovation across the entire wireless ecosystem[26]—wireless carriers are investing billions to create more expansive and robust networks; handset makers are designing more advanced devices to accommodate more intensive data usage; and content developers are using new platforms to deploy a universe of add-on applications, that are redefining the wireless market.[27]

There are currently over 292 million wireless subscribers in the United States, which represents a penetration rate of ninety-three percent.[28] The overall number of subscribers increased by fifty-one percent between June 2005 and June 2010 while the number of wireless-only households—those that "cut

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(2009).

[24] JOHN HORRIGAN, PEW INTERNET & AM. LIFE PROJECT, MOBILE ACCESS TO DATA AND INFORMATION 1 (2008), http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Mobile.Data.Access.pdf.

[25] For an overview of how the market has evolved to become more consumer-centric, *see*, *e.g.*, CHARLES M. DAVIDSON, ADVANCED COMMC'NS L. & POL'Y INST., LOSING THE FOREST FOR THE TREES: PROPERLY CONTEXTUALIZING THE USE OF EARLY TERMINATION FEES IN THE CURRENT WIRELESS MARKETPLACE 11 (2009), http://www.nyls.edu/user_files/1/3/4/30/83/Early Termination Fees - June 2009.pdf [hereinafter LOSING THE FOREST];TONY CLARK & MICHAEL J. SANTORELLI, ADVANCED COMMC'NS L. & POL'Y INST., FEDERALISM IN WIRELESS REGULATION: A NEW MODEL FOR A NEW WORLD 5-6 (2009), http://www.nyls.edu/user_files/1/3/4/30/83/Clark%20%20&%20Santorelli%20-%20Wireless%20Federalism%20-%20February%202009.pdf.

[26] The FCC has used the "ecosystem" concept to describe the "virtuous cycle" of interactions among "networks, devices, and applications." NATIONAL BROADBAND PLAN, *supra* note 11, at 15.

[27] *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-779, TELECOMMUNICATIONS: ENHANCED DATA COLLECTION COULD HELP FCC BETTER MONITOR COMPETITION IN THE WIRELESS INDUSTRY 20 (2010); Phred Dvorak, *RIM Tries Harder on Apps*, WALL ST. J, Oct. 15, 2010, at B5; Jeffry Bartash, *Wireless Carriers Pushing 'Smart' Strategy for Growth*, MARKETWATCH (Dec. 10, 2009, 6:01 AM), http://www.marketwatch.com/story/wireless-carriers-push-smart-strategy-for-growth-2009-12-10 (providing an overview of the wireless industry evolution away from voice-based services towards more data-intensive services and devices); MORGAN STANLEY, THE MOBILE INTERNET REPORT 1 (2009), *available at* http://www.morganstanley.com/institutional/techresearch/pdfs/mobile_internet_report.pdf (observing "[t]he mobile Internet is ramping faster than desktop Internet did . . . ." and predicting "more users may connect to the Internet via mobile devices than desktop PCs within [five] years."); Jefferson Graham, *App Developers Pump Up for iPad*, USA TODAY, Mar. 24, 2010, at 1B (discussing the "huge market" created for applications developers when Apple released the iPad).

[28] *See U.S. Wireless Quick Facts*, CTIA – THE WIRELESS ASSOCIATION, http://www.ctia.org/advocacy/research/index.cfm/AID/10323 (last visited Jan. 1, 2011) [hereinafter *CTIA Wireless Stats*].

the cord" and relied exclusively on their cellphones for voice service—more than tripled.[29] Consumers use an average of over 700 minutes per month for calls,[30] and a rapidly increasing number of subscribers use their handheld devices to participate in an array of non-voice activities, such as sending and receiving text messages (which remains the most widespread activity),[31] searching online,[32] purchasing goods and services via mobile phones,[33] and sending and receiving emails, among many others.[34] Indeed, these types of data-based, as opposed to voice-based, activities have dramatically increased in popularity over the last few years.[35] As a result, data services and the revenues they gen-

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[29] *Id.* The Centers for Disease Control reported in May that nearly twenty-five percent of U.S. households were wireless-only by the end of 2009. STEPHEN J. BLUMBERG & JULIAN V. LUKE, CTR. FOR DISEASE CONTROL, WIRELESS SUBSTITUTION: EARLY RELEASE OF ESTIMATES FROM THE NATIONAL HEALTH INTERVIEW SURVEY: JULY-DECEMBER 2009 1 (2010), *available at* http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201005.pdf.

[30] For example, in 2007, the average number of minutes used per month by subscribers was 769, up from 255 in 2000. *In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Thirteenth Report*, 24 F.C.C.R 6185, 6277 at tbl.12 (Jan. 15, 2009) [hereinafter *Thirteenth CMRS Report*]. However, by June 2009 the average number of minutes used per month dropped to 735, reflecting a shift in utilization patterns by consumers towards more intensive data consumption. *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Fourteenth Report*, 25 F.C.C.R. 11407, 11522 fig.21 (May 20, 2010) [hereinafter *Fourteenth CMRS Report*].

[31] *CTIA Wireless Stats*, *supra* note 28 (reporting the average number of text messages sent per month in the U.S. was over 173 billion by mid-2010 and 1.81 trillion text messages were sent in the year ending June 2010).

[32] Several recent high-profile acquisitions of mobile advertising firms by Google and Apple has underscored the enormous and as-yet untapped potential value of the mobile search market. *See, e.g.*, Claire Cain Miller, *Apple Buys Quattro, a Mobile Ad Company*, N.Y. TIMES BITS BLOG (Jan. 5, 2010, 11:24 AM), http://bits.blogs.nytimes.com/2010/01/05/apple-is-said-to-buy-mobile-ad-company/.

[33] Consumer acceptance of mobile transactions has grown significantly over the last two years and has fueled a market for mobile payments that is expected to reach $300 billion per year by 2013. *See* Darcy Travlos, *All Eyes on Mobile Commerce*, FORBES.COM (Nov. 10, 2009, 3:00 PM), http://www.forbes.com/2009/11/10/travlos-apple-amazon-intelligent-investing-mobile.html.

[34] A December 2009 report by IDC found:

> [T]he most popular uses of the mobile Internet, currently, are visiting search engines, reading news and sports articles, downloading music and videos and sending and receiving e-mails and text messages. Over the next four years, however, IDC expects the fastest-growing applications of the mobile Web to include shopping, participating in online communities and blog creation . . . .

See Michelle Maisto, *Mobile Internet Users to Double by 2013, Says Report*, EWEEK (Dec. 10, 2009), http://www.eweek.com/c/a/Mobile-and-Wireless/Mobile-Internet-Users-to-Double-By-2013-Says-Report-194522/.

[35] In recognition of exponential growth in the popularity of wireless data services and

erate have become a key component of business models for carriers.[36] Between 2008 and 2009, the market for mobile data service grew thirty percent; it continues to expand despite recent economic turbulence.[37] Cisco estimates rapid mobile data service growth over the next five years, driven in large part by greater demand for and use of video-based applications.[38]

1. Network

These new mobile uses are the result of three interrelated trends in the wireless sector. First, robust network infrastructure is becoming more available to support intense mobile data usage. With the cell phone market nearly saturated, network owners are investing more money to enhance the overall user experience, including customer service, network capacity, and reliability.[39] To this end, wireless service providers invested over $21 billion in their networks in the year ending June 2010[40] and have averaged nearly $23 billion per year in investments since 2001.[41] Such large-scale investments led to the deployment of third-generation (3G) networks that facilitate data uses like Internet access

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the revenues derived from these services, the FCC expanded its annual assessment of the wireless market to include "all mobile wireless services, such as voice, messaging, and broadband." In so doing, the FCC sought to highlight the "transformative importance of mobile wireless broadband, which has resulted in a shift from devices that can access the entire Internet." *See Fourteenth CMRS Report*, *supra* note 30; AARON SMITH, PEW INTERNET & AMERICAN LIFE PROJECT, MOBILE ACCESS 12 (2010), http://www.pewinternet.com/~/media//Files/Reports/2010/PIP_Mobile_Access_2010.pdf.

[36] *See, e.g.*, NET NEUTRALITY, INVESTMENT & JOBS, *supra* note 5, at 21 (observing this shift and noting that additional key inputs – e.g., spectrum – will be needed to support long-term growth in the sector); *see also* Simon Flannery and Sean Ittel, *Wireless Data: The Torch Passes from Voice to Data*, at 4, Morgan Stanley Research, Telecom Services (June 1, 2010) (predicting that "Wireless data revenue growth (excluding upside from emerging devices) should offset the decline in voice revenues").

[37] *See* Jason Ankeny, *U.S. Mobile Data Service Revenues Jump to $10.6B in Q2*, FIERCEMOBILECONTENT.COM (Aug. 10, 2009, 9:09 AM), http://www.fiercemobilecontent.com/story/u-s-mobile-data-service-revenues-jump-10-6b-q2/2009-08-10.

[38] *See* CISCO WHITE PAPER, CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE 1 (2009), *available at* http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf (last visited Jan. 1, 2011) (estimating a global compound annual growth rate in mobile data traffic of 131 percent between 2008 and 2013) [hereinafter CISCO VISUAL NETWORKING INDEX].

[39] *See Fourteenth CMRS Report*, *supra* note 30, at 168-170.

[40] *CTIA Wireless Stats*, *supra* note 28.

[41] *See* Ex Parte Letter from CTIA – The Wireless Association, to Chairman Julius Genachowski, Comm'r Michael J. Copps, & Comm'r Robert M. McDowell, Fed. Commc'ns Comm (July 9, 2009), *available at* http://files.ctia.org/pdf/filings/2009_Wireless_Economic_Contributions.Letter.Final.pdf.

and email.[42] Adoption and usage of these advanced wireless services has increased substantially.[43] Between 2008 and 2009, the number of 3G device owners grew by eleven percent.[44] Recent FCC data on broadband availability reports that there are nearly 60 million wireless broadband connections in use across the United States.[45] In addition, it is estimated that shipments of consumer electronic devices "embedded with mobile broadband connectivity" will have increased some fifty-five-fold between 2008 and 2014.[46]

New network deployment continues apace. Carriers are investing billions of dollars to bolster 3G availability and transition towards next-generation infrastructure that can support faster data transmission.[47] The next iteration of wireless networks—the so-called fourth generation ("4G")—will be based on two different standards: WiMAX[48] and long-term evolution ("LTE").[49]

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[42] Initial 3G deployments began in the early 2000s. At about the same time, the FCC auctioned off 90 megahertz of "advanced wireless spectrum," which was allocated in a "flexible, market-oriented" way so that made carriers could easily aggregate swaths in this band, facilitating the deployment of nationwide networks. *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Eleventh Report*, 21 F.C.C.R. 10947, ¶¶ 73-74 (Sept. 26, 2006) [hereinafter *Eleventh CMRS Report*]. By 2008, the majority of the U.S. population lived in areas where 3G networks were available. *Thirteenth CMRS Report*, *supra* note 30, ¶¶ 141-147. For an overview of the types of services enabled by 3G networks, *see* Marguerite Reardon, *3G Wireless Still Holds Promise*, CNET NEWS (Nov. 25, 2009, 4:00 AM), http://news.cnet.com/8301-30686_3-10404860-266.html (last visited Jan. 1, 2011); *see also* Scott Taves, *3G Phone Network Standards Vary by Carrier*, MSNBC.COM (Sept. 3, 2008, 8:56:41 AM), http://www.msnbc.com/id/26511322.

[43] *Thirteenth CMRS Report*, *supra* note 30, ¶¶ 204-206.

[44] COMSCORE, THE 2009 U.S. DIGITAL YEAR IN REVIEW: A RECAP OF THE YEAR IN DIGITAL MARKETING 12-13 (2010).

[45] *See* FED. COMMC'NS COMM'N, INDUSTRY ANALYSIS AND TECH. DIV., HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2008, tbl.1 (2009), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf.

[46] *See* Michelle Maisto, *Broadband-Enabled Devices to Grow 55-Fold by 2014*, EWEEK (Jan. 4, 2010), http://www.eweek.com/c/a/Mobile-and-Wireless/BroadbandEnabled-Devices-to-Grow-55-Fold-by-2014-210025/.

[47] The FCC reports that, by 2009, nearly 90 percent of the population was served by two or more mobile broadband providers. The FCC has also observed that all of the major wireless providers have detailed plans for 3G and 4G network deployments over the course of the next few years. *Fourteenth CMRS Report*, *supra* note 30, at 7-8.

[48] *See* RYSAVY RESEARCH, 3G AMERICAS HSPA TO LTE-ADVANCED: 3GPP BROADBAND EVOLUTION TO IMT-ADVANCED (4G) 36-37 (2009) *available at* http://www.rysavy.com/Articles/2009_09_3G_Americas_RysavyResearch_HSPA-LTE_Advanced.pdf [hereinafter BROADBAND EVOLUTION TO 4G]. WiMAX is a "family of interoperable technologies" adhering to the IEEE 802.16 standard that "has emerged as a potential alternative to cellular technology for wide-area wireless networks." *Id.* It was deployed on a small scale in 2009 by a consortium of companies led by Clearwire and Sprint, and extended in 2010. These companies plan to make WiMAX service available in eighty

2. Devices

Second, the diversity of smartphones available and their increasing affordability drive data usage by increasing the number of consumers who utilize wireless services. A January 2010 survey found that, by the end of 2009, forty-two percent of consumers owned a smartphone.[50] By 2011, it is estimated that smartphone sales will overtake standard phone sales.[51] Some even predict that "by 2015 almost all shipped handsets will be smart."[52] This trend is significant since smartphone owners are much more likely to access the Internet on their handheld devices than those with traditional mobile handsets.[53] According to the FCC, BlackBerry owners consume twice as much data per month than traditional handset owners, while iPhone owners consume eleven times as much data per month.[54]

Netbooks are also becoming a popular means of accessing the Internet wirelessly. These low-cost and lightweight laptop computers, designed primarily for web-browsing and email via a built-in wireless data cards (or air cards), have become enormously popular among business travelers and students alike.[55] It is estimated that the number of netbooks sold in the United States in

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markets by the end of 2010. *See* Marguerite Reardon, *Clearwire to Bring WiMAX to 10 More Markets*, CNET NEWS (Aug. 3, 2009, 11:30AM), *available at* http://news.cnet.com/8301-1035_3-10301928-94.html.

[49] LTE is an approach to spectrum management that allows for more efficient use of existing spectrum assets in order to provide faster and more reliable data speeds. *See, e.g.*, ERICSSON, LTE: AN INTRODUCTION 6 (2009), http://www.ericsson.com/res/thecompany/docs/whitepapers/lte_overview.pdf. LTE will be deployed by Verizon Wireless, AT&T, and T-Mobile. These carriers are in different stages of upgrading their networks. *See* Marin Perez, *T-Mobile Lays Out 3G Plans*, INFO. WEEK (Nov. 11, 2009, 3:22 PM), http://www.informationweek.com/news/mobility/3G/showArticle.jhtml?articleID=221601338 (reporting that T-Mobile's 3G network will cover 200 million by the end of 2009; AT&T's 3G upgrade will be complete in 2011; and Verizon Wireless continues to pursue its LTE upgrades).

[50] *See* Paul Carton & Jean Crumrine, *New Survey Shows Android OS Roiling the Smart Phone Market*, CHANGEWAVE RESEARCH (Jan. 4, 2010), http://www.changewaveresearch.com/articles/2010/01/smart_phone_20100104.html.

[51] *See* Presentation, Fed. Commc'ns Comm'n, Broadband Gaps 14 (Nov. 18, 2009) *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-294708A1.pdf (citing TELECOMM. INDUSTRY ASS'N, ICT MARKET REVIEW & FORECAST (2009)) [hereinafter FCC Presentation].

[52] *See The Apparatgeist Calls*, THE ECONOMIST, Jan. 2, 2010, at 56.

[53] *Thirteenth CMRS Report*, *supra* note 30, at ¶ 192 (noting that fifty-eight percent of smartphone users had accessed information via their handheld device compared to just thirteen percent of all wireless subscribers).

[54] *See Fourteenth CMRS Report*, *supra* note 30, ¶ 182.

[55] *See* Rik Myslewski, *Apple Loses Students to Netbooks and Windows*, THE REGISTER (UK) (Aug. 19, 2009),

2009 increased 137 percent from 2008.[56] Given their popularity, portability and ability to access the Internet wirelessly, netbooks—and laptops—can, according to some estimates, at any given time consume nearly three-fourths of available network capacity despite comprising less than four percent of subscribers.[57] Indeed, the FCC observes that owners of laptops/aircards consume 56 times as much data per month than traditional handset owners and six times as much data per month than iPhone owners.[58]

3. Applications

The third trend evident in the current wireless marketplace is a direct result of the first two: innovation at the network level has spurred innovation at the handset level, which has in turn spawned a new and vibrant market for add-on applications that leverage fast networks and advanced mobile devices to provide users with an array of services.[59] Indeed, competition and innovation in each of these sectors has trickled down the value chain and empowered a new segment of innovators—software developers and other content providers—to contribute new inputs to the wireless marketplace.[60]

Perhaps the clearest example of this new segment is the marketplace for mobile applications that run on a growing number of smartphones. These applications are enabled by operating system (OS) software that allows users to download and install programs onto their phones.[61] For example, the iPhone, iPad, and iPod Touch[62] allow users to purchase and install any of the over three

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http://www.theregister.co.uk/2009/08/19/apple_losing_out_to_netbooks/ (citing a study by *DisplaySearch*); *see also* Rafe Needleman, *"Netbooks" Play Sidekick to Laptop*, CBSNEWS.COM (Mar. 19, 2009), http://www.cbsnews.com/stories/2009/03/12/tech/real_technology/main4861664.shtml.

[56] *See* Myslewski, *supra* note 55 (citing a study by *DisplaySearch*).

[57] *See* Stacey Higginbotham, *The Wireless Boom Will Cost the Carriers*, BLOOMBERG BUSINESS WEEK.COM (July 13, 2009, 7:05 PM), http://www.businessweek.com/technology/content/jul2009/tc20090710_158985.htm (last visited Jan. 1, 2011) (citing estimates made by Ericsson).

[58] *Fourteenth CMRS Report*, *supra* note 30, ¶ 182.

[59] *Id*. at ¶¶ 299-338 (discussing the emergence of innovative and competitive "downstream" segments of the wireless market, including handsets and add-on applications).

[60] The FCC defines the "value chain" in the wireless context as "the chain of individual, value-creating activities. This chain includes not only those activities performed by wireless communications service providers themselves, but also those performed by all other entities, including providers of inputs and complements to wireless communications services." *See In re* Fostering Innovation and Investment in the Wireless Communications Market, *Notice of Inquiry*, 24 F.C.C.R. 11322, 11323 n.2 (Aug. 27, 2009).

[61] *See, e.g.*, *Fourteenth CMRS Report*, *supra* note 30, ¶¶ 318-332 (discussing mobile applications).

[62] Although not a cell phone, the iPad and iPod Touch are important mobile computing

hundred thousand applications, many developed by third parties, that Apple, the device's developer, previously vetted and approved for use on the device.[63] To date, over six billion applications have been downloaded via Apple's App Store for use on its mobile devices.[64] The popularity of this service has spurred the development and incorporation of similar operating systems in a number of other phones. T-Mobile and Verizon Wireless, for example, have released myriad new phones that use the Android OS and that support applications made available in the Android Market.[65] BlackBerry, an early leader in the smartphone market, has also launched its own application marketplace, App

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devices that include all of the functionality of an iPhone expect for the ability to make and receive calls. Indeed, according to one recent analysis, "of the 58 million iPhone OS devices sold worldwide through September, the iPod Touch . . . represents 40 percent of the market, with 24 million units sold." Andy Patrizio, *iPod Touch Asserts Its Presence*, INTERNETNEWS.COM (Dec. 7, 2009), http://www.internetnews.com/hardware/article.php/3851716/iPod+Touch+Asserts+Its+Presence.htm (citing an analysis by mobile analytics company Flurry). The iPad is able to run most of the apps available for the iPhone and iPod touch, and 11,000 additional apps have been created exclusively for the device. *See* Press Release, Apple, Apple Sells Three Million iPads in 80 Days (June 22, 2010), *available at* http://www.apple.com/pr/library/2010/06/22ipad.html.

[63] *See* 148APPS.BIZ, *App Store Metrics*, http://148apps.biz/app-store-metrics/ (last updated Aug. 17, 2010). Apple's veto power over the content of applications for sale on iTunes has led to criticism, especially with regard to a perceived lack of clear and transparent criteria for rejecting applications. *See* Brian Chen, *A Call for Transparency in Apple's App Store*, WIRED.COM (Apr. 26, 2010, 8:00 AM), http://www.wired.com/gadgetlab/2010/04/app-store-transparency/.

[64] *See, e.g.* MG Siegler, *Apple Has Paid $1 billion to App Developers (and Other Key Stats)*, TECH CRUNCH (June 7, 2010), *available at* http://techcrunch.com/2010/06/07/ipad-ibooks-app-store-stats/. The growth of Apple's App Store has been remarkable. The App Store was launched in July 2008 with "just 500 applications." Jim Dalrymple, *Apple Reaches 100,000 Apps, 2 Billion Downloads*, CNET NEWS (Nov. 4, 2009, 7:51 AM), http://news.cnet.com/8301-13579_3-10390454-37.html. That number swelled to over 100,000 by November 2009 and 220,000 by June 2010. The one billionth app downloaded from the store took place in April 2009, nine months after the store was launched. *See* Arik Hesseldahl, *Almost a Billion iPhone Apps Downloaded*, BUSINESSWEEK.COM BYTE OF THE APPLE BLOG (Apr. 10, 2009), http://www.businessweek.com/technology/ByteOfTheApple/blog/archives/2009/04/almost_a_billio.html. The two billionth download occurred in November 2009. *See* Brad Stone, *Apple's App Store Tops 3 Billion Downloads*, N.Y. TIMES BITS BLOG (Jan 5, 2010, 1:08 PM), *available at* http://bits.blogs.nytimes.com/2010/01/05/apples-app-store-tops-3-billion-downloads/. In sum, it took about two years for six billion apps to be downloaded from the App Store. *See* Charles Cooper, *Apple Revamps iPod Line, Upgrades iTunes, Apple TV*, CBSNEWS.COM (Sept. 1, 2010, 1:57 PM), http://www.cbsnews.com/8301-501465_162-20015327-501465.html.

[65] *See* Android Market, http://www.android.com/market/ (last visited Jan. 1, 2011). For an extensive list of information about current Android handset offerings, *see* ANDROPHONES.COM, http://www.androphones.com (last visited Jan. 1, 2011).

World.[66] Microsoft[67] and Sprint,[68] among others, have also launched online stores for wireless applications. Innovators are also developing add-on applications for use on a wider array of handsets. For example, one company—GetJar—offers "about 60,000 applications for nearly 2,000 different mobile phones."[69] As a result of such vibrant and swift innovation, the market for add-on apps is expected to grow nearly fourfold over the next several years, increasing from a $1 billion a year business in 2009 to $4 billion per year by 2012.[70]

4. Effects on Marketplace

The immense success of the applications market has impacted the wireless market in two key ways. First, the applications market provides subscribers with access to a universe of new data services that are not available on other, less sophisticated phones.[71] Smartphone users are thus much more data-intensive users.[72] Second, and perhaps most important, this new business model has opened the wireless market to a new group of third-party innovators that would otherwise not have entered the wireless space.[73] Traditionally, third-parties were relegated to producing hardware add-ons for cell phones (e.g., head-sets) or coordinating software additions with mobile service providers.[74]

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[66] *See BlackBerry App World*, BLACKBERRY, http://na.blackberry.com/eng/services/appworld/ (last visited Jan. 1, 2011).

[67] *See* Sean Ludwig, *Hands On with the Windows Mobile Marketplace*, PC MAGAZINE (Oct. 8, 2009), http://www.pcmag.com/article2/0,2817,2354012,00.asp.

[68] *See* Jason Ankeny, *Sprint to Open Mobile App Store in 2010*, FIERCEMOBILECONTENT (Oct. 30, 2009, 9:23 AM), http://www.fiercemobilecontent.com/story/sprint-launch-mobile-app-store-2010/2009-10-30.

[69] *See* Jenna Wortham, *Giving Your Phone More Oomph: Entrepreneurs Venture Beyond the iPhone with Apps for the Not-Quite-Smartphone Set*, N.Y. TIMES, Jan. 4, 2010, at B1.

[70] *See* Douglas MacMillan, Peter Burrows & Spender E. Ante, *Inside the App Economy*, BLOOMBERG BUSINESS WEEK.COM (Oct. 22, 2009, 5:00 PM), http://www.businessweek.com/magazine/content/09_44/b4153044881892.htm [hereinafter *App Economy*].

[71] *Cf. id.* ("[S]martphones and other portable devices are transforming the tech world.")

[72] *See* Nate Anderson, *Wireless Carriers Beg FCC for Spectrum, Blame Smartphones*, ARS TECHNICA (Sept. 27, 2009, 7:00 PM), http://arstechnica.com/tech-policy/news/2009/09/wireless-carriers-beg-fcc-for-spectrum-blame-smartphones.ars. For example, AT&T has reported 5,000 percent growth in wireless data usage since the iPhone was released. Similarly, T-Mobile reported that users of its advanced smartphone, the G1, use 50 times more data than the average T-Mobile subscriber. *Id.*

[73] NET NEUTRALITY, INVESTMENT & JOBS, *supra* note 5, at 14-15 (noting the app market represents another avenue for job creation in the broadband sector).

[74] *See* Jenna Wortham, *Apple's Game Changer, Downloading Now*, N.Y. TIMES, Dec. 6, 2009, *available at* http://www.nytimes.com/2009/12/06/technology/06apps.html (last visited

This new openness on the part of carriers is fostering new modes of innovation across each segment of the market.[75]

The three trends described above have positioned the wireless market for further fundamental change. Indeed, the FCC has posited that "mobile broadband represents the convergence of the last two great disruptive technologies—Internet computing and mobile communications—and may be more transformative than either of those previous breakthroughs."[76] As a result of the wide availability and usage of wireless broadband in the many ways discussed above, other sectors of the economy are rapidly incorporating wireless broadband into new products and business models. Indeed, as discussed in the next section, wireless broadband is driving innovation in a number of non-traditional contexts as non-communications companies seek to leverage ubiquitous networks and insatiable consumer demand for mobile services in order to further inure wireless into additional aspects of everyday life.

B. Where Wireless Broadband is Taking Us: An Analysis of Four Sectors on the Cutting Edge

Stakeholders in the public safety, telemedicine, energy, and education spaces are using wireless broadband to create new life-enhancing services for use in an array of contexts. Innovators in each space are leveraging the mobility and reliability inherent in wireless broadband networks to develop cutting-edge solutions to address a number of problems identified by policymakers.

1. Public Safety

Wireless connectivity has proven to be invaluable in recent public emergencies at both the local and national levels.[77] In these instances, subscribers have relied on their cell phones and wireless data devices to contact emergency personnel and to communicate with family.[78] The reliability and mobility inherent in wireless networks provides subscribers with a sense of personal protection

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Jan. 1, 2011) (noting that "Gone are the days when mobile developers had to negotiate with major telecommunications companies if they had any hopes of publishing their applications on a mobile phone") [hereinafter *Apple's Game Changer*].

[75] NET NEUTRALITY, INVESTMENT & JOBS, *supra* note 5, at 15.

[76] NATIONAL BROADBAND PLAN, *supra* note 11, at 75.

[77] *See Wireless Communication Solutions for Emergency Situations*, HOMELAND SECURITY NEWSWIRE, (Mar. 8, 2010) http://homelandsecuritynewswire.com/wireless-communication-solutions-emergency-situations.

[78] LEE RAINIE & SCOTT KEETER, PEW INTERNET & AM. LIFE PROJECT, PEW INTERNET PROJECT DATA MEMO 9 (2006), *available at* http://www.pewinternet.org/~/media//Files/Reports/2006/PIP_Cell_phone_study.pdf.pdf.

in dire situations. According to one recent study, a majority of mobile users cite their phone's availability in an emergency situation as one of its most important features.[79] As a result, policymakers and other stakeholders are leveraging this level of consumer comfort with wireless services in order to provide more robust public safety applications, many of which are enabled by a wireless broadband connection.

Wireless broadband helps emergency services, such as police and fire departments, communicate and act more efficiently. Police departments, for example, use wireless devices to improve response time and bolster their effectiveness.[80] Wireless computing devices in emergency vehicles allow technicians to load maps directing them to the location of an emergency call, receive real-time updates about criminal activities, access patient health records, and "beam images of a patient wirelessly from the road so that emergency room doctors can review them while the patient is in transit."[81] Municipalities are also exploring the feasibility and value of deploying proprietary wireless networks to facilitate these public safety gains.[82] New York City, for example, recently launched a next-generation wireless broadband network that supports high-speed data and video transmission for use by first responders.[83]

Policymakers are also using wireless technologies to provide real-time news updates and alerts during emergency situations. For example, the use of text

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[79] *See* NICHOLAS P. SULLIVAN, CELL PHONES PROVIDE SIGNIFICANT ECONOMIC GAINS FOR LOW-INCOME AMERICAN HOUSEHOLDS 14-15 (2008), *available at* http://www.newmillenniumresearch.org/archive/Sullivan_Report_032608.pdf. Some discrete user groups view cell phones as especially indispensible in emergency situations. For example, more than three-quarters of people with disabilities reported their reliance on wireless devices in potential emergency situations, and seventy percent reported wireless devices provided a sense of security. These trends parallel general population patterns of wireless device reliance. *See* WIRELESS RERC, SECOND REPORT: FINDINGS OF THE SURVEY OF USER NEEDS (SUN) FOR WIRELESS TECHNOLOGY 2007-2009 5-6 (2009), http://www.wirelessrerc.org/publications/SUN Second Findings Report_2009-03-25.doc.

[80] MOTOROLA WIRELESS BROADBAND, MOTOROLA LICENSED 4.9 GHZ WIRELESS BROADBAND SOLUTIONS FOR GOVERNMENT AND PUBLIC SAFETY (2009), http://ezine.motorola.com/government?a=346 (follow "View PDF" hyperlink under "Motorola Licensed 4.9 GHz Wireless Broadband Solutions for Government and Public Safety – Brochure").

[81] Genachowski Remarks—Feb. 24, 2010, *supra* note 12, at 3.

[82] According to MuniWireless.com, as of March 2009, 55 cities are deploying wireless public safety networks. *See* MUNIWIRELESS.COM, MUNIWIRELESS.COM 28 MARCH 2009 LIST OF US CITIES AND REGIONS 4 (2009), *available at* http://www.muniwireless.com/reports/Mar-28-2009-list-of-cities.pdf (last visited Jan. 1, 2011).

[83] *See* Gary E. Salazar, *New York City Rolls Ahead with Public-Safety Network Plans*, RCR WIRELESS (Jan. 21, 2009, 12:39 PM), http://www.rcrwireless.com/article/20090121/WIRELESS/901219992/new-york-city-rolls-ahead-with-public-safety-network-plans.

messaging during and after recent tragedies like university shootings spurred the FCC and Congress to adopt a voluntary Commercial Mobile Alert System.[84] This system allows providers to blast presidential alerts, threat alerts, and Amber alerts to those users who wish to receive such messages.[85] In its *National Broadband Plan*, the FCC outlined a number of recommendations for using broadband to "enhance[e] the safety and security of the American people."[86] Key among these proposals is the allocation of 10 MHz to serve as the foundation for a "nationwide, interoperable public safety wireless broadband communications network."[87]

Ubiquity of wireless broadband and the decreasing costs of wireless-enabled services are spurring innovation in a number of other public safety areas. More affordable wireless sensors are enabling engineers to monitor the safety of critical infrastructure like bridges. For example, in the wake of a major bridge collapse in Minnesota, a replacement bridge included wireless sensors that monitor a number of metrics in real-time, including corrosion levels and air temperature to trigger the automatic spraying of antifreeze on the roadway when temperatures fall below the threshold temperature set for the system.[88] Application developers are also creating public safety-related services for use on smartphones. For example, one (controversial) application for the iPhone allows a user to identify the location of sexual offenders living in a given area.[89]

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[84] *In re* Commercial Mobile Alert System, *First Report and Order*, 23 F.C.C.R. 6144 ¶¶ 4-5. 26, 29 (Apr. 29, 2008).

[85] *See* Chloe Albanesius, *Emergency Alerts via Cell Phones Move Ahead*, PC MAG. (Apr. 10, 2008), http://www.pcmag.com/article2/0,1759,2282812,00.asp.

[86] NATIONAL BROADBAND PLAN, *supra* note 11, at 313.

[87] *Id.* at 313, 317. *See* JON M. PEHA ET AL., FED. COMMC'NS COMM'N, THE PUBLIC SAFETY NATIONWIDE INTEROPERABLE BROADBAND NETWORK: A NEW MODEL FOR CAPACITY, PERFORMANCE AND COST 1 (2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-298799A1.pdf (providing "a technical analysis of the capacity and performance of the public safety broadband network assuming that the National Broadband Plan recommendations concerning this network are implemented"). *See infra*, Part III.D for additional D-Block discussion.

[88] *See, e.g.*, *Span of Control*, THE ECONOMIST, Sept. 3, 2009, at 6 (noting that "[t]he cost of all this technology was around $1m, less than 1% of the $234m it cost to build the bridge.").

[89] *See* MG Siegler, *The iPhone's Latest Hit App: A Sex Offender Locator*, TECH CRUNCH (July 25, 2009), http://techcrunch.com/2009/07/25/the-iphones-latest-hit-app-a-sex-offender-locator/. Siegler notes that

> The app allows you to see a list of offenders based on your current location (using the iPhone's location services), any contact's address, or it allows you to manually enter an address. The app then scours the database and lists the sexual offenders based on their proximity to the location you gave. You can click on any of these names to get a picture of the person, their information like date of birth, height, weight, and a picture. And you can also see the specific sexual crime they were charged with.

Id.

These and many other innovations are reliant on wireless broadband networks that support real-time data transmission.[90]

2. Telemedicine & Healthcare

Broadband is playing an increasingly important role in healthcare by enabling a universe of telemedicine services that provide a number of life-enhancing, and potentially lifesaving, benefits.[91] Broadband-enabled telemedicine and health information technology (HIT) services provide quality medical care to rural parts of the country, streamline the administration of healthcare, and empower individuals to have more control over medical decisions.[92]

Wireless broadband in particular is of critical importance to the shift towards more individualized, in-home care of patients.[93] For example, wireless broadband is a key component of in-home monitoring systems that track the movements and vital signs of patients in real-time in order to, among other things, prevent falls.[94] These types of services are increasingly popular among seniors, people with disabilities and others, and could enable enormous cost-savings.[95] According to one study, "a full embrace of remote monitoring alone could reduce healthcare expenditures by a net of $197 billion (in constant 2008 dollars) over the next [twenty-five] years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[96] The

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[90] *See, e.g.*, *Advanced Wireless Broadband Technology Will Help Reduce Crime in El Salvador*, RTI Int'l (June 3, 2010), http://www.rti.org/news.cfm?objectid=8D07A966-0111-C4B2-59D8DEFAA03A0CD6.

[91] NATIONAL BROADBAND PLAN, *supra* note 11, at 199. The FCC dedicated a chapter of its *National Broadband Plan* to examining how broadband impacts and enhances healthcare. *Id.* at 199-222.

[92] *See generally* CHARLES M. DAVIDSON & MICHAEL J. SANTORELLI, THE IMPACT OF BROADBAND ON TELEMEDICINE, A REPORT TO THE U.S. CHAMBER OF COMMERCE (2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/BroadbandandTelemedicine.pdf [hereinafter BROADBAND & TELEMEDICINE].

[93] *See* Elizabeth G. Olson, *The Virtual Doctor Visit*, WASH. POST, Nov. 17, 2009, at E5 (describing a number of recent innovations that facilitate in-home care for senior citizens, some of which use wireless Internet connections to relay data between patient and doctor); Genachowski Remarks—Feb. 24, 2010, *supra* note 12, at 3 ("Mobile medicine takes remote monitoring to a new level. A patient's heart rhythm can be monitored continuously, regardless of her whereabouts, and diabetics can receive continuous, flexible insulin delivery through real-time glucose monitoring sensors that transmit date to wearable insulin pumps.").

[94] *See, e.g.*, Steve Lohr, *Watch the Walk and Prevent a Fall*, N.Y. TIMES, Nov. 8, 2009, at 4 (describing a pilot program that uses wireless sensors to track and prevent falls by senior citizens, which are fairly prevalent among the elderly and result in $75 billion of healthcare and other costs each year).

[95] *Id.*

[96] *See* ROBERT LITAN, BETTER HEALTHCARE TOGETHER, VITAL SIGNS VIA BROADBAND:

market for such services is poised to become a multi- billion dollar per year industry, and, by 2012, it is estimated that 3.4 million seniors will be using networked sensor applications to monitor and improve their health. [97]

In-home monitoring via wireless broadband provides a number of benefits. First, wireless monitoring makes the administration of healthcare more efficient. A pilot initiative sponsored by the U.S. Veterans Association, for example, found that in-home chronic disease management tools (e.g., teleconsultations, remote diabetes monitoring) resulted in forty percent fewer emergency room visits and a sixty-three percent reduction in hospital admissions.[98] Second, real-time monitoring is of particular importance to older Americans, as regular data collection allows doctors and caretakers to track and diagnose the early onset of chronic diseases like Alzheimer's, for example.[99] Treatment of chronic diseases in the elderly is extremely costly,[100] yet estimates show that early "interventions that could delay the onset of Alzheimer's disease by as little as one year would reduce prevalence of the disease by 12 million fewer cases in 2050" and potentially provide dramatic cost savings for this disease alone.[101] However, concerns regarding the reliability and affordability of these systems could create barriers to more robust adoption in the near term.[102]

Each of these broadband-enabled telemedicine services will generate data that can be aggregated in electronic health records (EHRs).[103] EHRs allow

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REMOTE HEALTH MONITORING TRANSMIT SAVINGS, ENHANCES LIVES 2 (2008), *available at* http://www.betterhealthcaretogether.org/Library/Documents/VITAL SIGNS via BROADBAND FINAL with FOREWORD and TITLE pp 10 22.pdf.

[97] *See Senior Citizens to See High Tech Sensors in Homes, on Bodies to Monitor Health*, SENIOR JOURNAL.COM, (Dec. 6, 2007), http://www.seniorjournal.com/NEWS/Features/2007/7-12-06-SenCit2See.htm.

[98] *See* Marlis Meyer et al., *Virtually Healthy: Chronic Disease Management in the Home*, 5 DISEASE MANAGEMENT, no. 2, June 2002, *available at* www1.va.gov/visn8/v8/clinical/cccs/articles/virtually.doc.

[99] *See* Yung Bok Kim & Daeyoung Kim, *Healthcare Service with Ubiquitous Sensor Networks for the Disabled and Elderly People*, LECTURE NOTES IN COMPUTING SCIENCES, Vol. 4061 (2006), http://www.springerlink.com/content/056710u827874021.

[100] These diseases cost the United States more than $148 billion annually in Medicaid and Medicare services and in indirect costs to businesses that employ [Alzheimer's] and dementia caregivers. *See* ALZHEIMER'S ASSOCIATION, INTERNATIONAL CONFERENCE ON ALZHEIMER'S DISEASE: HIGHLIGHTS OF RESEARCH FINDINGS 2 (2008) *available at* http://www.alz.org/icad/documents/2008_ICADhighlights.pdf.

[101] *See* Press Release, Johns Hopkins Univ. Bloomberg Sch. of Pub. Health, Alzheimer's Disease to Quadruple Worldwide by 2050 (June 10, 2007), *available at* http://www.jhsph.edu/publichealthnews/press_releases/2007/brookmeyer_alzheimers_2050.html.

[102] *See generally*, BROADBAND & TELEMEDICINE, *supra* note 92, at 36-46 (discussing an array of other potential barriers to more robust adoption of broadband-enabled telemedicine services).

[103] NATIONAL BROADBAND PLAN, *supra* note 11, at 200-01.

healthcare providers and patients to access a patient's full medical history via an Internet connection.[104] In addition to providing patients with more power over individual health decisions,[105] widespread implementation and use of EHRs can drastically reduce healthcare costs.[106] One study estimates that cost-savings could total $80 billion each year.[107] Mobile carriers and application developers are making available first-generation EHRs for use by subscribers on an array of mobile phones,[108] and EHRs are a key component of healthcare reform. The stimulus legislation included some $19 billion for the continued deployment and adoption of EHRs by providers across the country.[109]

Going forward, wireless broadband is poised to play an ever more critical role in healthcare. In the near-term, basic services like text messaging will continue to provide a primitive platform for the transmission of personal health data like blood sugar to a doctor for monitoring purposes.[110] Hospitals and other healthcare providers are also increasingly using mobile phones to enhance communication[111] and to make more informed decisions at the point of care.[112] In the long-term, wireless telemedicine services are poised to become

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[104] *See id.* at 201-02.

[105] *See* Richard Hillestad et al., *Can Electronic Medical Record Systems Transform Helathcare? Potential Health Benfits, Savings, and Costs, in* 24 HEALTH AFFAIRS 1103, 1107-1109 (2005).

[106] *Id.*

[107] *See* Richard Hillestad et al., *Can Electronic Medical Record Systems Transform Healthcare? Potential Health Benefits, Savings, and Costs*, 24 HEALTH AFFAIRS 1103 (2005).

[108] For example, an application called Health Tracker allows users to store personal health information (e.g. weight, blood pressures, etc.) on their BlackBerry. *See Production Information – Health Tracker for BlackBerry*, T-MOBILE, https://t-mobile.handango.com/home (follow "Blackberry" hyperlink: then follow "T-Mobile Blackberry Curve 8900" hyperlink; then follow "Health & Fitness" hyperlink; then follow "Health Tracker for Blackberry" hyperlink) (last visited Jan. 1, 2011).

[109] *See* Joseph Conn, *Money to Boost EHR Initiatives Nationwide: Stimulus*, MODERNHEALTHCARE.COM, (Feb. 23, 2009, 12:01 AM), *available at* http://www.modernhealthcare.com/article/20090223/REG/302239983 (last visited Jan. 1, 2011).

[110] *See* Mark Terry, *Text Messaging in Healthcare*, 14 J. TELEMEDICINE & E-HEALTH 520, 521 (2008).

[111] *See* Mitch Wagner, *Florida Hospitals Dial up iPhones for Nurses*, INFO. WEEK, (Nov. 8, 2009), *available at* http://www.informationweek.com/news/healthcare/mobile-wireless/showArticle.jhtml?articleID=221600691 (last visited Jan. 1, 2011) (reporting on a pilot program that used iPod touch devices to wirelessly relay text messages among nurses in lieu of traditional announcements, pages, and alarms. Patients reported better conditions due to a decrease in noise levels, and nurses reported an increase in the effectiveness of their care).

[112] One article has observed:

> The use of mobile information technology to assist healthcare professionals in making treatment decisions at the point of care is expected to improve the quality, safety, and

seamlessly integrated into everyday life. For example, according to a recent report issued by OfCom, the British regulator of communications, wireless telemedicine applications will likely include services that can monitor personal information in real-time and automatically send emergency alerts when a person gets into an accident or suffers a sudden health event like a heart attack.[113] The FCC has observed that "[w]ireless body sensor networks reduce infection risk and increase patient mobility by eliminating cables; they also improve caregiver effectiveness."[114] These and other products, like in-home "smart" devices and health-related add-on applications for smartphones, will depend on fast broadband connections to deliver real-time services that can save lives or detect the early onset of chronic diseases.[115]

3. Energy & The Smart Grid

The electric power grid in the United States is tragically out-of-date.[116] Increasing energy demand has put enormous strain on this antiquated infrastructure, leading to outages that have devastated small towns and, on occasion, large swaths of the country.[117] Over the past forty years, five massive blackouts have occurred, three of which have taken place in the past nine years.[118]

Large-scale blackouts have enormous economic impacts. For example, the Northeast blackout of 2003 resulted in $6 billion in economic losses in the re-

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value of care delivery. Added value from these applications is extremely important for the growing number of seniors who want to independently age in place in the least restrictive environment possible."

See Gregory L. Alexander & William R. Kehr, *Mobile IT Applications*, LONG TERM LIVING, Jan. 2009, at 20, 21.

[113] OFCOM, TOMORROW'S WIRELESS WORLD 12 (2008), http://www.stakeholders.ofcom.org.uk/binaries/research/technology-research/randd0708.pdf; *see also* Adam Sherwin, *New Wi-Fi Devices to Tell Doctors: Help! I'm Having a Heart Attack*, TIMES (London), May 7, 2008, at 4.

[114] NATIONAL BROADBAND PLAN, *supra* note 11, at 202.

[115] *Id.* at 206-207 (observing that "[s]martphones have become useful tools for many physicians managing patient care on the go" and providing "examples of the convergence between communications and medicine," including "[m]obile applications that help individuals manage their asthma, obesity or diabetes," a "[s]martphone application that displays real-time fetal heartbeat and maternal contraction data" and an "iPhone application that presents images for clinicians making appendicitis diagnoses.").

[116] U.S. DEPT. OF ENERGY, THE SMART GRID: AN INTRODUCTION, 6-7, *available at* http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf [hereinafter DOE SMART GRIDS].

[117] *Id.* at 6-7; *see, e.g.*, Jaime Holguin, *Biggest Blackout in U.S. History*, CBS NEWS (Aug. 15, 2003), http://www.cbsnews.com/stories/2003/08/15/national/main568442.shtml.

[118] DOE SMART GRIDS, *supra* note 116, at 7.

gion.[119] A single blackout in Silicon Valley in the early 2000s totaled $75 million in losses.[120] In 2000, a one-hour outage at the Chicago Board of Trade resulted in $20 trillion in delayed trades.[121] With energy demand continuing to outstrip energy transmission capacity growth,[122] policymakers are examining a number of ways to upgrade the grid to increase energy efficiency. The *National Broadband Plan* proposes integration of broadband technologies to modernize the grid and make it "smart."[123]

A smart grid would provide energy companies and consumers with real-time usage and transmission data,[124] allowing consumers to easily cut energy usage and utilities to better monitor their infrastructure and protect against blackouts.[125] Wireless sensors placed at strategic points throughout the energy infrastructure use mobile broadband networks to relay supply and demand data across the many miles of transmission infrastructures.[126] Currently, many utilities are experimenting with mobile networks to monitor transmission and usage, and some have begun to experiment with different spectrum bands to send and receive this data.[127] The FCC is also exploring its role in facilitating the deployment of the smart grid via wireline and wireless broadband,[128] and the Department of Energy, in a study regarding the communications requirements for the smart grid, has underscored the critical role that wireless networks will play in spurring deployment of advanced energy infrastructure.[129]

The smart grid will enable innovative solutions to spur energy efficiency.

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[119] *Id.* at 8.

[120] *Id.*

[121] *Id.*

[122] The U.S. Department of Energy has found that demand for electricity in the United States has exceeded transmission growth by almost 25% each year since 1982. DOE estimates that new and necessary electricity infrastructure to support great demand would require a $1.5 trillion investment. *Id.* at 6, 17.

[123] Chapter Twelve of the FCC's *National Broadband Plan* focuses on how broadband could be used to optimize the provision and consumption of energy. NATIONAL BROADBAND PLAN, *supra* note 11, at 263-80.

[124] *Id.* at 272.

[125] *Id.* at 269.

[126] Katie Fehrenbacher, *FAQ: Smart Grid*, GIGAOM (Jan. 26, 2009, 9:00 PM), http://gigaom.com/cleantech/faq-smart-grid/; *see* NATIONAL BROADBAND PLAN, *supra* note 11, at 269.

[127] *See What if a WiMAX Gear Maker Tuned into Affordable UHF for You?*, SMART GRID TODAY, (Sept. 11, 2009), http://www.smartgridtoday.com/members/710.cfm (describing how a WiMAX equipment manufacturer retrofits its products to provide access to alternative wireless bands for use by energy utilities).

[128] Nick Sinai, *Clean-tech Investor Summit*, BLOGBAND: THE OFFICIAL BLOG OF THE NATIONAL BROADBAND PLAN (Jan. 21, 2010), http://blog.broadBand.gov/?entryId=111153.

[129] *See* COMMUNICATIONS REQUIREMENTS OF SMART GRID TECHNOLOGIES, U.S. DEPT. OF ENERGY (Oct. 2010) [hereinafter COMMUNICATIONS REQUIREMENTS OF SMART GRID TECHNOLOGIES].

For example, wireless smart meters will relay usage data from a customer's home to the grid for monitoring by the utility.[130] Some wireless carriers, including T-Mobile, Verizon, and AT&T, have partnered with smart meter companies to install data cards and other components to facilitate deployment.[131] Eventually, smart grids and smart meters will communicate, likely via a wireless connection,[132] with appliances and other items that consume energy in order to provide customers with a much more granular view of their energy footprint.[133]

Many energy reform proposals focus on smart grid deployment as a method to realize cost savings and reduce carbon emissions. The U.S. Department of Energy estimates significant implementation of the smart grid could eliminate fuel and greenhouse gases equivalent to current emissions from 53 million cars.[134] The smart grid also allows for diversification of the fuel supply through incorporation of intermittent renewable energy like wind power.[135] The ARRA of 2009 appropriated billions of dollars for smart grid deployment to spur continued investment and innovation in wireless broadband for deployment of the smart grid.[136]

In sum, an array of mobile technologies – including wireless network infrastructure, sensors, and devices – will be critical to the timely deployment of a national smart grid.[137]

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[130] NATIONAL BROADBAND PLAN, *supra* note 11, at 269.

[131] *See* Ariel Schwartz, *T-Mobile Joins the Smart-Grid Wireless Network Brigade*, FAST COMPANY.COM, (April 23, 2009), http://www.fastcompany.com/blog/ariel-schwartz/sustainability/t-mobile-joins-smart-grid-wireless-network-brigade; *AT&T Finally Jumps into the Smart Grid Pool*, SMARTSYNCH, (Mar 25, 2009), http://www.smartsynch.com/smartsynch_news_att.htm; *Vodafone, Verizon Wireless and nPhase Announce Strategic Alliance to Provide Global M2M Solutions*, VODAFONE, (Feb. 15, 2010), http://enterprise.vodafone.com/insight_news/2010-02-15_vodafone_verizon-wireless_nphase_announce_strategic_m2m_alliance.jsp.

[132] *See Building the Smart Grid*, ECONOMIST TECH. Q., June 6, 2009, at 15-16; Campbell McCool, *SmartSynch CEO Stephen Johnston: "Public Wireless Networks Will Drive the Smart Grid"*, SMARTSYNCH, (June 9, 2010), http://blog.smartsynch.com/smart-meter-technology/smartsynch-ceo-stephen-johnston-public-wireless-networks-will-drive-the-smart-grid/.

[133] *See Building the Smart Grid*, *supra* note 132, at 16.

[134] DOE SMART GRIDS, *supra* note 116, at 3, 7, 17, 21.

[135] *See* DOE SMART GRIDS, *supra* note 116, at 9.

[136] *See* Katherine Ling, *DOE Makes $30B Available to Jumpstart Renewable Energy, 'Smart Grid' Projects*, N.Y. TIMES (July 30, 2009), http://www.nytimes.com/gwire/2009/07/30/30greenwire-doe-makes-30b-available-to-jumpstart-renewable-16564.html.

[137] For example, some have argued that Wi-Fi technologies, which operate at the edges of broadband networks, are well suited to address the three segments – home area network, neighborhood area network, and wide area network – of the smart grid. *See* WI-FI ALLIANCE, WI-FI FOR THE SMART GRID: MATURE, INTEROPERABLE, SECURITY-PROTECTED TECH-

4. Education

Wireless broadband technologies bring educational service to primary, secondary, continuing education, and "eager learners wherever they may be."[138] One of the important short-term uses of wireless broadband is for students in remote rural areas of the country, where wireless broadband will be a key enabler of distance learning services and Internet access, providing students with an opportunity to have similar resources as their urban and suburban counterparts.[139] As the FCC has observed, broadband "can significantly improve the quality of education by providing students in rural America with the ability to do online research, interact with their teachers and schools from home, and obtain college credit and college degrees, even though they are not physically on campus."[140] Online learning via a wireless or wired broadband connection represents a new mode of learning that is a boon to all students.[141]

A recent pilot program in North Carolina, Project K-Nect,[142] illustrates how wireless broadband can transform the educational experience and enhance individual achievement. The program used "smartphones with advanced mobile broadband technologies to deliver educational material to ninth-grade students."[143] According to its project director, "[seventy-five] percent of partici-

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NOLOGY FOR ADVANCED UTILITY MANAGEMENT COMMUNICATIONS 6-9 (2009), *available at* http://www.wi-fi.org/knowledge_center_overview.php?docid=4583. *See also* COMMUNICATIONS REQUIREMENTS OF SMART GRID TECHNOLOGIES, *supra* note 129, at 2, 11.

[138] *See* Statement of Michael J. Copps, Comm'r, Fed. Commc'ns Comm'n, Fostering Innovation and Investment in the Wireless Communications Market (GN Docket No.09-157); A National Broadband Plan For Our Future (GN Docket No. 09-51); Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless Including Commercial Mobile Services (WT Docket No. 09-66); Consumer Information and Disclosure (CG Docket No. 09-158); Truth-in-Billing and Billing Format (CG Docket No. 98-170); IP-Enabled Services (WC Docket No. 04-36) *(Aug. 27, 2009) available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-09-66A3.pdf. *See generally* NATIONAL BROADBAND PLAN, *supra* note 11, ch. 11 at 241-62 (exploring how broadband can enhance education at all levels).

[139] Bringing Broadband to Rural America: Report on a Rural Broadband Strategy, *Public Notice*, 24 F.C.C.R. 12791, ¶ 19 (Oct. 19, 2009).

[140] *Id.* ¶ 9.

[141] A recent report by the U.S. Department of Education concluded that, "[o]n average, students in online learning conditions performed better than those receiving face-to-face instruction." Steve Lohr, *Study Finds That Online Education Beats the Classroom*, N.Y. TIMES BITS BLOG, (Aug. 19, 2009, 1:08 PM), http://bits.blogs.nytimes.com/2009/08/19/study-finds-that-online-education-beats-the-classroom (citing U.S. DEPT. OF EDUC., EVALUATION OF EVIDENCE-BASED PRACTICES IN ONLINE LEARNING: A META-ANALYSIS AND REVIEW OF ONLINE LEARNING STUDIES (2009)).

[142] *See* PROJECT K-NECT, http://www.projectknect.org/Project K-Nect/Home.html (last visited Jan. 1, 2011).

[143] CARLY SHULER, JOAN GANZ COONEY CTR. AT SESAME WORKSHOP, POCKETS OF PO-

pating classes outperformed other cohorts in math subjects in the recently completed first phase of research. Students also displayed increases in average study time [and] significant gains in parental involvement."[144]

In addition to enhancing the in-classroom experience, wireless broadband provides access to an array of innovative services and applications available on devices (e.g., mobile handsets and netbooks) that can be used in the home.[145] For example, students can supplement their learning by using smartphones to access supplemental materials such as podcasts, updated syllabi, reading materials, and discussion groups.[146] Smartphones are indeed becoming a popular locus of innovation for an array of new add-on applications that enable students to access a wide array of tools and services targeted at enhancing educational performance.[147] Digital textbooks are becoming increasingly available for wireless download on e-book readers like Amazon's Kindle and on handsets like the iPhone.[148] A number of schools and states are shifting towards these more affordable and easily updatable versions of textbooks.[149] Newer

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TENTIAL: USING MOBILE TECHNOLOGIES TO PROMOTE CHILDREN'S LEARNING 14 (2009), http://joanganzcooneycenter.org/upload_kits/pockets_of_potential_1_.pdf.

[144] *See id.*

[145] The FCC's National Broadband Plan recommends opening a rulemaking proceeding to "fund wireless connectivity to portable learning devices" in an effort to ensure that all students are able to use the Internet outside of school. NATIONAL BROADBAND PLAN, *supra* note 11, at 225-227.

[146] *See* John Timmer, *College Courses: Even "Offline" Classes are Online Now*, ARS TECHNICA (Jan. 4, 2009, 5:00 PM), http://arstechnica.com/business/news/2009/01/tracking-the-evolution-of-online-education.ars.

[147] *See, e.g.*, Tim Devaney, *Smartphones dial up learning experience*, THE DETROIT NEWS, Oct. 9, 2010, http://www.detnews.com/article/20101009/BIZ/10090310/1001/biz .

[148] *See, e.g.*, Daniel Etherington, *Textbooks Now On iPhone, iPod Touch*, THE APPLE BLOG (Aug. 10, 2009, 9:32 AM), http://theappleblog.com/2009/08/10/textbooks-now-on-iphone-ipod-touch/; Declan Butler, *The Textbook of the Future*, NATURE, Apr. 2, 2009, at 568-70; Todd R. Weiss, *College Textbooks Hit iPhone, iPod Touch*, PCWORLD (Aug. 12, 2009, 11:24 AM), http://www.pcworld.com/article/170075/college_textbooks_hit_iphone_ipod_touch.html; Eric Engleman, *CourseSmart Takes on Kindle, Puts Textbooks on iPhone*, TECHFLASH (Aug. 10, 2009, 9:41 AM), http://www.techflash.com/seattle/2009/08/CourseSmart_takes_on_Kindle_puts_textbooks_on_iPhone52896024.html.

[149] California, for example, recently announced that it has begun approving the use of digital textbooks in schools across the state. *See* John Timmer, *Open Source, Digital Textbooks Coming to California Schools*, ARS TECHNICA (June 9, 2009, 11:13 PM), http://arstechnica.com/tech-policy/news/2009/06/open-source-digital-textbooks-coming-to-california-schools.ars. Proposed federal legislation would provide funding to schools for e-readers via the E-Rate program. *See* Press Release, Office of Rep. Ed Markey, Markey Introduces E-Rate 2.0 Bill to Bring Successful Program into 21st Century (Feb. 9, 2010); *see also* Ron Schachter, *Digital Classrooms Take Flight*, DISTRICT ADMIN., Oct. 2009, at 30-37; Michael Baumann, *Bringing Digital Textbooks to the Masses*, ECONTENT, Jan./Feb. 2010, at

devices like the iPad, with a 3G connectivity option for a fee and Wi-Fi, have spurred development of unique educational applications and tools currently unavailable on laptops or e-readers.[150] Wireless-enabled services like these provide students, teachers, and parents with an array of innovative new approaches to learning.

C. Takeaways

Three important and interrelated ongoing trends in the wireless sector signal the critical role that wireless broadband services and the networks that support them will continue to play in all aspects of the economy. Market saturation and increasing consumer demand for additional and more robust mobile data services have spurred innovation and increased investment in networks, and have made service providers much more attentive and responsive to shifts in consumer preferences.[151] As a result, wireless carriers are investing billions of dollars to bolster and extend existing networks and to deploy next-generation networks that can support more robust data uses. Second, innovation at the network level has spurred innovation at the handset level. Smartphones are increasingly prevalent and a new market for add-on software (e.g., applications and services) is thriving as consumers seek to increase mobility, productivity, and quality of life. Moreover, increased smartphone ownership and usage of add-on applications is further inuring a sense of mobility among a growing portion of consumers. Untethering from a wired broadband connection allows users to be more productive and reap a number of individual benefits that, in the aggregate, have important and discernible impacts on the economy. Third, these new usage patterns spur other sectors to leverage wireless ubiquity and insatiable demand for wireless services in order to provide new services to

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12-13.

[150] *See, e.g.*, Dennis Carter, *Developers Seek to Link iPad with Education*, ESCHOOL NEWS (Apr. 5, 2010), http://www.eschoolnews.com/2010/04/05/ipad-app-store-has-wide-selection-of-education-options/; *see also iPad Features*, APPLE, INC., http://www.apple.com/ipad/features (last visited Jan. 1, 2011) (explaining exclusivity of apps available for iPad).

[151] LOSING THE FOREST, *supra* note 25 (observing that, as a result of carriers competing to retain existing customers and poach customers from competitors, service providers are competing on array of terms other than price, including the number and type of service plans and handsets available to customers, the range of advanced services available and able to be amply supported by a given network, and customer service, among many others). A November 2009 study by the Government Accountability Office (GAO) found that the vast majority – eighty-four percent – of wireless customers were satisfied with their wireless phone service. U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-34, FCC NEEDS TO IMPROVE OVERSIGHT OF WIRELESS PHONE SERVICE 8 (2009), http://www.gao.gov/new.items/d1034.pdf.

consumers. As detailed above, innovations in the public safety, healthcare, energy, and education sectors are providing consumers with heretofore unseen opportunities and services. These types of innovative business models are poised to spill over into a wider array of sectors across the economy. Private investment will drive innovation across these sectors and provide consumers with access to a nearly limitless universe of new services and applications, all of which will be available via wireless broadband on advanced handsets.

These three trends interrelate because they each rely on the availability of robust, next-generation mobile networks to enable new handsets, new applications, and new services. These networks are comprised of multiple components, including physical infrastructure (e.g., cell phone towers) and a more intangible resource that is essential for bolstering existing networks and deploying new ones: spectrum. Indeed, spectrum is the most important component of a wireless network. In order to ensure that these trends continue to evolve and multiply, it is essential that innovators have access to additional swaths of the airwaves. Thus, policymakers must immediately implement a forward-looking allocation strategy that makes additional spectrum available in a timely manner in order to support continued innovation across the wireless ecosystem.

III. PAST AS PROLOGUE? DERIVING BEST PRACTICES FROM THE EVOLUTION OF FCC SPECTRUM ALLOCATION POLICY

The present success of the wireless industry has been largely fostered by the FCC's careful approach to crafting policies and regulations that seek to guide rather than control the marketplace. The evolution of FCC spectrum allocation policy over the last three decades has largely paralleled an explosion in consumer demand for ever more innovative wireless devices and services, and has been largely successful in making spectrum available to innovators in a timely and efficient manner. In most instances, the FCC has forged policies reflective of the market rather than pursue anticipatory policies to predict consumer demand or technological innovation.[152] This cautious yet forward-looking approach has spurred competition, fostered innovation, and provided consumers

[152] Some have argued, though, that the FCC has not been aggressive enough in its approach to wireless spectrum allocation. For example, cellular technology was conceived in the 1940's but it was not until the early 1980's that the FCC was satisfied that the technology would benefit consumers and began licensing for its use. It is estimated that this delay cost the U.S. economy about $86 billion (measured in 1990 dollars). *See* JEFFERY H. ROLPHS ET AL., NAT'L. ECON. RESEARCH ASSOCS.,ESTIMATE OF LOSS TO THE UNITED STATES CAUSED BY THE FCC'S DELAY IN LICENSING CELLULAR COMMUNICATIONS 1 (1991).

with many welfare gains.[153] The evolution of FCC spectrum allocation policy highlights best practices for policymakers as they develop policies for the wireless broadband future.

A. Growing Pains: The FCC's Early Approach to Spectrum Allocation (1984-1992)

Once it deemed wireless telephony a viable technology that would likely appeal to consumers,[154] the FCC initially took a very heavy-handed and deliberate approach to spectrum allocation[155] in order to protect other spectrum-dependent technologies from harmful interference (e.g., radio and television) and to foster the newborn market.[156] Through its band plan, which outlined the accepted uses of a particular portion of spectrum, the FCC decided which services could be offered over which frequencies and how many licensees would be able to offer those services.[157] Because of the strict limitations placed on the licensee and the marketplace, this approach to spectrum allocation was termed "command and control."[158] Major justifications for the command and control

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[153] Philip J. Weister & Dale Hatfield, *Spectrum Policy and The Next Frontier of Property Rights*, 15 GEO. MASON L. REV. 549, 564 (2008) [hereinafter *Next Frontier of Property Rights*].

[154] The FCC issued an NPRM and NOI in the late 1960s seeking comment on the reallocation of spectrum, some of which would be dedicated to "land mobile radio service." *See, e.g.*, 47 C.F.R. § 2.102 (1968). In 1977, the FCC considered an application "to construct and operate the first developmental Mobile Radio Telecommunications system using Cellular concepts." The FCC was enthusiastic about this petition, specifically, and more generally about the promise of wireless telephony as a way to "achieve [its] objective of a nationwide, high capacity radiotelephone service." Ill. Bell Tel. Co., 63 F.C.C. 2d 655, 657 (1977).

[155] *See Next Frontier of Property Rights*, *supra* note 153, at 558-59 (2008) ("The traditional command-and-control model of spectrum management operates based on the wise man theory of regulation . . . . [T]his approach generally presumes that regulatory decisions, and not market forces, are capable of deciding what uses of spectrum are *best* for the public.") (internal quotation marks omitted).

[156] *See id.*

> In essence, the FCC's early concern about interference in the radio spectrum was that, without close government supervision, everyone would use the identical frequency at the same time in the same place and no one would be heard as a result. Based on this fear, the FCC viewed interference like a virus to be avoided—as opposed to a fact of life (like different sources of light) that can be managed (say, by wearing sunglasses).

Id.

[157] *See* STUART MINOR BENJAMIN ET AL., TELECOMMUNICATIONS LAW AND POLICY 67 (2nd ed. 2006) [hereinafter TELECOMM. LAW & POLICY].

[158] *Id.* From the beginning, critics of the "command and control" approach submitted that even though spectrum was a scare resource, it did not necessitate government control because free-market mechanisms could self-regulate and produce efficient outcomes. Ronald H. Coase first made this argument in the 1950s regarding licenses for television and radio. *See* Ronald H. Coase, *The Federal Communications Commission*, 2 J. L. & ECON. 1, 17-18

policy included scarcity of spectrum and the potential for harmful interference.[159] Because of the technological limitations of the first cellular networks, multiple users could not simultaneously use a portion of spectrum without interfering with other services.[160]

Even though wireless telephony service quality was unreliable and initially expensive, wireless carriers acquired a healthy number of new consumers each year. Between 1984 and 1985, the number of wireless consumers nearly tripled, increasing from 91,600 to 340,213; over the following year, that number doubled.[161] Recognizing the inherent flaws of the command and control approach and the limitations it placed on the market in light of growing demand, the FCC began to implement more flexible spectrum use policies.[162] For example, in 1988 the FCC allowed wireless license holders to employ a wider range of technologies when deploying cellular networks, a move intended to further spur growth in the cellular market and led to the development of new digital transmission technologies.[163]

By the 1990s, cell phones became more than just a novelty as consumer demand for wireless services increased significantly. At the end of 1990, over 5

(1959).

[159] The Supreme Court first recognized the scarcity rationale to justify government control over spectrum in the context of broadcasting. NBC v. US, 319 U.S. 190, 213 (1943) ("[There are] certain basic facts about radio as a means of communication – its facilities are limited, they are not available to all who may wish to use them…[r]egulation of radio was therefore as vital to its development as traffic control was to the development of the automobile."); *see also* TELECOMM. LAW & POLICY, *supra* note 157, at 30-37; Introduction to Cellular Communications, http://www.gsmfavorites.com/documents/introduction/gsm/ (last visited Jan. 1, 2011).

[160] The Supreme Court first recognized the scarcity rationale to justify government control over spectrum in the context of broadcasting. NBC v. US, 319 U.S. 190, 213 (1943) (stating that "[there are] certain basic facts about radio as a means of communication – its facilities are limited, they are not available to all who may wish to use them…[r]egulation of radio was therefore as vital to its development as traffic control was to the development of the automobile."); *see also* TELECOMM. LAW & POLICY , *supra* note 157 at 30 – 37.

[161] *Eleventh CMRS Report*, *supra* note 42, at ¶ 96 tbl. 1.

[162] The FCC later admitted that when it was first forging policies for the wireless market, "no one predicted that the service would be as popular" as it quickly became. *See In re* Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, *First Report*, 10 F.C.C.R. 8844, ¶ 3 (July 28, 1995) [hereinafter *First CMRS Report*].

[163] *See* Thomas Hazlett, *Wireless Craze, The Unlimited Bandwidth Myth, The Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's "Big Joke": An Essay on Airwave Allocation Policy*, 14 HARV. J. OF LAW & TECH. 335, 485-86 (2001) ("Only in 1988, after licensees had built their big-city systems (where capacity was stretched) did the FCC allow digital telephones, in one of the great blunders in the history of telecommunications.") [hereinafter *Wireless Craze*]; *see also In re* Amendment of Parts 2 and 22 of the Commission's Rules to Permit Liberalization of Technology and Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service, *Report and Order*, 33 F.C.C.R. 7033, ¶¶ 1-2 (Oct. 13, 1988).

million consumers subscribed to wireless services; by the turn of the century, this number approached 100 million.[164] As a result of the explosion in consumer demand, Congress and the FCC sought to bolster competition by auctioning off roughly 140 MHz of spectrum for "personal communications services" (PCS) in local and regional blocks.[165] In addition, the FCC adopted a more flexible spectrum use approach by allowing PCS licensees to employ "any mobile communications service," not just the analog technology.[166] This policy change spurred competition within the market and fostered creative approaches. For example, Nextel created a competitive network comprised of spectrum originally limited to specialized mobile radio (SMR) licenses and intended only for use as a private dispatch service.[167] Through various FCC waivers, Nextel was able to transform the SMR spectrum into a competitive wireless network that did not require new policymaking by the FCC.[168]

The FCC's more flexible spectrum policies provided license holders latitude to experiment with using their portion of the airwaves rather than confining them to limited uses under the command and control approach.[169] This created incentives for carriers to make more efficient and highly-valued choices in spectrum use.[170] It was during this period that the FCC set a precedent by adjusting its policies vis-à-vis spectrum in reaction to market forces.[171] This trend would continue well into the next decade as the wireless market evolved and matured.

B. Growth Spurt: FCC Spectrum Allocation Policy during the First Wireless Boom (1993-2001)

Between 1990 and 1993 the wireless market added an average of three million new subscribers per year, which represented an average annual growth of

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164 *Eleventh CMRS Report*, *supra* note 42.

165 *Wireless Craze*, *supra* note 163, at 513-14.

166 TELECOMM. LAW & POLICY, *supra* note 157, at 77.

167 *See* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE 244 (MIT Press 2005).

168 *See id.*

169 *Cf. id.* at 244-45 (discussing the evolution of FCC towards a "market-based model," in particular the "allocation of several bands to 'personal communications service' (PCS) licenses, which the holder [could] use to provide any mobile communications service, as well as fixed services, if provided in combination with mobile ones (but not broadcasting services under any circumstances).") (internal quotation marks omitted).

170 SPECTRUM POLICY TASK FORCE, FCC REPORT OF THE SPECTRUM EFFICIENCY WORKING GROUP 16 (Nov. 15, 2002), *available at* http://www.fcc.gov/sptf/files/SEWGFinalReport_1.pdf [hereinafter SPTF REPORT].

171 NUECHTERLEIN & WEISER, *supra* note 167, at 244-45.

about forty-four percent.[172] By 1993, there were sixteen million wireless subscribers in the United States.[173] In order to accommodate this robust growth and ensure that the market would continue to expand, Congress in 1993 amended the 1934 Communications Act in the Omnibus Budget Reconciliation Act of 1993 (1993 Act) to create a national deregulatory framework for wireless services.[174] The core provisions of the 1993 Act acknowledged the interstate nature of wireless,[175] which required a more streamlined approach to unburden the market of many inconsistent state-level regulations.[176]

With regard to spectrum, the FCC, in 1994, implemented a radical new allocation strategy: auctioning off portions of the airwaves instead of just giving them away.[177] The first ten licenses, earmarked for nationwide advanced paging services, were sold at auction for a total of $617 million.[178] Less than a year later, spectrum for personal communications services, which would form the first digital wireless networks, was auctioned off for a then-record of $7 billion.[179] The goals of the auction approach were to "promote efficient and intensive use of the electromagnetic spectrum; promote rapid deployment of new technologies; promote economic opportunity and competition by dissemination of licenses to a wide variety of applicants; [and] recover for the public a portion of the value of the public spectrum resource."[180] Indeed, ahead of the very first spectrum auction in 1994, then-FCC Chairman Reed Hundt proclaimed that the auctions would "offer Americans the opportunity to purchase a piece

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[172] *Eleventh CMRS Report*, *supra* note 42.

[173] *Id.*

[174] Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, § 6002(b), 107 Stat. 312, 392 (codified in relevant part at 47 U.S.C. § 332 (2006)). For an analysis of section 332, *see* Leonard J. Kennedy & Heather A. Purcell, *Section 332 of the Communications Act of 1934: A Federal Regulatory Framework That Is "Hog Tight, Horse High, and Bull Strong,"* 50 FED. COMM. L.J. 550 (1998) (analyzing section 332 as freeing wireless carriers "from the dual (federal and state) regulatory jurisdictional system designed to regulate the monopoly" wireline industry).

[175] *See* Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, § 6002(b), 107 Stat. 312, 392 (codified in relevant part at 47 U.S.C. § 332 (2006)).

[176] *See* Leonard J. Kennedy & Heather A. Purcell, *Wandering Along the Road to Competition and Convergence – The Changing CMRS Roadmap*, 56 FED. COMM. L.J. 489, 498-99 (2004).

[177] Omnibus Budget Reconciliation Act of 1993, Pub. L. No 103-66, Sect. 6002, 107 Stat. 312, 379086 (codified as 47 U.S.C. 309 (j) (2000)).

[178] *See* Edmund L. Andrews, *Airwaves Auctions Brings in $833 Million for U.S. Treasury*, N.Y. TIMES, July 30, 1994, at 1.

[179] *See* Edmund L. Andrews, *Winners of Wireless Auction to Pay $7 Billion*, N.Y. TIMES, Mar. 14, 1995, at D1.

[180] R. PRESTON MCAFEE ET AL., *The Greatest Auction in History*, *in* BETTER LIVING THROUGH ECONOMICS 168, 170 (J. Sigfreid, ed., 2008). For an insightful analysis of how these initial auctions were designed to meet their Congressional mandate, *see id.* at 168-83.

of the airwaves and then they—and their customers—will decide how to use it. The government is not deciding what is to be done with those airwaves—it is deciding to open that opportunity to everyone."[181] The "skylight," as Hundt put it, had truly been opened and a new age of wireless innovation began in earnest.[182]

Between 1993 and 1996, the number of wireless subscribers increased from just over sixteen million to forty-four million.[183] At the time, price was considered a primary indicator of whether the wireless market was competitive.[184] From 1993 to 1996, the average monthly bill dropped from $61.48 to $47.70; between 1988 and 1996, prices halved, decreasing from $98 to around $47 per month.[185] Similarly, the number of wireless carriers increased due to the availability of additional spectrum.[186] This new dynamic pressured all carriers to invest heavily in their networks in order to ensure a minimum level of service quality, which quickly became another key indicator of competition.[187] Consequently, the number of cell sites nationwide increased 134 percent, and the number of employees of carriers rose by roughly 110 percent during the 1993-1996 period.[188]

As a result of these market forces, policymakers did not radically alter spectrum allocation policy in the 1990s. For example, not even the massive regulatory overhaul of the telecommunications market in the middle of the decade—which culminated in the landmark 1996 Telecommunications Act—impacted FCC spectrum allocation policy.[189]

The ready availability of robust spectrum resources, an increase in consumer demand, and the emergence of viable competitors in the marketplace drove

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[181] *See* Reed Hundt, Chairman, Fed. Commc'ns Comm'n, FCC Nationwide Narrowband PCS Auctions (July 25, 1994), *available at* http://www.fcc.gov/Speeches/Hundt/spreh421.txt.

[182] *Id.*

[183] *Eleventh CMRS Report, supra* note 42, at 11033 tbl.1.

[184] *First CMRS Report, supra* note 162, at 70.

[185] *Eleventh CMRS Report, supra* note 42, at 11033 tbl.1.

[186] *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Third Report*, 13 F.C.C.R. 19746, 19751 (May 14, 1998) [hereinafter *Third CMRS Report*].

[187] William R. Drexel, *Telecom Public Policy Schizophrenia: Schumpeterian Destruction Versus Managed Competition*, 9 VA. J. L. & TECH. 5, 45-47 (2004).

[188] *Eleventh CMRS Report, supra* note 42, at 11033 tbl.1.

[189] *See, e.g., Wireless Craze, supra* note 163, at 359; James Speta, *Deregulating Telecommunications in Internet Time*, 61 WASH. & LEE. L.R. 1063, 1111 (2004); *see* Reed Hundt, *Ten Year s Under the 1996 Telecommunications Act*, 58 FED. COMM. L.J. 399, 401 (2006); *see In re* Federal-State Board on Universal Service, *Report & Order*, 12 F.C.C.R. 8776, 8932-34, 8944-46 (May 8, 1997); Universal Service, 47 U.S.C. § 254(d) (2006).

innovation in the late 1990s. Technological convergence, a hallmark of the wireless industry throughout its history, began in earnest in the late 1990s.[190] In 1997, for example, a new service offering – mobile data – was first observed by the FCC,[191] along with a rise in the use of digital technologies to increase network capacity.[192] By the end of the century, the wireless market had fully blossomed. Subscribership surpassed 100 million in 2000,[193] networks were more national in nature,[194] and mobile data was a much more integral part of wireless service.[195] Indeed by 2000-2001, many wireless carriers announced plans to develop and deploy 3G networks to provide consumers with better mobile data services like Internet access and email.[196]

By the dawn of the twenty-first century, the wireless market was developing more quickly than ever.[197] The number of minutes used per month by consumers skyrocketed between 1999 and 2002, rising from 185 to 427.[198] Upwards of three percent of wireless consumers had completely "cut the cord" by 2000, relying solely on their mobile devices for telephony.[199] By 2002, consumers used more minutes on their cell phones than on their landline phones for the first time ever.[200] With an increase in consumer demand for more minutes and

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190 *Third CMRS Report*, *supra* note 186,,at 19753-54 ("The convergence of product and service offerings continues to be a driving force in the wireless industry. Markets are defined by services, not legal or regulatory terms. One of the most easily recognizable results of this process is the increased use of "bundles" (i.e., multiple services from the same device) as a marketing tool. For example, a consumer might purchase a mobile telephone with paging services or a pager that offers voice messaging or data transmission.").

191 *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Second Report*, 12 F.C.C.R. 11266, 11321 (Mar. 6, 1997).

192 *Id.* at 19754.

193 *Third CMRS Report*, *supra* note186, at 11033 tbl.1.

194 *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Sixth Report*, 16 F.C.C.R. 13350, 13354, 13362 (July 17, 2001) [hereinafter *Sixth CMRS Report*].

195 *Id*. at 13355-56.

196 *Id*. at 13356.

197 *See Wireless Craze*, *supra* note 163, at 345-47 (comparing the "runaway performance" of NASDAQ during 1998-2000 where "[l]arge wireless equipment suppliers saw annualized returns of 181.2%, wireless broadband operators returned 177.4% for shareholders, and small wireless broadband suppliers rose an incredible 365.9%" to 13.63% per annum return from 1984 to 1998).

198 *Eleventh CMRS Report*, *supra* note 42,, at 11043 tbl.10.

199 *Sixth CMRS Report*, *supra* note 194 (*citing to* Judy Sarles, *Wireless users Hanging Up On Landline Phones*, NASHVILLE BUSINESS JOURNAL (Feb. 2, 2001) http://nashville.bizjournals.com/nashville/stories/2001/02/05/focus2.html; Simon Barker-Benfield, *Consumers Replacing Landline Phones with Wireless*, FLA. TIMES UNION, Jan. 10, 2001, at F1.

200 *Yankee Group Finds that Wireless Calling Surpasses Wireline Calling*, California

more data-rich mobile services like text messaging and email, along with a concomitant rise in competition among carriers and commitments to upgrade networks to 3G, the private sector demanded additional spectrum to enable the rollout of such services.[201] In response, the FCC began the process of making additional swaths available for auction.[202] There was a sense, however, that a more fundamental reexamination of spectrum allocation policies was necessary to ensure that demand for more advanced wireless services (e.g., data services) would be met.[203]

C. The Second Wireless Boom: Spectrum Allocation in the Age of Mobile Data (2002-2006)

In an effort to "keep pace with the ever-increasing demand for spectrum and the continuing advances in wireless technology and applications," the FCC, in 2002, established a Spectrum Policy Task Force (SPTF), an internal effort

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Science and Technology News, http://ccnmag.com/article/yankee_group_finds_that_wireless_calling_surpasses_wireline_calling (last visited Jan. 1, 2011).

[201] *Sixth CMRS Report*, *supra* note 194, at 50-51; *see e.g.*, *Eleventh CMRS Report*, *supra* note 42, at 11011, 11013.

[202] *Sixth CMRS Report*, *supra* note 194, at 51-52. "In January 2001, the Commission released a Notice of Proposed Rulemaking exploring the possibilities of using five different spectrum bands for advanced mobile services: 1710-1755 MHz, 1755-1850 MHz, 2110-2155 MHz, 2160-2165 MHz, and 2500-2690 MHz," *citing In re* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3GHz for Mobile and Fixed Services, Including Third Generation Wireless Systems; Petition for Rulemaking of the Cellular Telecommunications Industry Association Concerning Implementation of WRC-2000: Review of Spectrum and Regulatory Requirements for IMT-2000; Amendment of the U.S. Table of Frequency Allocations to Designate the 2500-2520/2670-2690 MHz Frequency Bands for the Mobile Satellite Service, *Notice of Proposed Rulemaking and Order*, 16 F.C.C.R. 596 (Dec. 29, 2000). "[T]he Commission is scheduled to begin auctioning licenses fo 30 megahertz of spectrum in the upper 700 MHz band on September 12, 2001. This spectrum is part of a larger band, 698-806 MHz, that the WRC-2000 identified for possible implementation of 3G systems," *citing In re* Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, *First Report and Order*, 15 F.C.C.R. 476 (Jan. 6, 2000).

[203] *See, e.g.*, *Wireless Craze*, *supra* note 166, at 556-57; *see, e.g.*, Elia Noam, *Spectrum Auctions: Yesterday's Heresy, Today's Orthodoxy, Tomorrow's Anachronism. Taking the Next Step to Open Spectrum Access*, 41 J.L. & ECON. 765-90 (1988); LAWRENCE LESSIG, THE FUTURE OF IDEAS (Random House 2001), *available at* http://the-future-of-ideas.com (last visited Jan. 1, 2011); Yochai Benkler, *Some Economics of Wireless Communications*, 16 Harv. J. Law & Tech. 25 92002); *see* Jerry Brito, *The Spectrum Commons in Theory and Practice*, 2007 STAN. TECH. L. REV. 1 (2007), *available at* http://stlr.stanford.edu/pdf/brito-commons.pdf (last visited Jan. 1, 2011); SPTF REPORT, *supra* note 170, at 1,4; Press Release, FCC, Press Statement of Chairman Michael K. Powell on Spectrum Policy Task Force (Nov. 7, 2002) (on file with author).

comprised of staff members from an array of departments,[204] to undertake a comprehensive evaluation of its existing spectrum practices.[205] The primary responsibility of the SPTF was to recommend more market-oriented policies that would encourage investment, promote innovation, and provide the marketplace with regulatory certainty.[206]

With regard to spectrum allocation, the SPTF recommended a hybrid approach, one that mixed the best elements of a variety of approaches, including the "commons model"[207] and command and control.[208] New technologies had begun to enhance and maximize the use of spectrum, thus allowing for more capacity to be wrung from individual swaths of spectrum.[209] This meant that the scarcity argument used to justify the historically rigid command and control approach was being undermined by technological innovation.[210] Yet spectrum, by its nature, is a scarce and finite resource,[211] which supports the granting of exclusive rights to swaths of the airwaves.[212] However, flexible use requirements for individual licensees would allow each to tailor their use in such a way that would increase access to spectrum for other users.[213] Overall, the task force concluded that a more flexible and market-oriented spectrum policy would create incentives for incumbent market participants to use their spectrum more efficiently and lure new entrants.[214]

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[204] Press Release, FCC, FCC Chairman Michael K. Powell Announces Formation of Spectrum Policy Task Force (Jun. 6, 2002) (on file with author).

[205] *See* SPTF REPORT, *supra* note 170, at 1.

[206] *Id.* at 1. The SPTF invited public comment and held "numerous information meetings as well as four public workshops," in an effort to produce a comprehensive report. *Id.* at 2.

[207] The "commons" model "[a]llows unlimited numbers of unlicensed users to share frequencies, with usage rights that are governed by technical standards or etiquettes but with no right to protection from interference." *Id.* at 29-30. For additional information on the commons model, *see* Brito, *supra* note 203.

[208] This has been described as a "hedging" strategy by the FCC. *See* John S. Leibovitz, *The Great Spectrum Debate: A Commentary on the FCC Spectrum Policy Task Force's Report on Spectrum Rights and Responsibilities*, 6 YALE J.L. & TECH. 390, 406-407 (2003-04) [hereinafter *Great Spectrum Debate*].

[209] SPTF REPORT, *supra* note 170, at 15.

[210] *Id.* at 403-05 ("The notion that the scarcity of a wireless system might actually decrease as transmission increases of course turns an assumption underpinning decades of spectrum policy on its head.").

[211] *Next Frontier of Property Rights*, *supra* note 153, at 556-557 (observing that, even though spectrum is "infinitely renewable," it is "still a scarce resource in the sense that two individuals cannot use the same frequency at the same time in the same place without canceling out—or at least interfering with—both transmissions.").

[212] *Great Spectrum Debate*, *supra* note 208, at 408-409 (observing four approaches to spectrum allocation available under the framework outlined by the Spectrum Policy Task Force).

[213] SPTF REPORT, *supra* note 170, at 15.

[214] *Id.*

The idea of flexibility in spectrum use and allocation was certainly not new to the FCC, but innovative technologies and surging consumer demand required a more fundamental reevaluation of how best to optimize the seemingly finite universe of spectrum.[215] The SPTF recommended the creation of more spectrum rights for individual licensees in response to this dilemma.[216] These rights included a grant of maximum authority to choose how to use spectrum (i.e., which services to offer), which technology to use to deliver those services, and the ability to transfer, lease or subdivide spectrum in a secondary market free of FCC intervention.[217] In sum, the SPTF sought to implement a more consistent approach to apportioning spectrum across all bands in the hope that such a framework would "significantly reduce the artificial scarcity of spectrum that currently exists as a result of barriers to access."[218] In other words, the SPTF recommended the adoption of policies that would bolster efficient use of spectrum by all licensees.[219]

The SPTF report underscored the FCC's evolving view of the wireless marketplace—market-oriented policies that balanced consumer welfare with the overall public interest.[220] While acknowledging that there was a role for the FCC in regulating spectrum, the SPTF also recognized the enormous consumer welfare gains being provided to consumers across the United States. In order to ensure continued growth, the FCC understood that it had to either reform its policies or risk impeding the progress of the marketplace.[221] To this end, the FCC began to implement some of the recommendations in the Task Force's report while it continued to auction new swaths of spectrum to wireless carriers.[222] For example, in 2003 and 2004, the FCC adopted policies to expand and

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[215] SPTF REPORT, *supra* note 170, at 1-4 (discussing the pressures technology places on current spectrum policy and the need for new policy to better utilize available spectrums).

[216] *Id.* at 17.

[217] *Id.*

[218] *Id.* at 9, 13, 16, 21.

[219] *Id.*

[220] For background on the FCC's role in regulating spectrum, *see, e.g.*, SPTF REPORT, *supra* note 170, at 7-10. *See id.* at 41 ("To the extent domestic policies and allocations complement international decisions, U.S. consumers and businesses will reap important benefits such as more international roaming and better economies of scale with regard to equipment manufacturing.").

[221] SPECTRUM BRIDGE, INC., ANALYSIS OF FCC SECONDARY SPECTRUM MARKETS POSITIONS, POLICIES AND COMMENTS 3 (2008).

[222] As then-FCC Chairman Michael Powell noted upon release of the SPTF report, its:

> "findings, recommendations and ideas…resonated in this new, technology driven global economy; we can no longer suffer under decades-old spectrum policy regimes that hinder, rather than promote, innovation." As a result, "the Commission . . . considered and incorporated the Task Force's findings and recommendations in a number of spectrum allocation and licensing proceedings"

See Press Release, Michael Powell, Fed. Commc'ns Comm'n Chairman, Press Statement

facilitate the creation of secondary markets in spectrum[223] and to create incentives for a licensee to maximize the use of their swath of spectrum.[224] Moreover, the technology necessary for enabling more efficient use of spectrum was beginning to be developed and adopted, ushering the market into what some hoped would be an era of spectrum abundance.[225]

As a result of adopting some SPTF policies and wider technological innovations, the wireless market continued to expand. Between June 2000 and June 2005, the wireless industry added almost 100 million customers, equal to the amount of users added from the birth of the wireless market to 2000.[226] Over this same period of time, carriers increased annual investments in networks from $10 billion in 2000 to $20 billion in 2005.[227] The number of cell sites increased to 178,025 from 95,733, and wireless penetration reached sixty-six percent.[228] Yet the most startling trend was the dramatic rise in wireless data usage.

As the FCC observed in 1997, wireless data applications were poised to become an integral part of the industry.[229] By June 2000, annual revenue derived from mobile data was $139.4 million; by June 2005 it was $8.5 billion, an increase of more than 6,000 percent.[230] Yet as late as 2003, the mobile data mar-

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Concerning the Spectrum Policy Task Force Report (Nov. 13, 2003), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-241195A2.pdf.

[223] *In re* Promoting the Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Report and Order*, 18 F.C.C.R. 20604, at 20607 (May 15, 2003). *In re* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Second Report and Order*, 19 F.C.C.R. 17503, at 17505-6 (July 8, 2004). A secondary market for spectrum is a mechanism by which unused portions of spectrum could be either leased or assigned by owners to third-parties. The goal of secondary markets is to ensure that spectrum resources are put to maximum use in an effort to increase "opportunities for the development and operation of new services and competition." *See In re* Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets, *Policy Statement*, 15 F.C.C.R. 24178 (Nov. 9, 2000).

[224] The development of the Commission's approach to secondary spectrum markets has evolved since it first considered the idea in 2000. *See id.*; *In re* Promoting Efficient Use of Spectrum through Elimination of Barriers to the Development of Secondary Markets, *Report and Order*, 18 F.C.C.R. 20604 (May 15, 2003); *Second Report and Order*,19 F.C.C.R. 17503 (July 8, 2004); *Third Report and Order*, 22 F.C.C.R. 7209 (Apr. 6, 2007).

[225] *See* Gregory Staple & Kevin Werbach, *The End of Spectrum Scarcity*, IEEE SPECTRUM (Mar. 2004), http://spectrum.ieee.org/telecom/wireless/the-end-of-spectrum-scarcity (last visited Jan. 1, 2011).

[226] *CTIA Wireless Stats*, *supra* note 28.

[227] *Id.*

[228] *CTIA Wireless Stats*, *supra* note 28.

[229] *Third CMRS Report supra* note 186, at 3-4.

[230] *CTIA Wireless Stats*, *supra* note 28.

ket was still maturing.[231] That year, the FCC observed that the market for "simple handset-based" mobile applications like text messaging was "more developed" than the market for more advanced services such as Internet access.[232] Disparate pricing plans and a spate of new services and applications reflected the fledgling nature of this market.[233] However, during this same period of time, there was a concomitant explosion in demand for broadband services, which increased from 2.5 million in December 1999 to 27.7 million in December 2003.[234] Along with the trend of wireless telephony substituting for, and in many cases replacing, wireline voice services,[235] consumers, especially younger ones, showed a demonstrated preference for mobile devices and mobile data in the early 2000s.[236]

In response to these trends, the FCC auctioned off additional swaths of spectrum in order to speed 3G network deployment. For example, in 2006 the FCC auctioned off spectrum to further bolster "advanced wireless services" ("AWS").[237] This spectrum was reallocated from a variety of users, including the U.S. Department of Defense,[238] for use by wireless carriers in order to facilitate the deployment of "a wide range of voice, data, and broadband services

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[231] *See* KEN DULANEY, GARTNER, INC., THE WIRELESS AND MOBILE MARKET STARTS TO MATURE 2-4 (2002) (predicting the ways in which the wireless market would mature in 2003).

[232] *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Ninth Report*, 19 F.C.C.R. 20597, ¶ 117 (Sept. 9, 2004).

[233] *Id.* at 118.

[234] FED. COMMC'NS COMM'N, INDUSTRY ANALYSIS AND TECH. DIV., HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF DECEMBER 31, 2006, tbl.10 (2007).

[235] *See* Om Malik, *Access Line Losses Hurt: Verizon CEO*, GIGAOM.COM (Oct. 30, 2008, 10:34 AM), http://gigaom.com/2008/10/30/access-line-losses-hurt-verizon-ceo/.

[236] The Pew Internet & American Life Project, in 2003, observed that there was a discernible trend in the "growth in consumption of information goods and services," which was being led by a distinct group of active users of technology that Pew broke down into three discrete segments – "Young Tech Elites, the Wired GenXers, and the Older Wired Baby Boomers." *See generally*, JOHN HORRIGAN, CONSUMPTION OF INFORMATION GOODS AND SERVICES IN THE UNITED STATES, PEW INTERNET & AMERICAN LIFE PROJECT (2003).

[237] Auction of Advanced Wireless Services, Licenses Scheduled for June 29, 2006, *Comment Sought on Reserve Prices or Minimum Opening Bids and Other Procedures*, AU Docket No. 06-30 at 1, 4 (Jan. 31, 2006), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-06-238A1.pdf; Auction of Advanced Wireless Services Licenses Schedules for June 29, 2006, *Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments and Other Procedures for Auction No. 66*, 21 F.C.C.R. 4562 at ¶¶ 7-8 (Apr. 12, 2006).

[238] *See* SCOTT FOX & JEFFREY WALKENHORST, GLOBAL VIEW PARTNERS, MOBILE BROADBAND IN THE AMERICAS: MOMENTUM BUILDING IN THE AWS BAND 10 (2009), *available at* http://www.gsmworld.com/documents/Momentum_Building_in_the_AWS_Band.pdf [hereinafter MOMENTUM BUILDING].

over a variety of mobile and fixed networks."[239] This auction—also known as the AWS-1 auction—generated over $13 billion in revenue and allocated licenses to over 100 bidders.[240] However, a number of problems in clearing some swaths of spectrum in this band resulted in the delayed deployment of 3G network infrastructure.[241]

D. Arrested Development: FCC Spectrum Allocation Policy Gone Awry (2007-2008)

The relatively consistent approach to spectrum allocation developed by the FCC over previous decades eventually yielded to a more experimental and uncertain approach in 2007 and 2008. Four separate proceedings at the FCC, encompassing two large spectrum auctions and an inquiry into unlicensed wireless uses, are illustrative of the turbulence vis-à-vis spectrum policy evident at the Commission in these years.

1. 700 MHz Auction – Rules for the C-Block

The first example came during the auction of spectrum in the 700 MHz range.[242] This swath of "beach front" spectrum was freed by broadcasters in their transition from analog to digital transmission.[243] During the rulemaking process for this auction, which stretched from 2002[244] to 2007,[245] some stake-

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[239] *See In re* Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems; Service Rules for Advanced Wireless Serivces In the 1.7 GHz and 2.1 GHz Bands, *Ninth Report and Order*, 24 F.C.C.R. 4473, ¶ 1 (Apr. 12, 2006) [hereinafter AWS-1 Rules].

[240] *See, e.g.*, Peter Pollack, *FCC Spectrum Auction Moves to Higher Gear*, ARS TECHNICA (Aug. 29, 2006, 5:22 PM), http://arstechnica.com/old/content/2006/08/7617.ars; Frank Ahrens, *FCC Wireless Auction Could Open Up Airwaves*, WASH. POST, Sept. 19, 2006, at D1.

[241] *See* discussion *infra*, Part IV.C.

[242] *See In re* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, *Second Report & Order*, 23 F.C.C.R. 8047, at ¶¶ 189-230 (May 14, 2008) [hereinafter 700 MHz Rules – 2008].

[243] Congress Amended DTV Transition Rules in 2005. *See Deficit Reduction Act of 2005*, Pub. L. No. 109-171, § 3003, 120 Stat. 4 (2006) (Title III of the DRA is the DTV Act).

[244] *In re* Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), *Memorandum Opinion and Order*, 17 F.C.C.R. 11613 (June 14, 2002).

[245] *In re* the Matter of Service Rules for the 698-746, 747-762, and 777-792 MHz Bands, et al, *Report and Order and Further Notice of Proposed Rulemaking*, 22 F.C.C.R. 8064 (Apr. 27, 2007).

holders sought to use the proceeding as a way to fundamentally reassess the wireless business model and the state of competition in the wireless market.[246] The concept that resulted from these deliberations, and that was ultimately adopted by the FCC, was "open access."[247] The open access rules that the FCC imposed on one block of the 700 MHz band—the C-block—"require[d] licensees to allow customers, device manufacturers, third-party application developers, and others to use or develop the devices and applications of their choice, subject to certain conditions."[248] Even though this portion of spectrum was successfully auctioned off to Verizon Wireless,[249] one study found that the imposition of these rules on this block of spectrum deterred more robust bidding and ultimately cost taxpayers upwards of $3.l billion in lost revenues to the U.S. Treasury.[250]

Moreover, during this lengthy proceeding there was evidence that the wireless market was moving towards more openness on its own. For example, even before the auction, Verizon Wireless announced that it would open its net-

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[246] Google and Skype, among others, were vocal advocates of using the auction rulemaking as a way to fundamentally alter the wireless business model. Skype, for example, submitted a petition to the FCC in 2007 that requested the "basic connectivity principle" of *Carterfone* be extended to wireless networks, which would allow a wireless consumer to connect any handset to the network of their choice, among other things. *In re* Matter of Skype Communications S.A.R.L, *Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks*, RM-11361 (submitted Feb. 20, 2007). Google used the rulemaking proceeding a way to advocate for using the available spectrum as a "third pipe" to increase broadband access. *See* Rick Whitt, *Tapping the Nation's Airwaves for More Net Access*, GOOGLE PUBLIC POLICY BLOG, (Apr. 24, 2007, 6:21 PM), http://googlepublicpolicy.blogspot.com/2007/04/by-richard-whitt-washington-telecom-and.html; *In re Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, Google Ex Parte Filing*, WC Docket No. 06-150 (submitted May 21, 2007); *In re Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, Comments of Google Inc.*, WC Docket No. 06-150 (submitted May 23, 2007).

[247] Nate Anderson, *FCC Sets 700 MHz Auction Rules: Limited Open Access, No Wholesale Requirement*, ARS TECHNICA (July 31, 2007, 3:32 PM), http://arstechnica.com/old/content/2007/07/fcc-sets-700mhz-auction-rules-limited-open-access-no-wholesale-requirement.ars; Anne Broache & Marguerite Reardon, *FCC Approves Some Open Wireless Requirements*, CNET NEWS (July 31, 2007, 4:56 PM), http://news.cnet.com/FCC-approves-some-open-wireless-requirements/2100-1039_3-6199990.html.

[248] 700 MHz Rules – 2008, *supra* note 242, ¶ 195.

[249] GEORGE S. FORD, THOMAS KOUTSKY & LAWRENCE J. SPIWAK, PHX. CTR. FOR ADVANCED LEGAL & ECON. PUB. POL'Y STUD., USING AUCTION RESULTS TO FORECAST THE IMPACT OF WIRELESS *Carterfone* REGULATION ON WIRELESS NETWORKS, PHOENIX CENTER POLICY BULLETIN NO. 20, at 2 (2008), *available at* http://www.phoenix-center.org/PolicyBulletin/PCPB20Final2ndEdition.pdf. [hereinafter IMPACT OF WIRELESS *Carterfone* REGULATION ON WIRELESS NETWORKS].

[250] *Id.* at 3.

work.[251] AT&T also opened its network in late 2007.[252] The winning bidder of the encumbered C-block has yet to deploy services in this band,[253] yet, as previously discussed, the wireless ecosystem currently provides for a wide range of "open" activities, e.g., open development of smartphone applications.[254] In addition, the "closed" business model of the iPhone, which does not allow for open application development,[255] has proven to be enormously successful and popular among consumers and innovators.[256] Thus, the FCC's attempt to assure a specific policy outcome—openness—via the imposition of conditions on spectrum use appears to have been ill-conceived given the organic evolution of the wireless market.[257]

2. 700 MHz Auction – Rules for the D-Block

Second, in addition to adding an open access encumbrance to the C-block of

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[251] *See* Marguerite Reardon, *Verizon Wireless Opens its Network*, CNET NEWS (Mar. 19, 2008, 11:42 AM), http://news.cnet.com/8301-10784_3-9898119-7.html.

[252] *See* Leslie Cauley, *AT&T Flings Cellphone Network Wide Open*, USA TODAY (Dec. 5, 2007, 11:08 PM), http://www.usatoday.com/tech/wireless/phones/2007-12-05-att_N.htm.

[253] Sam Churchill, *Phoney Spectrum Scarcity*, DAILY WIRELESS.ORG (June 18, 2010, 9:52 AM), http://www.dailywireless.org/2010/06/18/phoney-spectrum-scarcity.

[254] *See, e.g.*, Matt Assay, *In Mobile, Open Source Is a Winning Strategy*, CNET NEWS (Oct. 8, 2009, 12:26 PM), http://news.cnet.com/8301-13505_3-10370702-16.html.

[255] *See, e.g.*, Jenna Wortham, *Apple Lifts the Curtain on App Store Approvals*, N.Y. TIMES BITS BLOG (Aug. 21, 2009, 6:04 PM), http://bits.blogs.nytimes.com/2009/08/21/apple-lifts-the-curtain-on-app-store-approvals/ ("Apple receives 8,500 new applications and updates to applications each week. The company employs a team of 40 full-time trained reviewers, and each application is independently evaluated by two separate reviewers before getting a green light."); *Apple's Game Changer*, *supra* note 74 (observing that Apple has bolstered its review process in order to speed along approvals).

[256] *See* Brian X. Chen, *How Microsoft Blew it with Windows Mobile*, WIRED.COM GADGET LAB (Nov. 17, 2009, 12:45 PM), http://www.wired.com/gadgetlab/2009/11/microsoft-windows-mobile/. Chen writes:

> The iPhone operates on a closed system, which can only run on Apple hardware, meaning third-party developers can produce apps and games that work exclusively with the iPhone. Therefore, despite Apple's questionable and controversial approval policy for iPhone apps, developers can code one app that works with 40 million iPhone and iPod Touch devices, which is less time consuming than developing several versions of one app for a variety of [other] smartphones. In turn, that spells out to a larger number of apps in the App Store, which enables Apple's hardware to cater to a larger and broader audience.

Id.

[257] The market for smartphone applications is still developing. Application developers and other stakeholders continue to debate the relative merits of more "open" platforms like Android and the more "closed" platform on the iPhone. *See, e.g.*, Mark Sigal, *Android vs. iPhone: Why Openness May Not Be Best*, GIGAOM.COM (Feb. 22, 2009, 9:00 AM), http://gigaom.com/2009/02/22/is-being-"open"-an-absolute-in-mobile/.

spectrum during the 700 MHz auction, the FCC initially designated another block—the D-block—for public safety purposes.[258] As originally conceived, this block of spectrum would be auctioned off to a commercial provider with the understanding that the winning bidders would be required to "partner with public safety constituencies to make use of the adjacent public safety broadband spectrum."[259] However, after multiple rounds of bidding, the auction for the D-block failed to attract a bid that met the reserve price set by the FCC.[260] An audit of the auction proceedings conducted by the FCC revealed that several stakeholders withheld bids on the D-block because of a number of "uncertainties and risks "stemming from the many usage requirements attached to this particular swath of spectrum.[261] In 2008, the FCC issued two further notices of rulemaking for the D-block[262] in the hope that it could devise a framework that resulted in a "nationwide interoperable broadband wireless network for public safety entities."[263] By the time the FCC issued its *National Broadband Plan* in early 2010, the D-block auction remained stalled despite a number of proposals by public safety officials and wireless carriers.[264] However, the Commission's

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[258] 700 MHz Rules – 2008, *supra* note 242, ¶¶ 122-24, at 8091.

[259] *See* Blake Harris, *Larger Cities View FCC 700MHz "D Block" Public Safety Plan as Critically Flawed*, GOVERNMENT TECHNOLOGY (Oct. 28, 2009), http://www.govtech.com/gt/articles/426176.

[260] *See, e.g.*, Stephen Labaton, *Wireless Spectrum Auction Raises $19 billion*, N.Y. TIMES, Mar. 19, 2008, at C2.

[261] *See* KENT R. NILSSON, FCC, D BLOCK INVESTIGATION 2 (2008), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-281791A1.pdf. In particular, these encompassed a number of "uncertainties and risks" stemming from the requisite negotiation and costs associated with actually building out a public safety network. *Id.*

[262] *See In re* Service Rules for the 698-746, 747-762 and 777-792 Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz, *Second Further Notice of Proposed Rulemaking*, 23 F.C.C.R. 8047 (May 14, 2008); *In re* Service Rules for the 698-746, 747-762 and 777-792 Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, *Third Further Notice of Proposed Rulemaking*, 23 F.C.C.R. 14301 (Sept. 25, 2008) [hereinafter *Third FNPRM – D Block*].

[263] *Third FNPRM – D Block*, *supra* note 262, ¶ 1.

[264] *See* Phil Goldstein, *What Will Become of the D-Block?*, FIERCEWIRELESS.COM (Sept. 17, 2009, 10:44 AM), http://www.fiercewireless.com/story/what-will-become-d-block/2009-09-17. Goldstein notes that

> [a] coalition of public-safety organizations—with the hefty backing of AT&T and Verizon Wireless—have coalesced around a proposal that asks Congress to direct the FCC to allocate 10 MHz of spectrum in the D Block directly to the public-safety community in regional chunks. The organizations would then choose private companies through a request for proposal bidding process to build out the network.

Id.

Other carriers, e.g., T-Mobile, have recommended that the FCC should auction off the D-block for commercial uses and use the proceeds to "fund the build-out and maintenance of a nationwide, interoperable public-safety network." *See* Comments of T-Mobile, *In re* Na-

Plan envisions a nationwide public safety broadband network undergirded by spectrum in the D-block.[265] To this end, the FCC expects to auction this spectrum by early 2011.[266]

3. AWS-3 Auction & The "Free" Broadband Requirement

The third example stems from a rulemaking for an auction of spectrum in the AWS-3 band. In the AWS-3 auction, much like in the 700 MHz proceeding, the FCC sought to attach a usage condition to a portion of the spectrum ahead of the auction. In particular, the FCC proposed the imposition of a "free" broadband rule, which would have required the winning bidder to "provide free, two-way broadband Internet service including . . . data rates of at least 768 kbps downstream using up to 25 percent of the licensee's network capacity" and to "provide for open devices for its free service."[267] The FCC received a spate of comments in this proceeding arguing against this rule for a number of reasons, including that such encumbrances and conditions ultimately devalue the spectrum[268] and slow innovation because it limits the choices a provider can make for using it.[269] Others viewed the "free" broadband encumbrance as a way of spurring network deployment to unserved parts of the country.[270] Ultimately, the FCC decided against moving forward with the "free"

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tional Broadband Plan for our Time, *Public Notice #6*, at 14-15 (submitted Oct. 23, 2009).

[265] NATIONAL BROADBAND PLAN, *supra* note 11, at 76, 316.

[266] *See* FED. COMMN'CNS COMM'N, BROADBAND ACTION AGENDA 2, *available at* http://www.broadband.gov/plan/national-broadband-plan-action-agenda.pdf (noting that by "late Q2 or early Q3 2010" the FCC will "adopt an order and [Notice of Proposed Rulemaking] to pave the way for an auction of the 10 MHz of spectrum in the . . . D Block in the first half of 2011.").

[267] *In re* Service Rules for Advanced Wireless Services, *Further Notice of Proposed Rulemaking*, 23 F.C.C.R. 9859, ¶ 3.

[268] *See* George Ford, *Calculating the Value of Unencumbered AWS-III Spectrum* 3 (PHOENIX CENTER PERSPECTIVES 2008) *available at* http://www.phoenix-center.org/perspectives/Perspective08-01Final.pdf [hereinafter *Value of Unencumbered AWS-III Spectrum*] (estimating the cost of unencumbered AWS-III spectrum would be in the "upper $2 billion range" and that, even though no prediction was offered regarding how much the encumbrances might devalue the spectrum, "I see no reason to believe such a substantial discount would not appear in the AWS-III auction given the proposed conditions.").

[269] THOMAS M. LENARD, LAWRENCE J. WHITE & JAMES L. RISO, TECH. POLICY. INST., INCREASING SPECTRUM FOR BROADBAND: WHAT ARE THE OPTIONS? i (2010) (commenting that "[t]he growth of wireless broadband is a bright spot in the U.S. economy, but a shortage of flexibly licensed spectrum rights could put a crimp on this expansion.").

[270] *See, e.g.*, Jeffrey Silva, *FCC Again Urged to Vote on AWS-3 Plans: Spectrum Auction on Hold*, RCR WIRELESS NEWS (Dec. 18, 2008, 1:47 PM), http://www.rcrwireless.com/ARTICLE/20081218/WIRELESS/812189989/fcc-again-urged-to-vote-on-aws-3-plans; Nancy Gohring, *Lawmakers Urge FCC to Move Forward with 'Free' Plan*, PC WORLD, (Aug. 11, 2008, 4:00 PM),

broadband encumbrance for AWS-3 and will instead attempt to pair this swath of spectrum with other portions of the airwaves in order to provide innovators with more robust wireless resources.[271]

4. *Unlicensed Wireless Uses via the "White Spaces"*

Fourth, in late 2008 the FCC approved the use of "white spaces" for wireless broadband purposes. White spaces are "unused airwaves that abut broadcast TV spectrum, providing a buffer zone from stray signals and other interference."[272] These slivers of the airwaves could, in the aggregate, provide "300MHz and 400MHz of unlicensed spectral capacity throughout the country."[273] The FCC order would allow for the "development of new and innovative types of unlicensed devices."[274] Given the characteristics of this portion of the airwaves—it is national in scope and able to "easily penetrate obstacles such as buildings and trees and can reach longer distances than the higher frequencies currently utilized by unlicensed Wi-Fi devices"—some have argued that these bands can be used to facilitate rural broadband deployment and otherwise bolster affordable broadband access across the United States.[275] However, despite the potential upside for devices and services enabled by the freed white spaces, there are concerns that the continued proliferation of unlicensed access to spectrum could inadvertently skew the market and undercut the investments and innovations of service providers who paid billions to secure exclusive spectrum rights.[276] The FCC finally adopted rules to govern use of the white spaces in 2010.[277]

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http://www.pcworld.com/businesscenter/article/149693/lawmakers_urge_fcc_to_move_forward_with_free_plan.html.

[271] *See* Nancy Gohring, *FCC Strikes Down Free Broadband Plan*, COMPUTER WORLD, (Sept. 1, 2010, 3:20 PM) http://www.computerworld.com/s/article/9183220/FCC_strikes_down_free_broadband_plan?taxonomyId=16&pageNumber=1.

[272] *See* Leslie Cauley, *FCC Approves 'Whites Spaces' for Broadband*, USA TODAY (Nov. 14, 2008), http://www.usatoday.com/tech/news/2008-11-04-white-space_N.htm.

[273] *See* Marguerite Reardon, *Broadcasters Challenge FCC 'White Spaces' Report*, CNET NEWS (Oct. 17, 2008, 7:52 PM), http://news.cnet.com/8301-1035_3-10069428-94.html.

[274] *See In re* Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, *Second Report and Order and Memorandum Opinion and Order*, 23 F.C.C.R. 16807, ¶ 2 (Nov. 4, 2008).

[275] *See* Sascha D. Meinrath & Michael Calabrese, *"White Space Devices" & the Myths of Harmful Interference*, 11 N.Y.U. J. LEGIS. & PUB. POL'Y 495, 500-501 (2008).

[276] *See* Priya Ganapati, *FCC White Spaces Decision Kicks Off the Next Wireless Revolution*, WIRED GADGET LAB (Nov. 5, 2008, 12:45 PM), http://www.wired.com/gadgetlab/2008/11/fccs-decision-t/.

[277] *See In re* Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, *Second Memorandum Opinion*

E. Maturation: A Renewed Commitment to Bolstering Spectrum Access (2009-present)

In 2009, the FCC began a forward-looking, comprehensive review of the wireless market from a variety of vantages. First, the Commission issued a series of notices of inquiries (NOIs) focused on the wireless market generally.

The first NOI focused on "fostering innovation and investment in the wireless communications market" and was issued in order to "further [the FCC's] understanding of where and how key innovations are happening across the full "value chain" of the wireless market, including spectrum utilization, technologies, business models, and services."[278]

The second NOI focused on how to refine the FCC's approach to analyzing the wireless market and how the Commission might "expand [its] understanding of the mobile wireless industry" by broadening its traditional inquiry to include additional data sources and "market segments not covered thoroughly in previous [mobile competition] reports."[279]

The third NOI requested comments regarding whether or not the FCC needed to update its consumer policies in light of recent technological changes and innovations.[280]

During the development of its *National Broadband Plan*, the Commission issued two public notices ("PN") specifically focused on reforming its spectrum allocation policy. The first PN sought comment on "the fundamental question of whether current spectrum allocations . . . are adequate to support near-term and longer-term demands of wireless broadband."[281] The second PN sought data on a variety of different spectrum uses and their impacts on satisfying near-and long-term demand.[282]

These PNs and other public comments informed the final version of the *Plan*. In addition to the *Plan's* many spectrum-specific recommendations, which are discussed in more detail *infra*, the document made a series of prom-

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and Order, FCC 10-174, ET Docket No 04-186, ET Docket No. 02-380, at ¶1, (Sep. 23, 2010), *available at* http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0923/FCC-10-174A1.pdf.

[278] FCC Wireless Innovation NOI, *supra* note 62, ¶ 4.

[279] *See In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Notice of Inquiry*, 24 F.C.C.R. 11357, ¶ 5 (Aug. 27, 2009).

[280] *See In re* Consumer Information and Disclosure, *Notice of Inquiry*, 24 F.C.C.R. 11380, ¶ 3 (Aug. 28, 2009) (updating the FCC's consumer policies in light of recent technological changes and innovations).

[281] *See* Comment Sought on Spectrum for Broadband NBP Public Notice # 6, *Public Notice*, 24 F.C.C.R. 12032, ¶¶ 1-2 (Sept. 23, 2009) [hereinafter FCC Spectrum PN].

[282] *See* Data Sought on Uses of Spectrum NBP Public Notice # 26, *Public Notice*, 24 F.C.C.R. 14275, ¶¶ 1-2 (Dec. 21, 2009); *see also infra* Part IV.B. for further discussion.

ising observations about the need for modernizing the Commission's overall approach to managing the nation's airwaves.[283] In particular, the FCC observed that:

> [B]ecause mission needs and technologies evolve, there must be a public review process to ensure that decisions about federal and non-federal [spectrum] use that may have worked in the past can be revisited over time. In general, where there is no overriding public interest in maintaining a specific use, *flexibility should be the norm.*[284]

Such flexibility is essential to spurring additional network deployments and upgrades, which in turn will spur continued innovation at the edges of the network.[285]

In some cases, notably the auction of spectrum in the C- and D-blocks of the 700 MHz band and in the AWS-3 band, the FCC has demonstrated a willingness to control spectrum usage in order to ensure a particular outcome (i.e., open access, a nationwide public-safety system and broadband deployment, respectively).[286] In other cases, notably the series of NOIs it issued in 2009 and the final version of its *National Broadband Plan*, the Commission has shown a more thoughtful approach to modernizing its approach to spectrum. However, the market has continued to rapidly evolve, oftentimes at a faster pace than FCC inquiries or rulemaking. Best intentions aside, the FCC has struggled in recent years to fashion an appropriately forward-looking spectrum allocation framework that is flexible enough to accommodate the brisk pace of innovation and competition of the wireless market.

F. Lessons Learned

Four observations stemming from the preceding historical analysis provide policymakers with potential best practices for forging new spectrum allocation policies that seek to support continued innovation across the entire wireless ecosystem. First, the FCC has generally made additional spectrum available in a timely manner to facilitate continued innovation and network deployment.[287] Over the past 15 years, the FCC has conducted some 88 auctions for spectrum.[288] As of December 2010, seven additional auctions were either scheduled

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[283] NATIONAL BROADBAND PLAN, *supra* note 11, at 78.

[284] *Id.* (emphasis added).

[285] *Id*. at 77 ("If the U.S. does not address [growing spectrum needs] promptly, scarcity of mobile broadband could mean higher prices, poor service quality, an inability for the U.S. to compete internationally, depressed demand, and, ultimately, a drag on innovation.").

[286] Ellen Goodman, *Spectrum Auction and The Public Interest*, 7 J. TELECOMM. & HIGH TECH. L. 343, 343-45 (2009).

[287] Kathleen Q. Abernathy et al., *Major Wireless Policy Developments*, September 2008 – September 2009, 990 PRAC. LAW INST. 125, 148 (2009).

[288] *See generally Auctions Summary*, FED. COMMC'NS COMM'N,

or waiting to be scheduled for some future date.[289] However, as discussed below, the amount of spectrum readily available for auction in the near-term will not meet the demands of innovators.[290] But the FCC has acknowledged this shortcoming and has pledged to rectify it in a timely manner.[291]

Second, the FCC has generally kept the regulatory hand off the wireless market, deferring to market forces to provide welfare gains.[292] However, as discussed above, there have been cases where the FCC has tried to impose its own policy agenda in lieu of actual consumer demand, mostly by encumbering spectrum with rules that attempt to ensure a certain outcome.[293] The result has been a devaluation of spectrum[294] and regulatory uncertainty as the FCC sends mixed signals to wireless innovators regarding the exact role of the Commission in the modern marketplace.[295] Thus, spectrum allocation policies should be adjusted to reflect actual market conditions. Moreover, spectrum should not be encumbered with conditions that seek to achieve certain policy outcomes. Such policies could deter investment,[296] stifle innovation, slow network deployments, and undermine ownership rights in spectrum.[297]

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http://wireless.fcc.gov/auctions/default.htm?job=auctions_all (follow "Completed Auctions" hyperlink) (last updated Dec. 15, 2010).

[289] *Id.*

[290] *See infra*, Part IV.A.

[291] *See* Blair Levin, *You Can't Coach Height: A Winning Spectrum Strategy*, FCC BLOGBAND: THE OFFICIAL BLOG OF THE NATIONAL BROADBAND PLAN (Oct. 29, 2009), http://blog.broadband.gov/?entryId=10624 (noting that the many innovations and advancements predicted by many stakeholders in the wireless market cannot happen "without spectrum"); Genachowski Remarks—April 13, 2010, *supra* note 13, at 3-5 (discussing the serious lack of spectrum to meet future "mobile Internet access" demands and how the National Broadband Plan will solve the problem).

[292] *See* TONY CLARK & MICHAEL J. SANTORELLI, ADVANCED COMMC'NS L. & POL'Y INST., FEDERALISM IN WIRELESS REGULATION: A NEW MODEL FOR A NEW WORLD 5-6 (2009), http://www.nyls.edu/user_files/1/3/4/30/83/Clark & Santorelli - Wireless Federalism – February 2009.pdf (discussing the impact of a deregulatory approach to wireless on competition, innovation, and consumer welfare).

[293] *See supra*, Part III.D.

[294] *Value of Unencumbered AWS-III Spectrum*, *supra* note 268*;* IMPACT OF WIRELESS *Carterfone* REGULATION ON WIRELESS NETWORKS, *supra* note 249. An analysis of auctions from the early 1990s found that heavily encumbered spectrum resulted in more tentative bidding by companies. *See* Peter C. Cramton, *The FCC Spectrum Auctions: An Early Assessment* 6 J. of ECON. & MGMT. STRATEGY 431-495 (1997).

[295] LOSING THE FOREST, *supra* note 25, at 19-22 (discussing the impact of regulatory certainty on innovation in the wireless marketplace).

[296] NET NEUTRALITY, INVESTMENT & JOBS, *supra* note 5, at 26-33 (assessing the negative impacts of proposed network neutrality and Title II regulations on broadband service provider business models).

[297] *See, e.g.*, Thomas W. Hazlett, *A Law & Economics Approach to Spectrum Property Rights: A Response to Weiser & Hatfield*, 15 GEO. MASON L. REV. 975, 1004-1015 (2008) [hereinafter *Spectrum Property Rights*] (comparing and contrasting the spectrum allocation

Third, the FCC has acknowledged that spectrum allocation policy must evolve along with the market.[298] The SPTF convened in the early 2000s was a high point of internal self-reflection and yielded useful, forward-looking policies for ensuring continued growth of the wireless market.[299] For example, secondary markets for spectrum were expanded and bolstered by the SPTF.[300] These markets have been moderately successful in creating new opportunities for innovators to access additional swaths of spectrum.[301] As one commentator has observed, one current success of secondary spectrum markets has involved educational licensees:

> "The FCC . . . allowed the educational licensees, subject to certain conditions, to lease the right to operate under those licenses to commercial providers. Companies such as Sprint/Nextel and Clearwire . . . have taken many such leases. Although the terms are private, one indication of the success of this plan is the more than one thousand lease notifications on file with the FCC."[302]

These types of comprehensive spectrum policy reviews often result in new frameworks that favorably position the wireless market for continued innovation.[303] In addition, these reviews have important direct and indirect impacts on the amount of spectrum available to innovators.

Fourth, the FCC is not immune to backsliding in its approach to allocating spectrum or to adjusting its agenda to support specific outcomes.[304] The Com-

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approach in the cellular market, which has a relatively liberal spectrum policy, and the broadcast TV market, which has a relatively restrictive licensing model with more encumbrances attached to licenses. Hazlett observes that "Cellular's productive activities, efficiently organized via market transactions that dynamically reconfigure spectrum rights to seize evolving opportunities, contrasts with broadcasting's common interest tragedies," and concludes that "When liberal licenses supply the spectrum rights necessary for productive market transactions, economic incentives generate rational tradeoffs.").

[298] *Spectrum Allocation, Assignment and Enforcement*, FED. COMMC'NS COMM'N, http://www.fcc.gov/connectglobe/sec7.html (last visited Jan. 1, 2011).

[299] Michael K. Powell, Chairman, Fed. Commc'ns Comm'n, Broadband Migration III: New Directions in Wireless Policy, Remarks at the Silicon Flatirons Telecommunications Program at University of Colorado at Boulder (Oct. 30, 2002).

[300] *See* James B. Speta, *Spectrum Policy Experiments: What's Next?*, 2008 U. CHI. LEGAL F. 389, 395 (2008).

[301] *In re* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Second Report and Order, Order on Reconsideration, and Second Further Notice of Proposed Rulemaking*, 19 F.C.C.R. 17503, ¶¶ 1-3 (July 8, 2004).

[302] *See* Speta, *supra* note 300, at 393.

[303] The FCC announced the launch of another Spectrum Task Force in May 2010. The Task Force will "will play a critical role in the execution of the spectrum recommendations in the National Broadband Plan, including long-term spectrum planning." *See* Press Release, Fed. Commc'ns Comm'n, FCC Chairman Julius Genachowski Announces Launch of Spectrum Task Force (Apr. 26, 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-297722A1.pdf.

[304] *See* Philip Weiser, *Institutional Design, FCC Reform, and the Hidden Side of the*

mission has long been accused of being susceptible to "regulatory capture," which further compounds the perceived vulnerability of this agency to the demands of special interests and limits its ability to undertake bold action.[305] However, recent action by the Commission on this point suggests that the FCC is addressing these shortcomings and implementing policies that support openness and transparency.[306] To this end, the various inquiries initiated in 2009 in conjunction with the development of the *National Broadband Plan* were among the most inclusive and open on record, and could ultimately result in a valuable set of forward-looking wireless policies.[307] Thus, open, transparent, and inclusive rulemakings, and other policy proceedings that are data-driven, tend to yield effective policies that provide stakeholders with regulatory certainty.[308]

Keeping in mind the lessons of the past while creating a forward-looking set of proposals for spectrum allocation will result in a policy framework that allows the wireless market—including its millions of subscribers and the ever-increasing number of innovators that contribute to a vibrant mobile ecosystem—to continue fostering competition, enabling innovation, and producing cutting-edge services and applications.

IV. TURNING POINT: RECOMMENDATIONS FOR A 21ST CENTURY SPECTRUM ALLOCATION POLICY

A surfeit of oftentimes contradictory proposals for revising the FCC's spectrum allocation policy has been offered over the last few years. Some have

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Administrative State, 61 ADMIN. L. R. 675, 692 (2009).

[305] *See, e.g.*, *id.*, at 683-684 (2009) (citing former FCC staff criticisms of the agency's vulnerability to capture and observing that "the FCC's challenge is not so much the classic portrait of agency capture (e.g., the revolving door) or even the more subtle version of the intertwined interests model (i.e., taxation by regulation) advanced by [Judge Richard] Posner. Rather, it is the agency's institutional limitations – a failure to approach issues strategically, to develop independent solutions, and to anticipate issues ahead of particular crises – that often lead it to miss opportunities to chart independent courses of action . . . .").

[306] *See, e.g.*, Julius Genachowski, Chairman, Fed. Commc'ns Comm'n, Remarks to the Staff of the Federal Communications Commission (June 30, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291834A1.pdf (noting that the FCC will be "open and transparent"); *In re* Amendment of the Commission's Ex Parte Rules and Other Procedural Rules, *Notice of Proposed Rulemaking*, FCC 10-31, GC Docket No. 10-43, ¶¶ 1-2 (Feb. 18, 2010) (soliciting comment on enhancing participation in FCC rulemaking proceedings).

[307] *See Recent FCC Broadband Initiatives*, FED. COMMC'NS COMM'N (July 9, 2009), http://www.fcc.gov/cgb/consumerfacts/broadband_initiatives.html; *FCC to Release Ambitious but Pragmatic, National Broadband Plan*, WIRED.COM (Mar. 15, 2010, 5:48 PM), http://www.wired.com/epicenter/2010/03/fcc-ambitious-broadband-plan/.

[308] NATIONAL BROADBAND PLAN, *supra* note 11, at 37, 52.

theorized that alternative spectrum allocation approaches such as open spectrum or heavily encumbering spectrum with onerous usage requirements, could produce significant consumer welfare gains,[309] while others have argued that the imposition of policies that further this experimentation with valuable portions of the continually shrinking airwaves risks impeding the organic innovation described above.[310] Some predict that promoting unlicensed wireless devices will result in "less expensive and more readily deployable forms of wireless service."[311] Many counter by saying that strong spectrum property rights are essential to supporting continued innovation.[312] Still others have proposed a middle-ground approach that combines a more open "commons" model with traditional property rights.[313] Despite an array of differences, these and many other proposals do share one common thread: the FCC's spectrum allocation regime needs to fundamentally change in order to accommodate further market growth and innovation. Such a policy shift must be framed around the concept of supporting the current wireless ecosystem, applying historical best practices to spectrum allocation that have proven to be effective, building sufficient flexibility into the FCC's wireless regulatory approach, and fostering a competitive and innovative environment going forward.

A. Appreciate the Scale & Scope of the Looming Spectrum Crisis

As discussed above, mobile data usage continues to increase across all user groups and demographics.[314] Indeed, Nielsen reported that mobile data usage

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[309] *See, e.g.* Michael Calabrese, *The End of Spectrum Scarcity: Building on the TV Bands Database to Access Unused Public Airwaves*, (New Am. Found. Working Paper No. 25, 2009), (advocating for an open spectrum model that would maximize utilization of the nation's airwaves) [hereinafter *End of Spectrum Scarcity*]. *available at* http://www.newamerica.net/files/Calabrese_WorkingPaper25_EndSpectrumScarcity.pdf

[310] *See, e.g.* GERALD R. FAULHABER & DAVID J. FARBER, INNOVATION IN THE WIRELESS ECOSYSTEM: A CUSTOMER-CENTRIC FRAMEWORK 1-4, [hereinafter CUSTOMER-CENTRIC FRAMEWORK], *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=7020039960 (arguing that "there is no market failure [in the wireless sector] which would necessitate market intervention by the FCC.").

[311] *See, e.g.*, Harold Feld, *From Third Class Citizen to First Among Equals: Rethinking the Place of Unlicensed Spectrum in the FCC Hierarchy* 15 COMMLAW CONSPECTUS 53, 54 (2006) (noting unlicensed deployments tend to be less reliable than licensed deployments and more prone to interference).

[312] *Next Frontier of Property Rights*, *supra* note 153*; Spectrum Property Rights*, *supra* note 297.

[313] *See, e.g.*, Ellen Goodman, *Spectrum Rights in the Telecosm to Come*, 41 SAN DIEGO L. REV. 269, 379-80 (2004) (outlining how such an approach might work in practice).

[314] *See Women, Teens, and Seniors Help Fuel 34% Mobile Web Spike*, NIELSENWIRE (Sept. 30, 2009), http://blog.nielsen.com/nielsenwire/online_mobile/mobile-web-up-34-percent-july-09/.

increased 34 percent between 2008 and 2009.[315] Growth was observed across every age group, with adults over the age of 65 experiencing the largest growth rate.[316] Data usage among people with disabilities also continues to increase[317] and certain minority groups, particularly African-Americans and Hispanics, utilize mobile devices for Internet access much more frequently than other demographic groups.[318] Overall, Cisco estimates that mobile data traffic will increase some sixty-six times by 2013.[319] In the U.S., demand for mobile Internet services is expected to increase forty-fold between 2010 and 2015.[320]

These upward trends in usage by individual subscribers, coupled with the increasing integration of wireless broadband into sectors like healthcare and energy (as discussed in Part II.B.2), undergird projections for the amount of spectrum that is needed to support more intensive use and innovation across all sectors of the economy.[321] To this end, several organizations have estimated that a large amount of spectrum must be made available in order to support more intensive network usage by consumers and entire sectors of the economy. For example, in 2006 the International Telecommunications Union (ITU) issued a report that called for a substantial amount of new spectrum to support new innovations and deployments.[322] Indeed, the ITU predicted that "[b]ased

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[315] *Id.*

[316] Senior mobile data usage increased sixty-seven percent between 2008 and 2009. This large spike, however, is due to a very low percentage of older adults using mobile data. As of 2009, only three percent of adults over sixty-five used mobile data services. *Id.*

[317] A 2009 study by the Wireless Rehabilitation Engineering Research Center (RERC) found that "wireless information and communications technologies play an increasing role in education, employment, healthcare, and other aspects of independent living for people with and without disabilities." *See Background: Addressing a Significant Need*, WIRELESS RERC, http://www.wirelessrerc.org/about-us/background-addressing-a-significant-need.html (last visited Jan. 1, 2011). A recent survey by the Wireless RERC found that after voice communications, text messaging, email, and Internet access were the most important uses of a cell phone among people with disabilities. *See* SECOND REPORT: FINDINGS OF THE SURVEY OF USER NEEDS (SUN) FOR WIRELESS TECH., 2007-2009 2 (2009), *available at* http://www.wirelessrerc.org/publications/SUN Second Findings Report_2009-03-25.doc.

[318] PEW WIRELESS STUDY 2009, *supra* note 22, at 29 (finding these two demographic groups are more likely to participate I most mobile data activities than Whites); *see id.* at 33 (observing African-Americans are "[seventy *percent*] *more likely* to [access the Internet on a wireless device on a typical day] than white Americans.").

[319] CISCO VISUAL NETWORKING INDEX, *supra* note 38; *see* Brad Reed, *Cisco: Mobile Data Traffic to Grow 66-Fold by 2013*, NETWORK WORLD (Feb. 11, 2009, 2:27 PM), http://www.networkworld.com/news/2009/02/109-cisco-mobile-data-traffic.html.

[320] Genachowski Remarks—April 13, 2010, *supra* note 13, at 4.

[321] *Supra* Part II.B.2.

[322] *See Estimated Spectrum Bandwidth Requirements for the Future Development of IMT-2000 and IMT-Advanced*, INTERNATIONAL TELECOMMUNICATIONS UNION (ITU), Report ITU-R M.2078, at 25 (2006), *available at* http://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2078-2006-PDF-E.pdf (estimating that an additional 1,300 MHz of spectrum would be needed by 2015).

on current trends . . . in the next 12 years the mobile industry will utilize three times more spectrum than in the last 20 years."[323] Similarly, 3G Americas has observed that "with the projected increase in the use of mobile-broadband technologies, the amount of spectrum required by the next generation of wireless technology . . . could be substantial."[324] CTIA–The Wireless Association considered these various proposals and called for the allocation of 800 MHz of spectrum in order to "meet[] rapidly increasing demand" for wireless services.[325]

Despite the high demand for spectrum by innovators, spectrum is in short supply. CTIA has estimated that wireless service providers currently "operate with just under 450 MHz of spectrum," which is much less than the spectrum available to innovators in other developed nations, and that only 40 MHz of spectrum is "in the pipeline" for use by network operators.[326] However, there is a growing appreciation among policymakers for the possibility of a spectrum shortage as the United States fully transitions to a society and economy defined by wireless broadband-enabled transactions and services.[327] Indeed, the FCC has acknowledged that even though the FCC has "authorized a 3-fold increase in commercial spectrum" over the last several years, "many anticipate [a dramatic increase] in wireless traffic," which presages a potential "spectrum gap."[328]

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[323] MOMENTUM BUILDING, *supra* note 238, at 8.

[324] BROADBAND EVOLUTION TO 4G, *supra* note 48, at 21.

[325] *See In re* A National Broadband Plan for Our Future, *Written Ex Parte Communication of CTIA – The Wireless Association*, GN Docket No. 09-51, at 1 (Sept. 29, 2009) (accessible via FCC Electronic Comment Filing System).

[326] Comment Sought on Spectrum for Broadband, *Public Notice*, 24 F.C.C.R. 12032, 12034 (Sept. 23, 2009) (citing comments filed by CTIA in the Commission's national broadband docket on June 8, 2009).

[327] *See* Ann Compton, Yunji de Nies & Sunlen Miller, *The Spectrum Crunch: President Obama Takes on the Shortage of Wireless Capacity*, ABC NEWS.COM (June 28, 2010, 9:49 AM), http://blogs.abcnews.com/politicalpunch/2010/06/-the-spectrum-crunch-president-obama-takes-on-the-shortage-of-wireless-capacity.html; *see also* Tim Conneally, *Legislation Begins on the Next Great Spectrum Shift*, BETANEWS.COM (Dec. 15, 2009, 1:16 PM), http://www.betanews.com/article/Legislation-begins-on-the-next-great-spectrum-shift/12609091014 (citing Steve Largent, President and CEO of CTIA – The Wireless Association, "[T]here is less than 500 MHz of commercial spectrum available for commercial deployments, and that the demand is expected to exceed 1300 MHz."); Stacey Higginbotham, *Spectrum Shortage Will Strike in 2013*, GIGAOM (Feb. 17, 2010, 1:00 PM), http://gigaom.com/2010/02/17/analyst-spectrum-shortage-will-strike-in-2013/.

[328] Genachowski Wireless Remarks—Oct. 7, 2009, *supra* note 12, at 5; *see* Charles Mathias, *Is There Enough Spectrum?*, FCC BLOGBAND (Oct. 6, 2009), http://blog.broadband.gov/?entryId=10878 ("The amount of spectrum available for use for broadband devices is crucial in determining an overall national broadband plan. With the continued rise of the use of smartphones, and the needs for spectrum associated with their use, we have to look to the future availability of spectrum and where that spectrum is lo-

The Commission's various inquiries and proceedings related to spectrum signal a strong commitment to reforming its allocation policy, but there appears to be tension between the amount of spectrum needed by innovators and the time it will take to make that spectrum available.[329] As a result, a clear framework for identifying, clearing, and making available viable swaths of the airwaves to innovators is needed to assure continued innovation.

B. Undertake a Comprehensive & Rapid Inventory of the Airwaves

A key component of a new spectrum allocation framework will be a comprehensive effort to understand how the airwaves are currently being used. Without a thorough comprehension of how this scarce resource is utilized, the possibility exists that spectrum will be inefficiently used or squandered.[330] Moreover, the speed with which such an inventory is completed is critical to making new swaths available to mobile broadband providers in a timely manner.[331] However, the completion of an inventory should not delay efforts focused on reallocating or otherwise making additional spectrum available to innovators.

Currently, both the FCC and the National Telecommunications and Information Administration (NTIA) have responsibility for administering and monitoring spectrum in the United States. The NTIA oversees spectrum use by the

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cated."); Kim Hart, *FCC to Release Broadband Airwaves in Big Win for Cell Phone Companies*, HILLICON VALLEY (Feb. 23, 2010, 6:50 PM), http://thehill.com/blogs/hillicon-valley/technology/83263-fcc-to-release-airwaves-in-big-win-for-cell-phone-companies ("FCC Chairman Julius Genachowski has repeatedly warned of an impending spectrum shortage that could hinder the United States' efforts to stay competitive in the broadband market."); Genachowski Remarks—April 13, 2010, *supra* note 13, at 4.

[329] *See* Allie Winter, *3G Buildouts Tied to Spectrum Availability*, RCR WIRELESS NEWS (Oct. 16, 2008, 6:00 AM), http://www.rcrwireless.com/article/20081016/WIRELESS/810139966/3g-buildouts-tied-to-spectrum-availability.

[330] *See* NEW AMERICA FOUNDATION, DUPONT CIRCLE SPECTRUM UTILIZATION DURING PEAK HOURS: A COLLABORATIVE EFFORT OF THE NEW AMERICA FOUNDATION AND THE SHARED SPECTRUM COMPANY 4 (2003), *available at* http://www.newamerica.net/files/archive/Doc_File_183_1.pdf (arguing the current spectrum allocation and utilization policies can lead to a "fundamentally broken and inefficient" use of the resource).

[331] *See, e.g.*, John Eggerton, *Spectrum Inventory Bill Fails to Pass on Unanimous Consent*, BROAD. & CABLE.COM (Apr. 14, 2010, 1:06 PM), http://www.broadcastingcable.com/article/451466-Spectrum_Inventory_Bill_Fails_To_Pass_On_Unanimous_Consent.php; *see also* Conneally, *supra* note 327 (discussing how the two upcoming bills, H.R. 3019 and H.R. 312, are aimed to "speed up the inventory and reallocation of spectrum" and explains how the two are working in tandem to achieve that end).

federal government, while the FCC manages "non-federal and commercial uses."[332] Each agency maintains a spectrum use database that tracks licenses and other such uses.[333] The FCC has also deployed a spectrum "dashboard" that "provides a public means of reviewing how spectrum bands are allocated and for what uses, and who holds licenses and in what areas."[334] However, since thousands of spectrum bands exist and since thousands of licenses have been doled out,[335] the scope of spectrum usage is vast and often difficult to monitor.

The federal government, for example, is one of the most intensive users of spectrum.[336] According to a 2008 report issued by the NTIA, "[s]ixty-nine Federal agencies and departments further their missions by using radio frequency spectrum for communications, navigation, broadcasting and other purposes."[337] These agencies "use over [forty] specific radio services and their frequency assignments are recorded in the Government Master File maintained by NTIA."[338] However, monitoring the myriad agencies using spectrum has proven to be unwieldy for the NTIA. By its own admission, "the current spectrum management system at times lacks the flexibility to rapidly accommodate new operational requirements and innovative technologies."[339] As a result, the federal government is a very inefficient user of its spectrum. Indeed, several surveys suggest that, at any one time, a significant amount of government-owned spectrum is unused or underused.[340] Other studies that examined public uses of spectrum confirmed that this resource is generally underused by government.[341]

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[332] *See Spectrum Reform*,CCIANET.ORG, http://www.ccianet.org/Spectrum-Reform (last visited Jan. 1, 2011).

[333] For example, the FCC maintains several Frequency Assignment Data Bases, *available at* http://www.fcc.gov/oet/info/database/Welcome.html (last updated Aug. 4, 2010).

[334] *See About the Spectrum Dashboard*, REBOOT.FCC.GOV, http://reboot.fcc.gov/reform/systems/spectrum-dashboard/about (last visited Jan. 1, 2011).

[335] *See, e.g.*, Patricia Fusco, *FCC Closes Spectrum License Auction*, INTERNETNEWS.COM (May 9, 2000), http://www.internetnews.com/xSP/article.php/357581/FCC-Closes-Spectrum-License-Auction.htm.

[336] *End of Spectrum Scarcity*, *supra* note 309, at 3 (estimating "the federal government exclusively controls over 13 percent of all allocated spectrum bands and has primary access to shared bands comprising 56 percent of all other bands" and "federal government exclusive and shared bands account for 64 percent of all allocations below 3.1 GHz").

[337] CARLOS M. GUTIERREZ & MEREDITH A. BAKER, U.S. DEP'T OF COM., SPECTRUM MANAGEMENT FOR THE 21ST CENTURY: THE PRESIDENT'S SPECTRUM POLICY INITIATIVE 3 (2008), *available at* http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf.

[338] *Id.*

[339] *Id.*

[340] *End of Spectrum Scarcity*, *supra* note 309, at 3 (citing government documents obtained by the New America Foundation and studies conducted by Mark McHenry).

[341] *End of Spectrum Scarcity*, *supra* note 309, at 3 (citing NEW AMERICA FOUNDATION,

Most agree that additional information is needed in order to better understand how this resource is being used and to identify fallow or underutilized bands that could be reallocated.[342] To this end, two bills were introduced in Congress in 2009 that would require a federal spectrum inventory, the results of which would be made publicly available via a web portal.[343] The wireless industry[344] and a number of other stakeholders have endorsed the idea of an inventory.[345] While there is some disagreement among stakeholders regarding whether a spectrum inventory should result in reallocation or not, most agree that a comprehensive and rapid review of current spectrum usage is a necessary condition precedent to adjusting allocation policies that support further wireless broadband deployment.[346]

DUPONT CIRCLE SPECTRUM UTILIZATION DURING PEAK HOURS: A COLLABORATIVE EFFORT OF THE NEW AMERICA FOUNDATION AND THE SHARED SPECTRUM COMPANY (2003), *available at* http://www.newamerica.net/files/archive/Doc_File_183_1.pdf); *Spectrum Occupancy Measurements*, SHARED SPECTRUM CO., http://www.sharedspectrum.com/measurements (last visited Jan. 1, 2011).

[342] *See, e.g.*, Joelle Tessler, *Government Working on Wireless Spectrum Inventory*, MSNBC.COM (July 14, 2010, 5:44 PM), http://www.msnbc.msn.com/id/38249699/ns/technology_and_science-tech_and_gadgets/ (discussing the reasons behind the forthcoming government inventory of the entire spectrum, including the identification and reallocation of certain bands for the "cutting-edge 4G services now being rolled out by the big mobile carriers").

[343] The Radio Spectrum Inventory Act of 2009 (S. 649) was introduced in March 2009 and calls on the NTIA and FCC to compile a report that " includes an inventory of each radio spectrum band, from 300 Megahertz to 3.5 Gigahertz, managed by each such agency." The Radio Spectrum Inventory Act, S. 649, 111th Cong. §2 (2009). The Radio Spectrum Inventory Act of 2009 (H.R. 3125) was introduced in July 2009 and calls on the NTIA and FCC to "create an inventory of each radio spectrum band of frequencies used in the United States Table of Frequency Allocations, from 225 megahertz to 10 gigahertz." Radio Spectrum Inventory Act of 2009, H.R. 3125, 111th Cong. § 2 (2009) The House passed this version of the bill in April 2010. *See* John Eggerton, *House Passes Spectrum Inventory Bill*, BROAD. & CABLE (Apr. 14, 2010, 5:15 PM), http://www.broadcastingcable.com/article/451482-House_Passes_Spectrum_Inventory_Bill.php.

[344] *See, e.g.*, Press Release, CTIA – The Wireless Ass'n, CTIA–The Wireless Association Applauds Introduction of Radio Spectrum Inventory Act (March 20, 2009) *available at* http://www.ctia.org/media/press/body.cfm/PRID/1803.

[345] *End of Spectrum Scarcity*, *supra* note 309, at 5; *see also* Richard Whitt, *Taking Stock of the Nation's Airwaves*, GOOGLE PUB. POL'Y BLOG (May 4, 2009, 10:55 AM), http://googlepublicpolicy.blogspot.com/2009/05/taking-stock-of-nations-airwaves.html (announcing Google's support of a spectrum inventory); Elise Ackerman, *Google and Others Urge Inventory of National Airwaves*, PHYSORG, May 6, 2009, http://www.physorg.com/news160850607.html (noting that "In a rare show of unity over national communications policy, Google, the wireless industry and consumer advocates have come together to support a bill that would require the federal government to take a complete inventory of the national airwaves to determine what spectrum is being used, how it is being used and who is using it.").

[346] *Overview of the National Broadband Plan*, 18 COMMLAW CONSPECTUS 517, 518

C. Develop & Implement Clear Policy Mechanisms for Making Additional Spectrum Available in a Timely Manner: Reallocation

Another critical step towards making additional spectrum available in a timely manner is the development and implementation of clear policy mechanisms for reallocating underused and unused portions of the airwaves.

Reallocating spectrum is a complicated and time-intensive process that requires, among other things, identifying contiguous bands that would support a certain type of wireless deployment (e.g., broadband), clearing that spectrum, which entails relocating incumbent users, and auctioning the spectrum.[347] This process typically takes several years to complete, and, in some cases, can take as long as a decade.[348] For example, it took approximately 13 years for the spectrum in the 700 MHz proceeding to be cleared and made available for auction.[349] As previously discussed, a portion of this spectrum has yet to be auctioned.[350]

The mechanics of reallocating spectrum vary from proceeding to proceeding. In general, most reallocations involve multiple technical inquiries and rulemaking proceedings in order to assure that incumbent users are relocated to spectrum bands that will support their uses and that the spectrum is able to support the new deployments that it is being cleared to support.[351] For example,

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(2010).

[347] *End of Spectrum Scarcity*, *supra* note 309, at 7.

[348] FCC Presentation, *supra* note 51, at slide 16 (estimating that it takes approximately 6-13 years to make spectrum available); NATIONAL BROADBAND PLAN, *supra* note 11, at 79 (providing several additional examples of how long it takes to clear spectrum).

[349] The process began with provisions regarding digital television in the Balanced Budget Act of 1997. *See* Balanced Budget Act of 1997, Pub. L. No. 105-33, 111 Stat. 251 § 3004 (1997) (codified as amended at 47 U.S.C. §337 (2006); *see also* LENNARD G. KRUGER, CONG. RESEARCH SERV., RL 31260, DIGITAL TELEVISION: AN OVERVIEW , *available at* http://www.usembassy.it/pdf/other/RL31260.pdf (providing a comprehensive discussion of the digital TV transition, which freed up the spectrum available in the 700 MHz auction).

[350] *See*, JONATHAN B. BAKER & PAUL DE SA, FED COMMC'NS COMM'N, THE YEAR IN ECONOMICS AT THE FCC: A NATIONAL PLAN FOR BROADBAND (Oct. 13, 2010) (As of October 2010, the FCC has yet to hold an auction but has plans to do so).

[351] *In re* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands; Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems; Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones; Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services; Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission's Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010; Declaratory Ruling on Reporting Requirement Under Commission's Part 1 Anti-Collusion Rule, *Second Report and Order*, 22 F.C.C.R. 15289, ¶¶

during the broadband PCS proceeding, the FCC issued new licenses under flexible use rules while requiring incumbents to clear, relocate or retune to alternative bands by a specified date.[352] Ahead of the first AWS auction in 2006, which reallocated a large swath of government-owned spectrum for broadband purposes,[353] the FCC required the relocation of Broadband Radio Service and Fixed Microwave Service incumbents from the 2.1 GHz band, and set forth a comprehensive cost-sharing framework for such relocations.[354] In addition, the FCC adjusted the terms and conditions associated with these licenses in order to "give licensees more time to build out service in a spectrum band where equipment did not yet exist."[355] Yet despite these adjustments and the creation of a relocation fund to "provide a mechanism whereby federal agencies can recover the costs of moving from one spectrum band to another," carriers encountered a number of problems during their attempts to deploy network infrastructure.[356] Foremost among these obstacles were the delays associated with clearing portions of the auctioned spectrum.[357] These delays pushed back scheduled network deployments for several carriers.[358]

Other considerations may complicate the reallocation process. For example, in the 700 MHz reallocation process, television broadcasters were required to relocate their services in order to free up spectrum for commercial wireless services and to make available digital television services.[359] The original target date for completing this transition was 2006.[360] However, this date was moved back several times for a variety of reasons,[361] including a lack of public awareness regarding the need for acquiring a digital receiver that would be necessary

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432-43 at 15443-46 (July 31, 2007); *see* SPTF REPORT, *supra* note 170, at 50-51 (describing the various methods for spectrum transitions with particular attention to incumbent transitions).

[352] SPTF REPORT, *supra* note 170, at 48-51.

[353] *See* LINDA K. MOORE, CONG. RESEARCH SERV., RL 31764, SPECTRUM MANAGEMENT: AUCTIONS, 9-10 (2008) [hereinafter SPECTRUM MANAGEMENT: AUCTIONS].

[354] AWS-1 Rules, *supra* note 239.

[355] MOMENTUM BUILDING, *supra* note 238, at 12.

[356] LINDA K. MOORE, CONG. RESEARCH SERV., RL 31764, SPECTRUM MANAGEMENT: AUCTIONS 9 (2008) (discussing the genesis of the Commercial Spectrum Enhancement Act, Title II of P.L. 108-494.

[357] *See* Winter, *supra* note 329 (discussing the difficulties that T-Mobile faced when trying to clear spectrum for their 3G network).

[358] *See, e.g.*, *id*. (noting that some carriers, including T-Mobile, were forced to delay the deployment of 3G services in several markets due to such delays).

[359] KRUGER, *supra* note 349, at 2-3; Auction of 700MHz Band Licenses Scheduled for January 16, 2008; Comment Sought on Competitive Bidding Procedures for Auction 73, *Public Notice*, 22 F.C.C.R. 15004, ¶¶ 1-4 (Aug, 17, 2007) (introducing and describing the 700 MHz auction).

[360] *Id.* at 3.

[361] *Id.*

to convert new digital television signals on older televisions.[362]

Ensuring that reallocations are successfully completed in a timely manner is essential given the high costs associated with acquiring the spectrum and deploying new network infrastructure.[363] The inherently scarce nature of spectrum has resulted in this resource being viewed as a valuable commodity.[364] As such, aggregate bidding in major spectrum auctions often reaches the multi-billion dollar level.[365] Conversely, the opportunity costs associated with failing to successfully auction off spectrum capable of supporting broadband deployment are potentially enormous. For example, several studies suggest that the opportunity costs associated with failing to auction off spectrum in the D-block of the 700 MHz band range from $1-2 billion.[366]

Given the complexity and high stakes of reallocation, some have urged for a spectrum inventory to result in a more open approach to spectrum allocation and use.[367] For example, some stakeholders have advocated in favor of mandating the sharing of underutilized spectrum between the incumbent and other providers.[368] In particular, proposals to "overlay" or "underlay" multiple uses of spectrum have been put forward as a way to realize the full potential of certain spectrum bands.[369] These proposals rest partly on the assumption that

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[362] *See, e.g.*, Chloe Albanesius, *House Approves DTV Transition Delay*, PC MAG. (Feb. 4, 2009), http://www.pcmag.com/article2/0,2817,2340416,00.asp (reporting on Congress's decision to push the DTV transition date back from Feb. 17 to June 12 in order to increase public awareness of the transition).

[363] *Id.*

[364] *Wireless Craze*, *supra* note 166, at 566.

[365] *See* Pennsylvania State University, Center for the Study of Auctions, Procurements and Competition Policy, FCC Spectrum Auction Data, http://capcp.psu.edu/FCC/ (providing data on each of the 82 spectrum auctions to date). According to this page, the seven auctions that resulted in multi-billion dollar aggregate bidding involved spectrum capable of supporting broadband-type services (e.g., PCS, 3G and 4G, etc.).

[366] *See* Robert W. Hahn et al., *The Static and Dynamic Inefficiency of Abandoning Unrestricted Auctions for Spectrum: A Critique of Professor Wilkie's Analysis of the M2Z Proposal* 22 (Criterion Economics LLC, Working Paper, 2008), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1229782; *Value of Unencumbered AWS-III Spectrum*, *supra* note 268. *Cf.* SIMON WILKIE, M2Z NETWORKS, SPECTRUM AUCTIONS ARE NOT A PANACEA: THEORY AND EVIDENCE OF ANTI-COMPETITIVE AND RENT-SEEKING BEHAVIOR IN FCC RULEMAKINGS AND AUCTION DESIGN (2007)(arguing in favor of a proposal to assign rather than auction off the D-block of spectrum in the 700 MHz band for use by M2Z Networks).

[367] Joelle Tessler, *Government Working on Wireless Spectrum Inventory*, MSNBC.COM (July 14, 2010, 5:44 PM), http://www.msnbc.msn.com/id/38249699.

[368] In its spectrum PN, the FCC asked for comments on the viability of this potential arrangement. FCC Spectrum PN, *supra* note 281, at 12036.

[369] *End of Spectrum Scarcity*, *supra* note 309, at 7-8 (distinguishing underutilized spectrum is that which is shared between licensees in certain bands from overlaying spectrum, which involves assigning to a new licensee, band that was originally vacant and used to separate spectrum users).

commercial mobile providers are inefficient users of spectrum and that alternate providers could leverage underused portions of a network to provide service.[370] However, several studies have found that wireless service providers are in fact very *efficient* users of their spectrum.[371] Unlike their international counterparts, commercial wireless network owners in the United States have been forced to develop innovative approaches for making do with less spectrum assets.[372] In 2009, one analyst estimated that U.S. wireless carriers served three times as many subscribers per MHz of spectrum than carriers in Britain and twice as many as carriers in Japan.[373] An approach that gives preference to mandated sharing arrangements over the reallocation of underused spectrum could reduce an incumbent's incentive to innovate by replacing organic experimentation with artificial policy prescriptions.

A more robust reallocation policy could strengthen incentives for licensees to maximize utilization of their particular portion of the airwaves.[374] Even though commercial mobile service providers are efficient users of spectrum, a number of other private-sector licensees have been accused of under-using spectrum resources.[375] For example, some have argued that spectrum allocated for broadcast television content is inefficiently used[376] and potentially impeding billions of dollars in consumer welfare gains.[377] Indeed, by some estimates, upwards of 174 MHz of spectrum is underutilized in major markets across the

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[370] Marguerite Reardon, *Rethinking the Wireless Spectrum Crisis*, CNET NEWS (May 25, 2010, 4:00 AM), http://news.cnet.com/8301-30686_3-20005831-266.html.

[371] *See* JOHN T. MCDONALD, ILLINOIS INST. OF TECH., A SURVEY OF SPECTRUM UTILIZATION IN CHICAGO (2007), *available at* http://www.ece.iit.edu/~wemi/publications/spectrum.pdf; *see also generally* JOHN T. MCDONALD & DENNIS A. ROBERSON, ILLINOIS INST. OF TECH., SPECTRUM OCCUPANCY ESTIMATION IN WIRELESS CHANNELS WITH ASYMMETRIC POWER TRANSMITTERS (2007), *available at* http://www.wemi.ece.iit.edu/publications/crowncom.pdf (describing the process by which cognitive radio systems scan the spectrum to determine where there are new areas of spectra that can be utilized).

[372] CUSTOMER-CENTRIC FRAMEWORK, *supra* note 310, at 9.

[373] *Id.* at 21.

[374] *Id.* at 20-21.

[375] Reardon, *Rethinking the Wireless Spectrum Crisis*, *supra* note 370.

[376] Thomas Hazlett has noted that FCC rules regarding broadcast spectrum limit the ability of licensees to "underutilize spectrum-saving techniques." *See* Thomas W. Hazlett, *Optimal Abolition of FCC Spectrum Allocation*, 22 J. ECON. PERSP. 103, 106 (2008).

[377] One commentator has observed that "the spectrum dedicated to UHF TV broadcasting has less value as a medium for transmitting TV signals than it does for an array of other uses," including commercial wireless services. *See* Philip J. Weiser, *The Untapped Promise of Wireless Spectrum* 20, Brookings Institution Hamilton Project Discussion Paper 08-8 (July 2008), [hereinafter *Untapped Promise*], *available at* http://www.brookings.edu/~/media/Files/rc/papers/2008/07_wireless_weiser/07_wireless_weiser.pdf.

country.[378] Moreover, it would appear that the evolving television business model militates against generous spectrum arrangements for broadcasters since "the vast majority of programming from over-the-air broadcasters is viewed on subscription services such as cable and satellite," which has resulted in a large amount of spectrum being underutilized.[379] The FCC has observed that the number of people who receive over-the-air television has decreased by 56 percent over the last decade.[380] By one estimate, reallocating this spectrum for wireless broadband purposes could result in a consumer surplus exceeding $1 trillion.[381] Others have postulated that the benefits associated with the reallocation of underutilized spectrum by television broadcasters, such as the availability of additional prime spectrum for auction, vastly outweigh the economic and social costs of reclaiming these swaths of the airwaves (e.g., a decrease in free programming available via the traditional over-the-air distribution model).[382] These swaths of spectrum are especially valuable given their potential robustness for wireless broadband purposes.[383]

The Obama administration,[384] the FCC,[385] and many other prominent stake-

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[378] *See* Ex Parte Letter from CTIA – The Wireless Association, to Chairman Julius Genachowski, Comm'r Michael J. Copps, & Comm'r Robert M. McDowell, Fed. Commc'ns Comm. (July 9, 2009), *available at* http://files.ctia.org/pdf/filings/2009_Wireless_Economic_Contributions.Letter.Final.pdf.

[379] *See* COLEMAN BAZELON, THE BRATTLE GROUP, THE NEED FOR ADDITIONAL SPECTRUM FOR WIRELESS BROADBAND: THE ECONOMIC BENEFITS AND COSTS OF REALLOCATIONS 1 (2009), [hereinafter NEED FOR ADDITIONAL SPECTRUM], *available at* www.brattle.com/_documents/uploadlibrary/upload809.pdf

[380] *See* Blair Levin, Exec. Dir., Omnibus Broadband Initiative, Fed. Comm'cns Comm'n, Remarks at The Progress & Freedom Foundation Congressional Seminar: Let's Make a Deal: Broadcasters, Mobile Broadband, and a Market in Spectrum (Dec. 1, 2009), *in* PROGRESS & FREEDOM FOUND., PROGRESS ON POINT No. 16.27, at 22 (2009).

[381] *Id.* at 8.

[382] *See, e.g.*, Stuart Minor Benjamin, *Roasting the Pig to Burn Down the House: A Modest Proposal*, 7 J. ON TELECOMM. & HIGH TECH. L. 95, 97-98 (2009) [hereinafter *Burn Down the Hou*se]. Benjamin writes that

> The value of [broadcast] spectrum is enormous. The revenue generated by selling the spectrum would depend on auction prices, of course, but the estimated range is in the hundreds of billions of dollars. And because service providers could not capture all the value of the spectrum, the value to citizens – the consumer surplus created by the new services – would far exceed the auction revenue.

Id. See also Stuart Minor Benjamin, *Evaluating the Federal Communications Commission's National Television Ownership Cap: What's Bad for Broadcasting Is Good for the Country*, 46 WM. & MARY L. REV. 439, 496 (2004) (outlining a way for government to subsidize continued access to free programming to consumers negatively impacted by the reallocation of broadcast spectrum).

[383] *See Spectrum Analysis: Options for Broadcast Spectrum*, FCC OBI Technical Paper No. 3, June 2010, at 1 [hereinafter *Spectrum Analysis*].

[384] Memorandum from Pres. Obama on the Wireless Broadband Revolution to the heads of Executive Departments and Agencies (June 28, 2010), [hereinafter Wireless Broadband

holders have endorsed a plan that would encourage television broadcasters to "voluntarily clear spectrum through incentive auctions."[386] Under this approach, broadcasters would be able to make their spectrum resources available to wireless broadband innovators via an auction, the proceeds of which would be shared with the U.S. Treasury.[387] In addition, broadcasters would be provided with additional spectrum resources in order to ensure that they are able to continue providing service and to ensure that the FCC continues to adhere to its commitment to competition, diversity, and localism.[388] The goal of this approach is to bolster federal efforts to make a total of 500 MHz of additional spectrum available to wireless broadband innovators over the next decade.[389] The FCC has outlined several different scenarios and incentive auction structures in the hope of spurring broadcasters to voluntarily relinquish existing spectrum assets for auction.[390] However, the voluntary aspect of this approach may prove to be an impossible barrier to overcome, as could the requirement that broadcasters share only a percentage of auction revenues with the U.S. Treasury.[391] Moreover, even though there is a spectrum *quid pro quo* involved in each of the FCC's auction scenarios, many of the more viable approaches would require Congressional action to adjust FCC authority, which could slow the process.[392]

In sum, a robust policy that clearly defines the conditions under which spectrum bands will be reallocated could result in additional spectrum being made available to innovators that need it for new deployments.[393] In addition, in order to satiate short-term demand for additional spectrum, an approach that favors reallocation over forced sharing, and one that strengthens incentives for

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Revolution Memo], *available at* http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution.

385 *Spectrum Analysis*, *supra* note 383; NATIONAL BROADBAND PLAN, *supra* note 11, at 81-82.

386 NATIONAL BROADBAND PLAN, *supra* note 11, at 81.

387 *Spectrum Analysis*, *supra* note 383, at 24.

388 *Id.* at 25.

389 Wireless Broadband Revolution, *supra* note 387.

390 *Spectrum Analysis*, *supra* note 383, at 25-27.

391 Michael Grotticelli, *Vague 'Voluntary Spectrum Auction Bill' introduced in House*, Broadcast Engineering (Aug. 2, 2010, 8:00AM), http://broadcastengineering.com/news/voluntary-spectrum-auction-bill-introduced-House/index.html.

392 *Spectrum Analysis*, *supra* note 383, at 25.

393 As opposed to implementing regulations that continue to encourage inefficient uses of spectrum even though those regulations might, on their face, be in the public interest. *See, e.g.*, *Burn Down the House*, *supra* note 382, at 100 (arguing against regulations that would entrench broadcasters in their swaths of spectrum and in favor of regulations that would increase the costs associated with keeping the spectrum).

maximizing utilization of existing spectrum resources, would provide innovators with sufficient certainty in their ability to experiment and innovate and the network level.[394] Such certainty will encourage continued investment, which is critical to further deployment of necessary network infrastructure that can support more bandwidth-intensive uses.[395]

D. Develop & Implement Clear Policy Mechanisms for Making Additional Spectrum Available in a Timely Manner: Secondary Markets

Secondary spectrum markets represent a valuable and efficient way of ensuring that "spectrum will migrate to more efficient uses."[396] Over the course of the 2000s, the FCC developed a secondary market policy for spectrum that supports a range of leasing arrangements,[397] including "wholesale access to carriers' infrastructure and spectrum."[398] Other reforms included a concerted effort to "remove regulatory barriers" and streamline administrative processes for approving license transfers and assignments.[399] The FCC also recently clarified the rights and responsibilities of incumbent licensees that wish to engage in secondary spectrum market transactions.[400] For example, incumbent licensees have control over establishing technical parameters of the types of devices that can be used in their "private commons" and are responsible for preventing harmful interference beyond their band.[401]

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[394] *See, e.g.* Ian Grant, *Spectrum Reallocation is Key to Digital Britain*, COMPUTER WEEKLY, Oct. 22, 2009, *available at* http://www.computerweekly.com/Articles/2009/10/22/238271/spectrum-reallocation-is-key-to-digital-britain.htm (noting that spectrum reallocation is essential to realizing Britain's goal of "guaranteed universal access to a minimum 2Mbps broadband connection by 2012.").

[395] NET NEUTRALITY, INVESTMENT & JOBS, *supra* note 5, at 20-23.

[396] *See* JOHN W. MAYO & SCOTT WALLSTEN, GEORGETOWN CTR. FOR BUS. & PUB. POL'Y, ENABLING EFFICIENT WIRELESS COMMUNICATIONS: THE ROLE OF SECONDARY SPECTRUM MARKETS 2 (2009), [hereinafter ROLE OF SECONDARY SPECTRUM MARKETS]. *available at* http://www.gcbpp.org/files/Academic_Papers/EnablingWirelessCommunicationsJuly2009.pdf.

[397] *Id.* at 9-11.

[398] *Id.* at 13. Lessees are known as Mobile Virtual Network Operators (MVNOs). Examples of MVNOs include Tracfone. *Id.*

[399] *See Secondary Markets Initiative*, FED. COMMC'NS COMM'N, WIRELESS TELECOMM. BUREAU, http://wireless.fcc.gov/licensing/index.htm?job=secondary_markets (last updated Aug. 13, 2010).

[400] SPECTRUM BRIDGE, INC., ANALYSIS OF FCC SECONDARY SPECTRUM MARKETS POSITIONS, POLICIES AND COMMENTS 1 (2008), *available at* http://spectrumbridge.com/web/images/whitepapers/analysisoffccsecondaryspectrummarkets.pdf.

[401] *See id.* at 7.

Secondary spectrum markets are beginning to emerge, but face two key barriers to further development and more robust use.[402] First, even though the FCC has implemented policies to streamline the administrative aspects of secondary market transactions,[403] a number of information problems exist. For example, the FCC's database that tracks spectrum licenses, the Universal Licensing System, has been criticized as being frustratingly opaque.[404] As a result, parties interested in entering into a lease agreement or other such spectrum arrangements may find it difficult to identify suitable partners.[405] To overcome this impediment, several innovative approaches have been proposed to enhance the quality of information provided to interested parties. For example, Spectrum Bridge has launched an online spectrum trading site to expand the secondary spectrum market by providing more consumer-friendly information regarding available spectrum licenses.[406] This company also maintains a database of unlicensed spectrum, including white spaces.[407] In addition, the FCC's Spectrum Dashboard, and a commitment to "implement ongoing improvement to the database," are promising first steps toward lowering current informational barriers.[408]

Second, the range of allowed secondary market transactions is limited. Leasing and transfers are allowed so long as lessees adhere to the same set of usage rules as the incumbent lessee.[409] Secondary markets do not allow for reallocation.[410] For example, the current framework does not allow a broadcaster to sell their licenses to interested commercial mobile service providers[411] even though the estimated market value of "broadcasters' spectrum if it was available for wireless broadband [is] about $62 billion."[412] These types of limitations skew

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402 *Untapped Promise*, *supra* note 377.

403 NATIONAL BROADBAND PLAN, *supra* note 11, at 5.

404 ROLE OF SECONDARY SPECTRUM MARKETS, *supra* note 396, at 18-19.

405 *Untapped Promise*, *supra* note 377, at 12.

406 *See* Marin Perez, *Spectrum Bridge Launches Online Secondary Market*, INFO. WEEK (Sept. 5, 2008, 6:38 PM), http://www.informationweek.com/news/telecom/regulation/showArticle.jhtml?articleID=210500380.

407 *See SpecEx, TV White Spaces, UDIA, and uAccess - Smart Wireless Access*, SPECTRUM BRIDGE, http://spectrumbridge.com/products-services.aspx (last visited Jan. 1, 2011).

408 NATIONAL BROADBAND PLAN, *supra* note 11, at 80.

409 *In re* Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Second Report and Order*, 19 F.C.C.R. 17503, ¶¶ 100-108 (July 8, 2004).

410 *See, e.g.* Thomas W. Hazlett, *Property Rights and Wireless License Values*, 51 J.L. & ECON. 563, 566 n.5 (2008).

411 *Id.* at 566-67 (noting that the current approach "allows trading of existing rights rather than reallocation of spectrum [say, using TV band frequencies for a new wireless broadband service]").

412 NEED FOR ADDITIONAL SPECTRUM, *supra* note 379, at 2.

the economic incentives that bolster the efficient allocation of resources in most secondary markets and could be discouraging more robust utilization of and maximally efficient transfers via secondary spectrum markets.[413] Allowing a broader range of secondary market transactions, including reallocations, might enhance the view among spectrum owners that these types of transactions are "worth the effort."[414]

E. Bolster Policies to Ensure Maximum Utilization of Existing Spectrum Assets

Since additional spectrum is unlikely to be made available in the immediate near-term,[415] wireless network operators will require wide latitude to maximize the use of their existing spectrum assets. This section analyzes and assesses a critical component of this strategy, network management.

The spectrum used by wireless carriers is a shared resource, which means that increases in traffic on a network at any one time can cause congestion.[416] Even though wireless service providers are upgrading their networks to provide higher throughput data speeds,[417] robust consumer demand for more interactive and real-time wireless services and applications (e.g., streaming radio and video) is beginning to challenge existing traffic management techniques.[418]

As previously discussed, wireless data traffic has increased exponentially

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[413] As one commentator posits, "The benefits of this [approach] go far beyond efficiency in spectrum use. A major economic benefit is that anywhere suppliers of communications service are overcharging customers, entrants can get the spectrum they need to build new capacity, driving down the prices consumers have to pay for service." *See* Bruce M. Owen, *A Fresh Start in Communications Policy: Two Modest Reforms*, *in* NEW DIRECTIONS IN COMMUNICATIONS POLICY 2 (R. May ed., 2008).

[414] *Untapped Promise*, *supra* note 377, at 12.

[415] As previously discussed, CTIA estimates that only 40 MHz of spectrum is expected to be made available in the short-term. *See* discussion *supra* note 341.

[416] *See* Roger Entner, *Considerations Around Wireless Net Neutrality: The Few Vs. the Many*, NIELSEN WIRE BLOG (Oct. 12, 2009), http://blog.nielsen.com/nielsenwire/online_mobile/considerations-around-wireless-net-neutrality-the-few-vs-the-many/ [hereinafter *Considerations Around Wireless Net Neutrality*] (noting that wireless network's are increasingly challenged "when we move from bursty traffic to streaming."); *see also* Michael J. Santorelli, *Rationalizing the Municipal Broadband Debate*, 3 I/S: J.L. & POL'Y FOR INFO. SOC'Y 43, 54 (2007) (comparing the various modes of delivering broadband and noting that shared deliver mediums—Wi-Fi, cable broadband, and cellular 3G, among others—"can slow down with an increase in the number of users on an immediate network").

[417] *See* Martin Moylan, *Wireless Companies to Roll Out Higher-Speed Data Service*, MINN. PUB. RADIO (July 20, 2010, 8:25 AM), http://minnesota.publicradio.org/display/web/2010/07/20/4g-wireless/.

[418] *Considerations Around Wireless Net Neutrality*, *supra* note 416 (noting that wireless network's are increasingly challenged "when we move from bursty traffic to streaming.").

over the last few years as more consumers purchase smartphones and utilize an array of broadband-enabled applications on their handsets.[419] The variation in the amount of bandwidth consumed by voice calls as compared to more advanced uses (e.g., watching video on a mobile device) is extreme. For example, one study has estimated that "a voice user with a 1,000-minute plan can consume about 100 megabytes of voice data in a month. However, a data user can consume this much data watching just 15 minutes of YouTube."[420] Additional examples of the data speeds required by new wireless services and of new usage patterns generally provide insight into the unique challenges facing network managers.

Pandora, a streaming music service, is increasingly popular on smartphones.[421] To date, some 13 million accounts have been created via mobile handsets.[422] This type of application "typically uses about 40 KB/s and can support around 90 concurrent users (a theoretical best case scenario of 3.6 MB/s divided by 40 KB/s) in a cell sector."[423] Most cell sectors, however, support more than 90 subscribers.[424]

Mobile video continues to gain in popularity among consumers.[425] For example, uploads to YouTube continue to increase at a rapid pace. In the first half of 2009, YouTube reported a 1,700 percent increase in mobile uploads to its Web site.[426] Slingbox, another popular streaming video application that allows a user to watch television episodes on their handset, uses approximately

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[419] *See* Suzanne Choney, *Is 2010 the Year of Wireless Congestion?*, MSNBC.COM (Jan. 4, 2010, 3:58 PM), http://www.msnbc.msn.com/id/34634571/ns/technology_and_science-tech_and_gadgets/.

[420] *See* RYSAVY RESEARCH, WIRELESS E-MAIL EFFICIENCY ASSESSMENT 3 (2009), *available at* www.rysavy.com/Articles/Rysavy_Wireless_EMail.pdf.

[421] *See* Paul Bonanos, *Pandora: 24% of Our Users Signed Up on a Mobile Phone*, GIGAOM.COM (Nov. 19, 2009, 4:54 PM), http://gigaom.com/2009/11/19/pandora-24-of-our-users-signed-up-on-a-mobile-phone/.

[422] *Id.*

[423] *Considerations Around Wireless Net Neutrality*, *supra* note 416 (noting the size of a cell sector varies depending on the given geographic area and the number of subscribers in the immediate area – "How big is a cell sector? Anywhere from the size of the city block that houses Madison Square Garden in Manhattan, to the size of Capitol Hill in Washington DC to several square miles of corn fields in rural Nebraska.").

[424] *Id.*

[425] Nielsen estimated that mobile video penetration was approximately seven percent in mid-2009 and that it grew by 70 percent between 2008 and 2009. *See* Nic Covey, *The State of Mobile Video: Promise vs. Progress*, NIELSEN WIRE BLOG (Sept. 23, 2009), http://blog.nielsen.com/nielsenwire/consumer/the-state-of-mobile-video-promise-vs-progress/.

[426] *See Mobile Uploads to YouTube Increase Exponentially*, YOUTUBE BLOG (June 25, 2009), http://youtube-global.blogspot.com/2009/06/mobile-uploads-to-youtube-increase_5122.html.

384 KB/s.[427] If a particular cell sector provides for data throughput of 3.8 MB/s, then nine subscribers simultaneously watching TV via their Slingbox application would dominate that given sector.[428]

An increase in the use of mobile banking services has been linked to an increase in smartphone sales and to the deployment of advanced data networks.[429] These types of applications require a seamless user experience, which is enabled by robust connectivity to the Internet.[430]

The next generation of mobile applications is increasingly providing real-time services (e.g., telemedicine tools and smart grid applications).[431] An application available for use with the Android OS allows for GPS-enabled navigation services, including turn-by-turn directions, automatic rerouting, and live traffic updates.[432]

Many mobile devices, including smartphones and netbooks, will leverage cloud computing services to deliver remotely stored content.[433] For example, Google's Chrome Operating System, which will initially run on netbooks, is "designed to start most data in the cloud with very little local storage."[434] Under this model, data that is typically stored on a mobile device's hard-drive will instead be accessible via a wireless broadband connection.[435]

Increased mobile data usage also raises security risks for individual end-users and the core network. In recent years, several pernicious attacks on individual users have led to personal e-mail accounts being infiltrated.[436] In addi-

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[427] *Cf. Considerations Around Wireless Net Neutrality*, *supra* note 416.

[428] *Id.*

[429] *See* Press Release, ComScore, Demand for Mobile Financial Services Poised to Grow with Increased Penetration of Smartphones and 3G Service (July 9, 2009), *available at* http://www.comscore.com/Press_Events/Press_Releases/2009/7/Demand_for_Mobile_Financial_Services_Poised_to_Grow_with_Increased_Penetration_of_Smartphones_and_3G_Service.

[430] *Id.*

[431] *See* Nadi Kaonga, *In Search of Mobile Telemedicine Platform: A Few Open Source Applications*, CNET NEWS (Apr. 26, 2010), http://mobileactive.org/search-mobile-telemedicine-platform-review-open-source-applications; *see also* Marguerite Reardon, *T-Mobile Goes for Smart Grids*, CNET NEWS (Apr. 23, 2009, 3:43 PM), http://news.cnet.com/8301-1035_3-10226418-94.html.

[432] *See Announcing Google Maps Navigation for Android 2.0*, OFFICIAL GOOGLE BLOG (Oct. 28, 2009, 7:01 AM), http://googleblog.blogspot.com/2009/10/announcing-google-maps-navigation-for.html.

[433] *See Mobile Cloud Computing Subscribers to Total Nearly One Billion by 2014*, ABI RESEARCH (Sept. 4, 2009), http://www.abiresearch.com/press/1484-Mobile+Cloud+Computing+Subscribers+to+Total+Nearly+One+Billion+by+2014.

[434] *See* Tom Krazit, *Google Has Its Own Plan for Netbooks*, CNET NEWS (Nov. 19, 2009, 2:30 PM), http://news.cnet.com/8301-30684_3-10401919-265.html.

[435] Tim Anderson, *What is Cloud Computing?*, GUARDIAN (June 21, 2010, 9:44 AM), http://www.guardian.co.uk/cloud-computing/what-is-cloud-computing.

[436] Olga Kharif, *Smartphones: A Bigger Target for Security Threats*, BLOOMBERG BUSI-

tion, one in five smartphone users have encountered a phishing scam, which is prevalent via wire-based broadband connections.[437] Going forward, "as the mobile OS landscape changes, and with devices comprising a huge amount of memory and storing a host of sensitive data," smartphone devices will likely "increase as a popular target for" these types of attacks.[438]

In response to increased traffic on their networks, and in lieu of adding additional spectrum to networks given the looming spectrum gap, wireless service providers have employed a multifaceted approach to enhancing spectral efficiency,[439] elements of which include:

Hardware. A number of hardware options are available to service providers that wish to maximize throughput speeds and enhance reliability. For example, a carrier could build additional cell sites or "split" these sites to bolster network performance by decreasing the size of cell sectors.[440] However, such an approach will likely "reach a point of diminishing returns if the task consists solely of cell splitting an operator's existing frequencies."[441] Other hardware options for bolstering spectrum include the use of femtocells, which extend the range of wireless service into homes and offices.[442]

NESSWEEK.COM (Nov. 17, 2009, 12:05 AM), http://www.businessweek.com/technology/content/nov2009/tc20091116_827479.htm

[437] *See id.* (citing a survey conducted by Trend Micro in May 2009).

[438] *See* TREND MICRO, THE FUTURE OF THREATS AND THREAT TECHNOLOGIES: HOW THE LANDSCAPE IS CHANGING 11 (2009), *available at* http://us.trendmicro.com/imperia/md/content/us/trendwatch/researchandanalysis/trend_micro_2010_future_threat_report_final.pdf.

[439] *See* 3G AM., 3GPP TECHNOLOGY APPROACHES FOR MAXIMIZING FRAGMENTED SPECTRUM ALLOCATIONS 18-19 (2009), http://www.3gamericas.org/documents/3GA Underutilized Spectrum_Final_7_23_092.pdf (discussing observations of one study that when "[c]onfronted with burgeoning demand, mobile network operators have three options for responding: build more cell sites; increase spectral efficiency of existing spectrum assets; and deploy more spectrum into their networks. Operators cannot pick and choose among these options, but must invoke all of them in the hunt for capacity."); *In re* A National Broadband for Our Future; International Comparison and Consumer Survey Requirements in the Broadband Data Improvement Act; Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, *Comments of CTIA – The Wireless Association*, GN Docket No. 09-51; GN Docket No. 09-47; GN Docket No. 09-137, at 14 (Sept. 23, 2010) (accessible via FCC Electronic Comment Filing System); *In re* Preserving the Open Internet Broadband Industry Practices, *Reply Comments of AT&T, Inc.*, GN Docket No. 09-191, WC Docket No. 07-52, at 77-79 (Apr. 26, 2010) (accessible via FCC Electronic Comment Filing System).

[440] BROADBAND EVOLUTION TO 4G, *supra* note 48, at 19.

[441] BROADBAND EVOLUTION TO 4G, *supra* note 48, at 19.

[442] *See, e.g.*, *AT&T 3G MicroCell*, AT&T, http://www.wireless.att.com/learn/why/3gmicrocell/ (last visited Jan. 1, 2011) ("AT&T 3G MicroCell acts like a mini cellular tower in your home or small business environment. It

Software. In addition to the hardware that comprises the physical infrastructure of a wireless network, service providers have developed and implemented a range of software solutions for supporting more intensive data uses.[443] Indeed, the shift towards next-generation wireless network capabilities will involve a number of software upgrades throughout the network, including at the base station level.[444] For example, components of the Evolved EDGE standard for wireless networks require only software upgrades in order to increase peak data speeds by 100 percent and "[t]o avoid impacts on infrastructure by enabling improvements through a software upgrade."[445] In addition, carriers are increasingly using subscriber management software to more efficiently track and manage data usage across networks.[446]

Usage policies. Nearly all wireless carriers provide subscribers with a variety of options for using wireless data.[447] Different phones, data packages, and pricing plans provide customers with a variety of options for purchasing these

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connects to AT&T's network via your existing broadband Internet service (such as DSL or cable) and is designed to support up to four simultaneous users in a home or small business setting.").

[443] *See, e.g.*, *Why Is WiMAX Important for Mobile Broadband Wireless?*, WIMAX, http://www.wimax.com/general/why-is-wimax-important-for-mobile-broadband-wireless (last visited Jan. 1, 2011) (discussing Verizon, Sprint, AT&T, and Clearwire are carriers using software solutions to "produce higher-capacity broadband systems"); CISCO SYS., MAXIMIZING USE OF MOBILE DATA INFRASTRUCTURE: THE IMPORTANCE OF SERVICE CONTROL IN MOBILE NETWORKS 1-6 (2005), *available at* http://www.cisco.com/en/US/prod/collateral/ps7045/ps6129/ps6257/ps6501/prod_white_paper0900aecd80342822.pdf (explaining service providers' use of Cisco Systems service control technology "include the ability to analyze traffic usage, control bandwidth allocation . . ., and secure theire network from malicious traffic as data services increase). *See generally Huwaei – Software*, HUAWEI, http://www.huawei.com/software.do (Jan. 1, 2011) (discussing Huawei Software services and products usage by "426 operators in 138 countris" to enhance end-to-end operations); *Telecordia – Innovation – Industry Leadership – Research Highlights*, TELECORDIA, http://www.telecordia.com/innovation/industry/research.html (last visited Jan. 1, 2011) (demonstrating that through innovative software technologies, Telecordia provides solutions to the telecommunications industry).

[444] *See generally* BROADBAND EVOLUTION TO 4G, *supra* note 48, at 5, 29-30, 55, 68, 87 (discussing the various software upgrades required for transitioning to 4G network capabilities).

[445] *Id.* at 69.

[446] *See* Olga Kharif, *Managing the Wireless Data Deluge*, BLOOMBERG BUSINESSWEEK.COM, (Dec. 23, 2009, 8:53 PM), http://www.businessweek.com/technology/content/dec2009/tc20091223_992099.htm ("Research firm Infonetics expects the market for this type of software to grow from $145 million in 2008 to nearly $800 million by 2013 . . . .").

[447] *See, e.g.*, LOSING THE FOREST, *supra* note 25, at 11-14 (describing the array of service plans available to consumers).

services. For example, BlackBerry users typically have an option of purchasing unlimited data plans, whereas purchasers of wireless data cards for netbooks usually have a choice of plans allowing for different levels of data usage per month.[448] This allows carriers to have some certainty in the amount of traffic it can expect flowing over its network at any given time. These models are still evolving as service providers develop new strategies for more accurately pricing consumption.[449]

Another key component of enhancing spectral efficiency is active network management to prevent against slow-downs and outages.[450] Indeed, many carriers manage traffic in such a way so that "large downloads can occur with lower priority, thus not affecting other active users."[451] This allows carriers to assure a minimum quality of service for all customers.[452] Despite the critical role that such techniques play in assuring a reliable user experience across a carrier's subscriber base, some have proposed limiting or eliminating the ability of a wireless service provider to manage traffic.[453] For example, as part of a

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[448] For example, via AT&T, a BlackBerry user can purchase an unlimited data plan for $30/month. *See BlackBerry Personal Plans*, AT&T.COM, http://www.wireless.att.com/cell-phone-service/services/services-list.jsp?catId=cat1510007&catName=BlackBerry%C2%AE+Services (last visited Jan. 1, 2011). Also via AT&T, a customer can purchase a wireless data card for a laptop and choose between two different plans – one that allows for up to 200 MBs in data usage per month and one that allows for up to 5 gigabytes per month. *See DataConnect Plans*, AT&T.COM, http://www.wireless.att.com/cell-phone-service/cell-phone-plans/data-connect-plans.jsp (last visited Jan. 1, 2011).

[449] For example, in June 2010 AT&T became the first wireless provider to offer tiered data pricing for iPhone owners. Low-intensity users can purchase a data plan with a relatively modest monthly data cap for less money than previous flat-rate pricing plans, while high-intensity users can purchase a plan with a higher monthly data cap for slightly more than previous flat-rate pricing plans. *See* David Lieberman, *New AT&T Smartphone Users Won't Get One-Price Net*, USA TODAY, June 2, 2010, at 1B.

[450] BROADBAND EVOLUTION TO 4G, *supra* note 48, at 7, 52.

[451] *Id.* at 9.

[452] *Id.*

[453] *Cf.* Comcast Corp. v. FCC, 600 F.3d 642 (D.C. Cir. 2010) (holding the Commission did not have ancillary authority over the wireline ISP to regulate its network management practices). This decision prompted a debate to reclassify wireline broadband service. *See generally In re* Framework for Broadband Internet Service, *Notice of Inquiry*, 25 F.C.C.R. 7866, ¶ 2 (June 17, 2010). The NOI seeks comment on whether to classify Internet service as "information service" under Title I, a "telecommunications service" under Title II, or establish a third way in which the FCC would:

> (i) reaffirm that Internet information services should remain generally unregulated; (ii) identify the Internet connectivity service that is offered as part of wired broadband Internet service (and only this connectivity service) as a telecommunications service; and (iii) forbear under section 10 of the Communications Act from applying all provisions of Title II other than the small number that are needed to implement the fundamental universal service, competition and small business opportunity, and consumer protection policies.

broader network neutrality inquiry, the FCC investigated whether and to what extent network management limitations should be placed on wireless carriers.[454] Others have suggested that such practices may limit consumer ability to choose the type of content they wish to access on their mobile device.[455]

Many arguments in favor of limiting wireless network management practices, however, fail to account for the unique nature of spectrum and the looming spectrum gap.[456] Moreover, these arguments do not account for the likely costs of imposing restrictive rules on wireless network managers. Indeed, some have suggested that the costs of imposing restrictions on a wireless carrier's ability to manage their network far outweigh any perceived benefit.[457] Conversely, the benefits derived from a carefully managed network outweigh any perceived costs because such practices provide end-users with a reliable experience and access to a growing universe of useful content.[458] In the absence of additional spectrum for use by wireless service providers, network management and other practices that enhance spectral efficiency are essential to meeting consumer demand for advanced applications and to fostering continued innovation across the wireless market.[459]

Indeed, the current wireless ecosystem has been supported, in part, by careful network management.[460] Rather than allow the rising tide of data usage to

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Id.

A Public Notice released by the FCC in September 2010 sought additional information regarding whether new regulations (e.g., network neutrality rules) were appropriate in light of the "unique" nature of wireless broadband networks. The "unique characteristics" of mobile wireless Internet access services are "related to technology, associated application and device markets, and consumer usage." *See* Further Inquiry Into Two Under-Developed Issues in the Open Internet Proceeding, GN Docket No. 09-191, WC Docket No. 07-52 (rel. Sept. 1, 2010). The FCC closed this docket and adopted formal net neutrality rules in December 2010. *See In re* Preserving the Open Internet, *Report and Order*, GN Docket No. 09-191 (rel. Dec. 23, 2010). Many provisions of the final set of rules extend to wireless services. *See, e.g.*, Declan McCullagh, *FCC Net Neutrality Rules Reach Mobile Apps*, CNET NEWS (Dec. 23, 2010, 7:06 PM), http://news.cnet.com/8301-13578_3-20026581-38.html.

[454] *In re* Preserving the Open Internet Broadband Industry Practices, *Notice of Proposed Rulemaking*, 24 F.C.C.R. 13064, ¶¶ 135, 137, at 13113, ¶ 154, at 13117-18 (Oct. 22, 2009).

[455] *See, e.g.*, Tim Wu, *Wireless Carterfone*, 1 INT'L J. OF COMM. 389, 417 (2009), *available at* http://ijoc.org/ojs/index.php/ijoc/article/view/152/96 (supporting the imposition of network neutrality requirements on wireless service providers).

[456] *See In re* Preserving the Open Internet; Broadband Industry Practices, *Reply Comments of AT&T Inc.*, GN Docket No. 09-191, WC Docket No. 07-52, at 10-11 (Apr. 26, 2010) (accessible via FCC Electronic Comment Filing System).

[457] *See* Robert W. Hahn, et al., *The Economics of 'Wireless Network Neutrality'* 7 (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper No. RP07-10, 2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=983111.

[458] *Id.*

[459] *See Reply Comments of AT&T Inc.*, *supra* note 439, at 10-11, 104-14.

[460] Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally*

overwhelm networks and suffocate further innovation, wireless network managers have been largely successful in navigating the swell in consumer demand for mobile broadband services by adapting management techniques to new uses.[461] Such a flexible approach to network management is required as wireless networks and consumer demand continue to mature and evolve.[462] But for such flexibility, various components of the wireless ecosystem may not have been able to emerge and flourish. For example, the market for add-on applications has evolved from nonexistent in early 2007 to being a multibillion dollar a year market that has made available hundreds of thousands of applications via portals like the App Store and Android Marketplace.[463] The rapid development of this segment of the wireless marketplace has lowered the barriers to entry into the market for mobile applications and has had important spillover effects on stakeholders across the wireless ecosystem.[464] Thus, careful network management that is adaptable to new services and applications is essential to nurturing a vibrant wireless ecosystem.

V. CONCLUSION

The analyses provided in this article support three general conclusions.

First, wireless broadband has emerged as a vital platform for the delivery of critical new services.[465] Key innovations in many sectors, including the healthcare, energy, public safety, and education spaces, increasingly rely on wireless broadband networks for the transmission of robust, interactive, and real-time services. As consumer demand for these types of services continues to increase, innovators across the wireless ecosystem have responded by deploying

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Networked Environment, 11 HARV. J.L. & TECH. 287, 323 (1998).

[461] *See* Kevin J. Martin, *Balancing Deregulation and Consumer Protection*, 17 COMMLAW CONSPECTUS i, v (2008).

[462] *See e.g.*, Robert Hahn & Peter Passell, *Why the FCC Should Stay Out of Data Plan Pricing*, CNET NEWS (June 3, 2010, 2:14 PM), http://news.cnet.com/8301-1035_3-20006760-94.html?tag=mncol;title; Mark Sullivan, *AT&T Wireless CEO Hints at 'Managing' iPhone Data Usage*, PCWORLD (Oct. 7, 2009, 7:11 PM), http://www.pcworld.com/article/173320/atandt_wireless_ceo_hints_at_managing_ipone_data_usage.html; Ken Denman, *Solving Network Congestion Requires Traffic and Demand Management*, OPENWAVE BLOG (Aug. 19, 2010), http://www.openwave.com/blog/10-08-19/solving-network-congestion-requires-traffic-and-demand-management.

[463] *App Economy*, *supra* note 70.

[464] *Apple's Game Changer*, *supra* note 74 (observing that the new market for add-on applications has been a boon to a diverse array of large and small content developers and noting that this new market has forced Apple, a notoriously secretive and closed company, to be more open regarding its application review process and other aspects of its App Store).

[465] *See supra* Part II.B.

next-generation networks and developing cutting-edge new services.[466] As a result, wireless service providers require additional spectrum to support continued innovation across the wireless value chain.

Second, the FCC has consistently demonstrated support for the wireless market and for the limitless potential of wireless broadband. To this end, it has adjusted its policies to reflect the growing importance of wireless services like mobile broadband and to facilitate continued network deployments and innovation across the ecosystem.[467] Moreover, the analysis of the FCC's general approach to spectrum allocation provided in this article reveals that the Commission has historically been responsive to market forces by making additional spectrum available and otherwise adjusting its policies to reflect actual consumer demand.[468] Perhaps most critically, consumer welfare is maximized when the FCC foregoes the imposition of encumbrances or other usage limitations on the spectrum that it makes available.[469]

Third, the FCC's spectrum allocation policy is comprised of a number of component parts, which include regulations related to spectrum auctions, reallocation of underused or unused portions of the airwaves, the development of a robust secondary spectrum market, and the ability of network engineers to manage traffic congestion.[470] Changes to one of these policies will likely impact spectrum allocation and utilization across the entire sector.[471] As such, the FCC and other policymakers should endeavor to understand the full range of costs and benefits associated with spectrum allocation policy reforms.

In order to provide innovators with the spectrum resources and regulatory certainty they need to continue producing and providing cutting-edge services,

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[466] *See supra* Part II.B.

[467] *See, e.g.*, *In re* Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and Preempt Under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance, *Declaratory Ruling*, 24 F.C.C.R. 13994, ¶ 1 (Nov. 18, 2009). The ruling "promotes the deployment of broadband and other wireless services by reducing delays in the construction and improvement of wireless networks." *Id.*

[468] *See* discussion *supra* Part II.C.

[469] NATIONAL BROADBAND PLAN, *supra* note 11, at 79; *See*, *e.g.*, Gregory L. Rosston, *The Long and Winding Road: the FCC Paves the Path with Good Intentions*, 27 TELECOMMS. POL'Y 501, 513 (2003); Coleman Bazelon, *The Need for Additional Spectrum for Wireless Broadband: The Economic Benefits and Costs of Reallocations, attached to In re* Spectrum for Broadband, *Comments*, GN Docket No. 09-47, GN Docket No. 09-51, GN Docket No. 09-137, at 2 (Oct. 23, 2009); THOMAS W. HAZLETT & ROBERTO E. MUNOZ, WHAT REALLY MATTERS IN SPECTRUM ALLOCATION DESIGN (2009), *available at* http://businessinnovation.berkeley.edu/Mobile_Impact/Hazlett-Munoz_Spectrum_Matters.pdf.

[470] *See* discussion *supra* Part III.B-C.

[471] *See supra* Part II.D.

the FCC and other policymakers must:

Appreciate the scope of the looming spectrum gap and the negative impacts on innovation, competition, and consumer welfare that a spectrum shortage would have on consumers, service providers, and all other stakeholders in the wireless ecosystem;

Undertake a comprehensive and rapid spectrum inventory in order to determine which swaths are being underused or unused;

Articulate a more robust policy for reallocating, in a timely manner, those unused or underused portions of the airwaves that are able to support wireless broadband;

Develop policies that support a more robust secondary market for spectrum licenses; and

Allow wireless service providers to carefully manage their networks in order to maximize usage of existing spectrum assets and to provide all consumers with a consistent and reliable user experience.

Policymakers have an opportunity to foster continued experimentation and innovation across the wireless sector by adopting a forward-looking and adaptable framework for spectrum allocation policy that includes mechanisms for providing service providers with the spectrum assets they need to deploy the networks that can support cutting-edge tools and applications. Without a sufficiently flexible policy that can adjust to disruptive innovations and new business models, the vibrant wireless ecosystem that has evolved over the last several years could collapse.

Attachment #5

Net Neutrality, Investment & Jobs: Assessing the Potential Impacts of the FCC's Proposed Net Neutrality Rules on the Broadband Ecosystem

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JUNE 2010

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EXECUTIVE SUMMARY

Sustained capital investments in broadband infrastructure have generated hundreds of thousands of U.S. jobs and annually contribute tens of billions of dollars to U.S. Gross Domestic Product (GDP). The proliferation of fast wireline and wireless networks has spurred edge innovators to develop new services, applications, devices, and cutting-edge content. Broadband has thus become a critical component of the nation's economic infrastructure. Broadband is also the focus of myriad federal initiatives, culminating most notably in the FCC's *National Broadband Plan*, which recognizes that broadband enables the delivery of an array of market-enhancing services like real-time telemedicine and smart energy tools. The nation's robust broadband ecosystem stems directly from the stable, light-touch regulatory approach that the FCC carefully developed and consistently implemented over the last several years.

The innovative vibrancy evident throughout the broadband ecosystem is in danger of being undermined by FCC proposals, including the impending application of common carrier regulations to some elements of the Internet, that would both overturn decades of precedent and fundamentally alter existing and future business models of broadband service providers. For a capital intensive sector like U.S. broadband – one that has invested hundreds of billions of dollars in network expansion and upgrades over the past decade, and that has directly generated hundreds of thousands of jobs in the communications sectors and many thousands more in related industries – the FCC's proposed actions are enormously significant. Especially at a time when the national economy is attempting to recover from a major and enduring downturn and private sector job creation remains a concern, the destabilizing impacts of the FCC's proposals place the nation's economy at even greater risk.

The FCC's Proposed Network Neutrality Rules & The Likely Negative Impacts on the Broadband Ecosystem

As the broadband ecosystem and consumer demand continue to evolve at a rapid and oftentimes unpredictable pace, new sources of revenue will be needed to assure that more data-intensive uses are supported and that additional network upgrades and expansions are adequately funded. Indeed, some predict that, without the ability to adapt business models to shifting utilization patterns, some service providers, especially those in the wireless arena, could become unprofitable. Thus, the FCC's network neutrality proposals, which would prohibit or restrict several new business models, threaten to constrain the ability of the market to identify and pursue sources of much needed revenues and to deliver new services.

This paper estimates a range of job and investment losses that are likely to result from the implementation of the FCC's proposed net neutrality rules. In particular, the *entire* broadband ecosystem is sensitive to changes in regulation since the sector has evolved and thrived under a light-touch regulatory regime. Indeed, many estimate that, *in the absence of the FCC's network neutrality proposals, investment and job growth will continue apace across the sector*. **This paper supports estimates that broadband service providers will commit at least $30 billion annually in capital expenditures on broadband alone between 2010 and 2015, resulting in the creation or sustainment of 509,000 jobs**. These investments will spur capital expenditures by others in the ecosystem. To this end, **a 5 percent incremental increase in capital**

expenditures by these ecosystem companies could boost investment by approximately $18 billion per year between 2010 and 2015, and yield an additional 450,000 jobs created or sustained. Conversely, decreased investments by broadband service providers will hinder capital expenditures by others in the ecosystem, particularly those at the edge. The analyses in this paper indicate that the imposition of network neutrality rules could have devastating impacts across the ecosystem between 2010 and 2015. In particular:

- A 10 percent decrease in investment by wireline and wireless broadband service providers, coupled with likely spillover effects, could result in the ***loss of 502,000 jobs across the entire ecosystem*** and would ***have a negative impact on U.S. GDP on the order of approximately $62 billion per year.***

- A 20 percent decrease in investment by wireline and wireless broadband service providers, coupled with likely spillover effects, could result in the ***loss of 553,000 jobs across the entire ecosystem*** and ***nearly $72 billion in GDP losses per year.***

- A 30 percent decrease in investment by wireline and wireless broadband service providers, coupled with likely spillover effects, could result in the ***loss of 604,000 jobs across the entire ecosystem*** and ***over $80 billion in GDP losses per year.***

- ***Because the FCC's network neutrality proposals could foreclose even larger investments than presumed in the paper's baseline scenario, the number of jobs lost or foregone in the ecosystem could be even greater, stretching toward 700,000.***

Despite FCC assertions to the contrary, history suggests that the Commission is incapable of micromanaging a dynamic sector via regulatory fiat and that such action results in consumer welfare and economic losses.

Righting the Ship: Helping the FCC Finds its Way

That the FCC insists on moving forward with its proposed broadband regulations despite the opposition of many stakeholders across the ecosystem and bipartisan majorities of Congress suggests that the Commission has lost its way. In particular, the FCC's proposed policies would burden a sector that has thrived for over a decade and that the FCC so enthusiastically touts in its *National Broadband Plan.* Instead of fostering the market forces that have proven to work, the FCC is determined to implement a regulatory approach – prescriptive rulemaking that seeks to manufacture certain outcomes – that has consistently failed. This paper examines the likely negative outcomes of the FCC's proposed approach.

1. INTRODUCTION

That broadband is essential to the continued prosperity of the United States has become fundamental to policymakers and regulators at all levels of government.[1] Over the past year, broadband has been at the center of myriad federal initiatives targeted at ensuring that this technology is widely available, adopted, and effectively utilized.[2] In its *National Broadband Plan*,[3] the Federal Communications Commission ("FCC" or "Commission") recognized that broadband "creates a platform for America's creativity to lead in developing better ways to solve old problems…it expands our ability to communicate, inform and entertain…[it] is a platform to create today's high-performance America."[4] In particular, the robust interplay of broadband networks, the content delivered via those networks, and the devices that are used to access networks and content has spurred innovation throughout the ecosystem and created immense consumer welfare gains.[5] These gains have been fostered by a deregulatory approach to broadband.[6]

The vibrancy of the broadband ecosystem, however, is in danger of being undermined by FCC proposals to overhaul how it regulates broadband. In particular, the Commission is considering whether and how to impose new rules on broadband service providers that would potentially undermine the very objectives the FCC spelled out in its *National Broadband Plan* regarding affordable, ubiquitous broadband access and adoption.[7] In practice, the FCC's proposals, including its recent suggestion to apply common carrier regulations to some elements of the

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[1] For example, President Obama "believes that modernized infrastructure is a necessary part of the foundation for long term economic stability and prosperity. That includes everything from a comprehensive national broadband plan, to new health care information technology, to a modernized electrical grid." *See* The White House, Issues: Technology, http://www.whitehouse.gov/issues/technology/.

[2] For example, the 2009 American Recovery and Reinvestment Act (ARRA) "create[d] a new Broadband Technology Opportunities Program within the National Telecommunications and Information Administration ("NTIA") of the Department of Commerce. The new grant program will distribute $4.7 billion to fund the deployment of broadband infrastructure in unserved and underserved areas in the country, and to help facilitate broadband use and adoption. An additional $2.5 billion in loans and grants will be administered by the [U.S. Department of Agriculture's] Rural Utilities Service." *See Bill Summary: Energy and Commerce Provisions on Healthcare, Broadband and Energy*, U.S. House of Representatives Committee on Commerce, Feb. 12, 2009, *available at* http://energycommerce.house.gov/Press_111/20090212/economiceecoverysummary.pdf.

[3] *See* FCC, *Connecting America: The National Broadband Plan* (rel. March 16, 2010), *available at* http://download.broadband.gov/plan/national-broadband-plan.pdf ("*National Broadband Plan*").

[4] Id. at p. 3.

[5] Id. at p. 29 (noting that "Broadband has been a main driver of growth and innovation in the ICT industry, generating demand for semiconductors, consumer and enterprise software, computers, devices, applications, networking equipment and many different types of services. A world-class broadband ecosystem will help ensure that America's ICT sector continues to lead the world – creating jobs, tapping American ingenuity and allowing American consumers to receive the substantial benefits that flow from the evolution of ICT.").

[6] For an overview of the FCC's approach to broadband, *see* Daniel F. Spulber & Christopher S. Yoo, *Rethinking Broadband Internet Access*, 22 Harv. J. Law & Tech. 1, 6-18 (2008). Additional discussion of the current regulatory approach to broadband is discussed in section 2.1, *infra*.

[7] In the Matter of Preserving the Open Internet, Notice of Proposed Rulemaking, GN Docket No. 09-191 (rel. Oct. 22, 2009) ("*FCC Net Neutrality NPRM*").

Internet ecosystem,[8] represent a wholesale shift in broadband and Internet policy – one that would not only overturn decades of precedent but that would also fundamentally alter existing and future business models of broadband service providers. For a sector that is as capital intensive as the U.S. broadband/communications sector is – one that has invested hundreds of billions of dollars in network expansion and upgrades over the past decade, and that has directly generated hundreds of thousands of jobs in the communications sectors and many thousands more in related industries – the FCC's proposed actions are enormously significant, especially at a time when the national economy is attempting to recover from a substantial downturn and private sector job creation remains a concern.

Several recent economic analyses indicate that investment in broadband network expansion and the capabilities, devices and applications that such networks engender, have actual, measurable, and discernible impacts on jobs, consumer welfare, and economic output. Consider that:

- Between 1999 and 2006, communities with "new access" to broadband experienced 6.4 percent higher employment growth than before broadband was available.[9]
- Between 2005 and 2009, U.S. companies invested $576 billion in communications equipment and structures. Adding computers and software, U.S. capital expenditures on information and communications technology ("ICT") since 2005 totaled $2.2 trillion. Today, IT investment accounts for a record 47.3 percent of all U.S. non-structure capital investment.[10]
- Over the past decade, investment in the broadband sector has corresponded with the creation of over 434,000 jobs.[11]
- Historical data suggest that every $1 billion in revenue corresponded to the creation of 2,329 jobs at "core" network companies and 1,199 jobs at non-network "edge" companies.[12]
- According to the Bureau of Economic Analysis, ICT industries, which include broadband service providers, accounted for four percent of U.S. GDP in 2008.[13]

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[8] *See* Press Release, *FCC Announces Tentative Agenda for June 17th Open Meeting*, FCC, May 27, 2010, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-298494A1.pdf.

[9] *See* Jessica Milano, *Where Jobs Come from: The Role of Innovation, Investment, and Infrastructure in Economic and Job Growth*, at p. 11, Democratic Leadership Council (Feb. 2010) (*citing* Jed Kolko, *Does Broadband Boost Local Economic Development?* at p. 22, Public Policy Institute of California (Jan. 2010)).

[10] Comments of Bret T. Swanson, at p. 1-2, In the Matter of Preserving an Open Internet, GN Docket No. 09-191 (filed April 26, 2010) ("*Swanson NN Comments – April 2010*").

[11] *See* Robert W. Crandall & Hal J. Singer, *The Economic Impact of Broadband Investment*, at p. 2 (Feb. 2010) ("*Crandall & Singer Jobs Paper – 2010*").

[12] *See* Larry F. Darby, Joseph P. Fuhr, Jr. and Stephen B. Pociask, *The Internet Ecosystem: Employment Impacts of National Broadband Policy*, at p. 1, American Consumer Institute (Jan. 2010).

- The net consumer benefits of household adoption of fixed-line broadband are approximately $32 billion per year.[14]

In light of these trends, the core question policymakers should be addressing is whether the FCC's proposals will actually impede further investment and growth in this sector and precipitate a negative spillover into the overall U.S. economy. Several recent studies suggest that the imposition of the FCC's proposed network neutrality rules will have significant negative impacts on revenues for broadband service providers, thereby constraining their ability to invest in network build-out and upgrades; will directly and indirectly impact job creation in the broadband market and related sectors; and would likely reverse the many economic gains realized over the last decade under the existing regulatory regime.[15] For example, one study estimates that implementation of network neutrality rules would jeopardize 65,000 jobs in 2011 and would negatively impact over 1.4 million jobs by 2020.[16] While there is some difference of opinion in the literature regarding the extent of these impacts, there appears to be unanimous agreement that the economic impacts flowing from the FCC's proposed net neutrality rules (whether these regulations flow from an assertion of Title II jurisdiction over broadband service providers or some other legal theory) will be negative and will result most immediately in tens of thousands of job losses. *Especially with a high national unemployment rate,[17] double-digits in many parts of the country, the FCC must tread carefully lest it hobble one of the few sectors that has helped sustain the American economy during this current economic crisis.*

1.1 Paper Overview

This paper analyzes the likely economic impacts of the FCC's proposed network neutrality rules on the broadband sector and the entire U.S. economy. As discussed in detail below, there is a direct correlation between investment in network infrastructure by broadband service providers and job creation in ICT industries most immediately and across the broadband ecosystem generally. These gains have resulted in positive impacts on consumer welfare and overall economic output. Adopting rules that alter or constrain the business models of broadband service providers, and the entities with which they do business across the entire ecosystem, jeopardize

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[13] *See* Donald D. Kim, Brian M. Lindberg & Justin M. Monaldo, *Annual Industry Accounts: Advance Statistics on GDP by Industry for 2008*, at p. 25, Bureau of Economic Analysis (May 2009), *available at* www.bea.gov/scb/pdf/2009/05%20May/0509_indyaccts.pdf.

[14] *See* Mark Dutz, Jonathan Orszag & Robert Willig, *The Substantial Consumer Benefits of Broadband Connectivity for U.S. Households*, at p. 4, Internet Innovation Alliance (July 2009).

[15] *See, e.g., Net Neutrality: Impact on the Consumer and Economic Growth*, Stratecast – A Division of Frost & Sullivan, Vol. 4, No. 13 (April 2010).

[16] *See* Coleman Bazelon, *The Employment and Economic Impacts of Network Neutrality Regulation: An Empirical Analysis*, at p. ii, A Report to Mobile Future (April 2010) ("*Bazelon Study*")

[17] The U.S. unemployment rate was 9.7% at the end of May 2010. Only 41,000 private sector jobs were added during the month of May. *See* Press Release, *The Employment Situation – May2010*, Bureau of Labor Statistics, U.S. Dept. of Labor, June 4, 2010, *available at* http://www.bls.gov/news.release/empsit.nr0.htm. Private sector job additions were far below the expectations of many analysts and observers. *See, e.g.,* Shobhana Chandra, *Payrolls in U.S. Increase in May Less than Forecast*, Bloomberg Business Week, June 4, 2010, *available at* http://www.bloomberg.com/apps/news?pid=20601087&sid=ar_thYFiXUk4.

these gains and will likely lead to lower investment levels, job losses, and lower economic output.

Section 2 provides an economic analysis of the broadband sector. The sector has evolved rapidly over the last several years and represents a vibrantly competitive and innovative space. A deregulatory framework for broadband Internet access has spurred innovation at the core of networks and at the edges. When the FCC gets its policies right, the results are spectacular increases in investments, job creation, consumer welfare, and economic output. This section also details the rapid evolution of the broadband ecosystem and underscores the need to allow businesses to experiment with new business models so they can anticipate and accommodate shifts in consumer demand and technological change.

Despite the gains documented in Section 2, the FCC is attempting to radically alter its regulatory approach to broadband. **Section 3** discusses the FCC's proposed network neutrality rules and analyzes their potential impacts on broadband service providers. As discussed, the FCC's proposals would have the perverse effect of limiting the ability of service providers to manage their networks, to assure quality of service to consumers and to content owners, to assure that time-sensitive and life-enhancing tools (e.g., real-time telemedicine) receive adequate priority on the network, to freely enter into contracts with partners, and to experiment with necessary new business models.

Section 4 contextualizes the FCC's recent regulatory proposals and assesses the historical interplay of regulation, investment, job creation, and competition in the communications sector. That the FCC is attempting to micromanage a dynamic sector is not a unique occurrence. Over the last 14 years, the Commission has implemented a number of regulations on a variety of services that have resulted in consumer welfare losses, job losses, and decreased economic output. Although the FCC is asking companies to trust that it will implement a "restrained approach to broadband," the Commission's policies and actions over the last few years have demonstrated that, despite good intentions, "trust us" has not proven to be a good enough message to attract the capital markets to this sector.[18]

Section 5 attempts to quantify the unavoidable negative impacts of the FCC's proposed network neutrality rules on the broadband sector. In particular, this section examines the likely negative impacts of these rules on specific business models, revenues, capital expenditures, jobs, and overall economic output. The analysis focuses primarily on how the rules will impact broadband service providers, but also includes a discussion of the potential harm to related industries in the ecosystem and to the entire U.S. economy. More specifically, this section includes a range of estimates for likely investment, job, and economic output losses stemming from the imposition of network neutrality rules on broadband service providers. As an overview, the analysis indicates that these rules would significantly rein in investments by broadband service providers, which would in turn result in the loss of thousands of jobs and billions in economic output.

[18] *See* Julius Genachowski, Chairman, FCC, *The Third Way: A Narrowly Tailored Broadband Framework*, at p. 1 (rel. May 6, 2010) ("*Genachowski – Third Way*").

Section 6 assesses why it is essential that the FCC get its policies right. In particular, this section underscores the vital role that broadband is poised to play in the U.S. economy going forward. Policymakers at all levels of government recognize that broadband will be a critical platform for transforming entire industries, including the healthcare and energy sectors, and for generating thousands of additional jobs and billions in economic output.

In light of the historical impact of regulation on this sector and the likely negative impacts of implementing an onerous network neutrality regulatory regime, the introduction of rules that are explicitly aimed at restraining the ability of broadband service providers to manage networks and experiment with new business models presage an inefficient reordering of the ecosystem, substituting the organic market forces that have produced enormous gains with the untested policy preferences of unelected regulators.

1.2 Key Takeaways

The analyses included in this paper support the following key takeaways:

- The regulatory approach developed and implemented by the FCC for broadband over the last decade has fostered a competitive marketplace that has generated enormous consumer welfare gains, hundreds of thousands of jobs, and billions of dollars in economic output.
- Competition among service providers has spurred companies to invest enormous sums of risk capital in their networks in order to provide consumers with ever more innovative services. These network investments, in turn, have driven innovation at the edges as companies seek to leverage increasing bandwidth to deliver cutting-edge new services. Further, innovation at the edge has spurred innovation in access technologies (e.g., smartphones, netbooks, etc.) as hardware manufacturers seek to satisfy rising consumer demand for new tools that can access the full range of content being delivered over robust networks. Thus, a vibrant ecosystem has emerged, supported and bolstered by underlying broadband network infrastructure.
- The rapid pace of innovation throughout the ecosystem and continuous shifts in consumer utilization patterns require broadband service provides and other innovators to continuously experiment with new business models in order to satisfy new consumer demands. Indeed, new business models are needed to assure adequate returns on investments and consistent revenue streams, both of which are essential to supporting key capital expenditures – and jobs – in the near-term and long-term.
- Recent proposals by the FCC to impose onerous regulations on broadband service providers threaten the many gains described throughout this paper. These regulations would serve only to restrain the ability of service providers to develop business models that assure adequate revenue streams. In the absence of this flexibility, some service providers could find it difficult to justify key capital expenditures. For example, as discussed in section 5, without the ability to adjust business models and network management

techniques, some wireless broadband service providers could eventually become unprofitable if new revenue streams are foreclosed.

- The inability to explore new business models, partnerships, network management techniques, and other essential business practices will have catastrophic effects on the immediate broadband sector, the entire ecosystem, and the wider U.S. economy. *Indeed, this paper estimates that implementation of the FCC's proposed regulations for broadband could result in hundreds of thousands of job losses and billions of dollars in lost capital expenditures and economic output*.
- The fact that the FCC is continuing to pursue new regulations in the face of the demonstrable welfare gains in the broadband market, the reports of an array of experts and analysts on the potential threats to jobs and capital expenditures, and pushback by bipartisan majorities in both houses of Congress *suggest that this agency has lost its way*.[19] Over the last decade, the Commission proved to be a capable monitor of a broadband market that has, in the absence of prescriptive regulations, developed into a vibrantly innovative and competitive space. Historical evidence suggests that FCC micromanagement of dynamic sectors leads only to net consumer welfare losses, not gains.
- That the FCC is continuing to move forward with its proposed regulations in the absence of compelling evidence that they are necessary suggests that this agency has sacrificed its commitment to data-driven policymaking in order to ordain winners and losers in the broadband ecosystem. Not only does this approach contradict established FCC precedent on these matters, it also overlooks the essential importance of flexibility to innovation in the digital age.

2. THE STAKES: AN ECONOMIC ANALYSIS OF THE CURRENT BROADBAND ECOSYSTEM

The emergence of broadband as a vehicle for economic growth and innovation has been as spectacular as it has been rapid. Indeed, in a report to Congress in 1998, the FCC observed that it could "only speculate about the [Internet] technologies and services that will be offered in the future."[20] At that time the FCC could only generalize the importance of the Internet, noting that "millions of consumers, both in the United States and around the world, daily obtain access to [it] for a wide variety of services."[21] One year later, the Commission observed that Internet access via a broadband connection facilitated many more potential uses, including the ability to "download feature-length movies in a matter of minutes" and to support "platforms for entrepreneurs to launch new information-based businesses and home-

[19] *See, e.g.*, Sara Jerome, *After Republican Letter, Majority of Congress Oppose FCC Plan*, The Hill, Hillicon Valley blog, May 28, 2010, *available at* http://thehill.com/blogs/hillicon-valley/technology/100487-after-republican-letter-over-240-house-members-oppose-fcc-plan.

[20] *See* In the Matter of Federal-State Joint Board on Universal Service, Report to Congress, at para. 2, 13 F.C.C.R. 11501 (1998).

[21] Id.

based businesses, great improvements in medical treatment, and health care at home in emergencies and for the chronically infirm."[22] By June 2000, less than five percent of U.S. households had adopted broadband.[23] Yet over the course of the next decade, broadband would transform from a service that allowed users to "change web pages as fast as changing the channel on a television"[24] to the core of a vibrant ecosystem that is poised to radically alter every sector of the U.S. economy.

This rise has been facilitated by the careful implementation of a deregulatory framework for broadband, which has been characterized by minimal regulatory intrusion by the FCC. As a result of this largely hands-off regulatory approach to broadband (discussed briefly in section 2.1), innovators across the sector – broadband network owners, content developers, and device manufacturers – have invested huge sums of risk and human capital into developing a world-leading broadband ecosystem that is driving economic growth, generating hundreds of thousands of jobs, and producing enormous consumer welfare gains. Moreover, this regulatory framework has fostered an intensely competitive sector that has further driven investment and innovation across the ecosystem, particularly among broadband service providers. An overview of these dynamics is provided in section 2.2.

Section 2.3 assesses a number of important recent trends in consumer demand and utilization of broadband and highlights how these shifts in preferences are impacting current business models of broadband service providers. In particular, this section makes clear that existing revenue streams are likely to be inadequate going forward and that, as a result, broadband service providers are beginning to experiment with new ways of assuring adequate returns on their investments. Thus, flexibility is essential to assuring long-term growth and innovation across the ecosystem as stakeholders continuously adjust to rising consumer consumption of advanced broadband services.

2.1 Action: The FCC's Regulatory Approach to Broadband

The policy of the United States vis-à-vis the Internet was set forth most clearly in the 1996 Telecommunications Act,[25] which states that it is "the policy of the United States…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation."[26] Many agree that Congress intended to "limit [FCC] authority" over the Internet.[27] However, Congress did delegate to the

[22] In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, para. 3, CC Docket No. 98-146 (rel. Feb. 2, 1999) ("*1st 706 Report – 1999*").

[23] *See* John Horrigan, *Home Broadband Adoption 2009*, at p. 11, Pew Internet & American Life Project (June 2009), *available at* http://www.pewinternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf ("*Pew Home Broadband Adoption 2009*").

[24] *1st 706 Report – 1999* at para. 3.

[25] Pub. LA. No. 104-104, 110 Stat. 56 (codified as 47 U.S.C 203 et seq.).

[26] 47 U.S.C. 230 (b) (2).

[27] *See* Kevin Werbach, *Off the Hook*, 95 Cornell L. Rev. 535, 558 (2010) ("*Off the Hook*").

FCC the authority to ensure that advanced telecommunications services were universally available to all Americans.[28] In carrying out this mandate, the Commission has consistently implemented a deregulatory approach to the Internet generally and to providers of broadband Internet access specifically. Indeed, the Commission has recognized that a limited government role is essential to a robust and innovative broadband sector.[29]

The primary vehicle for regulating broadband was the classification of broadband Internet access as an "information service," which, under the 1996 Act, refers to "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications."[30] According to established FCC precedent, information services are largely unregulated.[31] The FCC reaffirmed this approach in 2002 when it concluded that information services are subject only to the FCC's ancillary regulatory authority under Title I of the Communications Act.[32] Since 2002, the FCC has classified every type of broadband access technology as an information service in an effort to create a "consistent regulatory framework across broadband platforms by regulating like services in [a] similar manner."[33] Thus,

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[28] *See, e.g.*, Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, 17 F.C.C.R. 3019, 3021 (2002) (stating that "it is the Commission's primary policy goal to encourage the ubiquitous availability of broadband to all Americans" and citing to section 706 of the 1996 Telecommunications Act, which was incorporated into the amended Communications Act in the notes to 47 U.S.C 157, *id.* at fn. 4) ("*FCC Wireline Broadband Order 2002*").

[29] *See, e.g.*, William Kennard, Chairman, FCC, *Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at IX-2 (1999), *available at* http://www.fcc.gov/connectglobe/regguide.pdf (observing that "Government policy can have a profound impact on Internet development; it can either foster it or hinder it. To date, the Internet has flourished in large part due to the absence of regulation. A "hands-off" approach allows the Internet to develop free from the burdens of traditional regulatory mechanisms."); *National Broadband Plan* at p. 5 (noting that "While we must build on our strengths in innovation and inclusion, we need to recognize that government cannot predict the future. Many uncertainties will shape the evolution of broadband, including the behavior of private companies and consumers, the economic environment and technological advances. As a result, the role of government is and should remain limited.").

[30] 47 U.S.C. 153 (20).

[31] In the late 1960s, the FCC began to investigate the impact of new computer services on telecommunications generally. In a series of decisions stretching over two decades – often referred to as the *Computer Inquiries* – the FCC eventually came to characterize these various services as either "basic" or "enhanced." The "basic" category referred to the "transmission capacity in the physical network for the movement of information." *See* Robert Cannon, *The Legacy of the Federal Communication Commission's Computer Inquiries*, Fed. Comm. L. J. 167, 183 (2003). The "enhanced" category encompassed services like voicemail and data processing. *See* Susan Crawford, *Transporting Communications*, 89 B. U. L. Rev. 871, 892 (2009). As Seth Waxman has observed: "In its 1998 *Report to Congress*, the Commission concluded that Congress intended terms "telecommunications services" and "information service" in the 1996 Act to build upon the "basic" and "enhanced" service distinction the Commission had previously drawn, and it construed the terms to be mutually exclusive in light of Congress's evident intent to maintain a regime in which information service providers are not subject to regulation as common carriers merely because they provide their services "via telecommunications." (citations omitted) *See* Comments of Seth P. Waxman, at p. 7, GN Docket No. 09-51; GN Docket No. 09-191; WC Docket No. 07-52 (April 28, 2010).

[32] *FCC Wireline Broadband Order 2002* at 3028.

[33] In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks, 22 F.C.C.R. 5901 (2007) ("*Wireless Broadband Order*")

broadband delivered via cable modem,[34] DSL,[35] power lines,[36] and wireless[37] are considered information services and thus subject only to the FCC's ancillary authority under Title I of the Act.[38]

2.2 Reaction: The Current Broadband Ecosystem

As a result of the regulatory certainty and consistency described in section 2.1, the broadband marketplace has thrived. Innovators in and around the broadband sector have created an interdependent and vibrantly innovative space – an ecosystem that drives investment across the sector and that generates enormous consumer welfare gains.[39]

2.2.1 *Investment in Broadband Infrastructure*

Over the past decade, the number of people in the United Stated with broadband at home increased from just five million to nearly 200 million.[40] Wireless broadband effectively did not exist 10 years ago, but today there are approximately 50 million mobile broadband connections via third-generation (3G) wireless networks, tens of millions of Wi-Fi hotspots, and nearly 300 million mobile and portable broadband devices in the form of notebooks, netbooks, and smartphones.[41] Indeed, smartphone sales are expected to eclipse traditional computer sales by 2012.[42] In all, consumer bandwidth over the decade grew by an estimated 15,000 percent.[43]

This expansion in American communications power is a direct result of the enormous investments in broadband infrastructure by service providers, which have been driven in large part by the intense competition for consumers among these companies. In the last five years, U.S. companies invested $576 billion in communications equipment and structures – e.g.,

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[34] Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, 17 F.C.C.R 4798 (2002), aff'd Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv., 545 U.S. 967 (2005).

[35] Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, 20 F.C.C.R. 14,853 (2005).

[36] Classification of Broadband Over Power Line Internet Access Service as an Information Service, 21 F.C.C.R. 13281 (2006).

[37] *Wireless Broadband Order.*

[38] This determination was upheld by the U.S. Supreme Court in Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv., 545 U.S. 967 (2005). In this case, the Court found that the FCC's interpretation of what constitutes an information service was reasonable under the Communications Act. Id. at 997.

[39] *National Broadband Plan* at p. 15-16.

[40] Id. at p. xi.

[41] *See The Wireless Industry Overview*, at p. 21, CTIA – The Wireless Association (May 2010), *available at* http://files.ctia.org/pdf/051210_-_Wireless_Overview_FINAL.pdf ("*Wireless Industry Overview*").

[42] *See* Cecilia Kang, *Mobile Internet Exploding, Online Ads About to Take Off, Says Analyst Mary Meeker*, Wash. Post, Post Tech Blog, June 8, 2010, *available at* http://voices.washingtonpost.com/posttech/2010/06/mobile_internet_exploding_onli.html.

[43] *See* Bret Swanson, *Bandwidth Boom: Measuring U.S. Communications Capacity from 2000 to 2008*, Entropy Economics (June 2009), *available at* http://entropyeconomics.com/wp-content/uploads/2009/07/bandwidth-boom-measuring-us-comm-capacity-2000-08-062409c.pdf ("*Bandwidth Boom*").

routers, switches, fiber optics, satellites, and wireless cell towers, among many others.[44] Between 2003 and 2009, communications service providers alone invested $193.6 billion specifically in last-mile broadband technologies – e.g., DSL, fiber, cable modem networks, and 3G wireless networks.[45]

Economists Robert Crandall and Hal Singer counted investments in various broadband network platforms over the 2003-2009 period and found large, sustained capital expenditures. Annualized investments in these platforms were:

- $4.3 billion in cable modem networks;
- $11.7 billion in DSL and fiber optic networks; and
- $11.6 billion in 3G wireless and satellite technologies.[46]

Adding satellite and enterprise broadband, several sources estimate annual last-mile broadband investment averaged $30 billion over the last seven years.[47] Total annual capital expenditures by the service providers alone averaged around $60 billion.[48] In the last 15 years, U.S. wireless operators also invested more than $40 billion in licensed spectrum.[49]

These investments have come from the over 1,500 broadband service providers across the United States.[50] Competition among these companies has produced a vibrant core of the broadband ecosystem and has yielded enormous consumer welfare gains.[51] For example, broadband prices have generally decreased over the last several years while service offerings have multiplied.[52] Moreover, the vast majority of Americans live in areas where there are at least two wireline broadband service providers and at least three 3G mobile service providers.[53] The key fruits of

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[44] *See National Economic Accounts*, Tables 5.5.5U and 5.4.5U, U.S. Bureau of Economic Analysis, *available at* http://www.bea.gov/national/nipaweb/index.asp ("*National Economic Accounts*, Tables 5.5.5U and 5.4.5U").

[45] *Crandall & Singer Jobs Paper – 2010* at p. 12, Table 2.

[46] Id. at p. 2.

[47] Id.

[48] Id.

[49] *See* FCC, Auctions Summary, http://wireless.fcc.gov/auctions/default.htm?job=auctions_all.

[50] *See* High-Speed Services for Internet Access: Status as of December 31, 2008, at Table 10, FCC Industry Analysis and Technology Division, Wireless Competition Bureau (2010) ("*FCC High-Speed Data – Dec. 31, 2008*")

[51] *Crandall & Singer Jobs Paper – 2010* at p. 2 (noting that "A decline in absolute prices matched by an increase in output means that annual consumer welfare – measured as the difference between a consumer's willingness to pay for broadband less the access price, summed over all consumers –associated with broadband consumption has increased significantly over the past decade.").

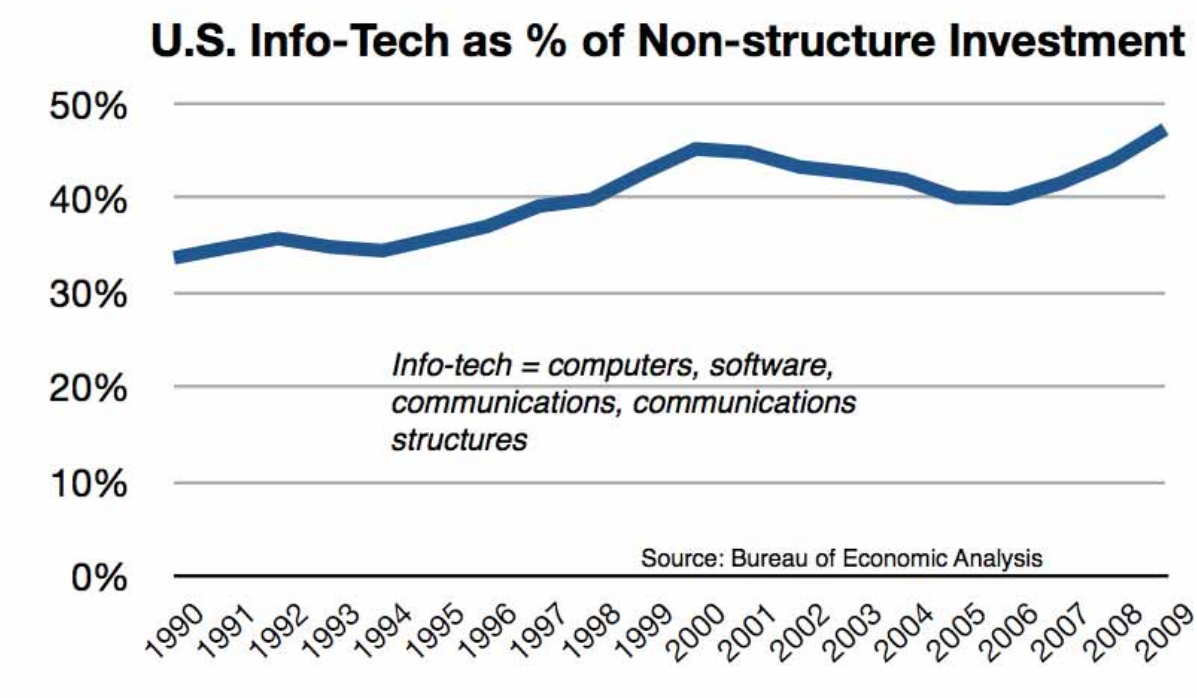
[52] *See, e.g., National Broadband Plan* at p. 38-39.

[53] Id. at p. 37, 40. It should be noted that both the FCC and the U.S. Department of Justice (DoJ) both agree that the "lack of [multiple] wireline providers does not necessarily mean competition among broadband providers is inadequate." Id. at 37. Moreover, the DoJ has observed that "competition" is best assessed locally. *See* Ex Parte Comments of the U.S. Department of Justice, at p. 7, In the Matter of a National Broadband Plan for Our Time, GN Docket No. 09-51 (filed Jan. 4, 2010).

competition – choice and lower prices – have resulted in high rates of customer satisfaction. Indeed, a recent FCC survey found that approximately 90 percent of broadband consumers are satisfied with their service.[54]

More generally, broadband is a crucial ingredient in the large and diverse digital ecosystem. Computing, digital storage, and bandwidth are the key resources of the emerging digital age. They play off one another in a virtuous upward cycle where advances in one drive demand and innovations in the others.[55] Thus, looking more broadly at the American information technology arena reveals similar health and robust investment. Indeed, over the last half decade, total U.S. investment in ICT, which includes communications equipment, software, and computers, was $2.2 trillion.[56] In 2009, information technology, including communications structures, accounted for almost half (47.3%) of all U.S. non-structure capital investment, a record high (see chart 1).[57]

Chart 1 –U.S. IT Investment as Share of All Non-Structure Investment, 1990-2009



A portion of the recent rise in ICT investment may be attributed to a steeper drop in investment in other categories during the recent recession. However, the fact that ICT "gained share" during the recession further underscores the health of the sector. The larger story, though, appears to be that the rise of ICT's share of U.S. investment is both a cause and a result of the shift toward a

[54] *See* Joel Gurin, *More on Speed: Just How Satisfied are Consumers?*, FCC, Blogband, June 2, 2010, *available at* http://blog.broadband.gov/?entryId=477720.

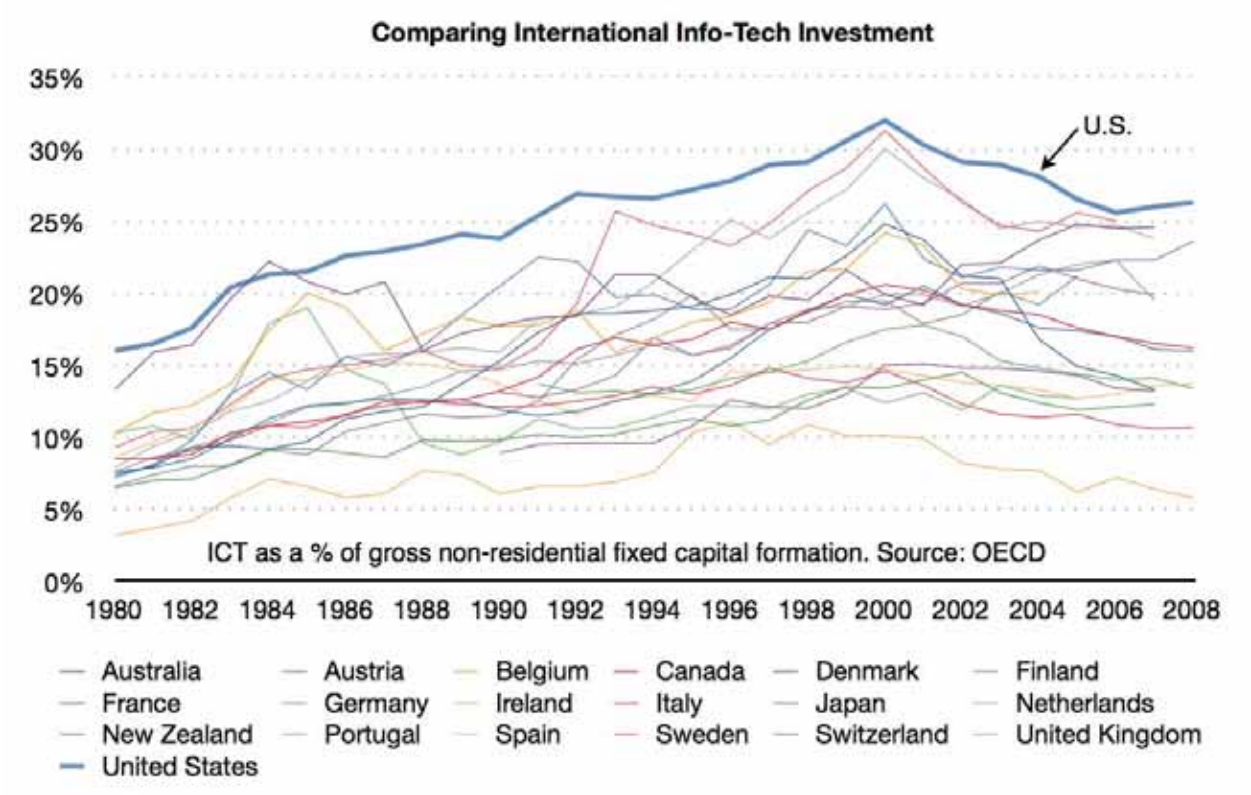
[55] Id. at p. 15.

[56] *National Economic Accounts*, Tables 5.5.5U and 5.4.5U.

[57] Id.

knowledge economy, which has been facilitated by the FCC's regulatory approach to the core platform driving much of these investments and innovations – broadband. *Indeed, as depicted in chart 2, the United States has the highest share of information technology investment of any country in the Organization for Economic Cooperation & Development ("OECD") stretching back almost 30 years.*[58]

Chart 2 – Comparison of IT Investment in OECD Countries, 1980-2008



A number of additional metrics demonstrate the vitality and dynamism of the U.S. advanced communications market:

- Verizon has deployed more fiber-to-the-premises lines than all European operators combined.[59]
- The number of broadband service providers across the U.S. increased by 22 percent between June 2005 and December 2008.[60] More significantly, the

[58] *See Investment Data and Shares of ICT Investment in Total Non-residential GFCF*, OECD, Feb. 8, 2010, available at http://www.oecd.org/LongAbstract/0,3425,en_2649_33715_36396990_1_1_1_1,00.html.

[59] *See* Ivan G. Seidenberg, *Speech to the Council on Foreign Relations*, Verizon, April 6, 2010, *available at* http://www22.verizon.com/Content/ExecutiveCenter/Ivan_Seidenberg/Council_On_Foreign_Relations/Council_On_Foreign_Relations.

[60] *FCC High-Speed Data – Dec. 31, 2008* at Table 10.

number of companies providing fiber to the home services tripled over this period of time.[61]

- The U.S. market accounts for 6 percent of world mobile subscribers, but 21 percent of world 3G mobile subscribers.[62]
- Of the top 15 U.S. websites in 1999, only four remained in the top 15 in 2009.[63]
- Among the top global networks in terms of traffic, Google and Comcast vaulted from outside the top 10 in 2007 to become respectively, by 2009, the third and sixth largest networks on the planet.[64]

Broadband and wireless service providers are by far the largest investors in Internet infrastructure. However, other critical stakeholders in the broadband ecosystem, notably software, content, and Web application companies, are also making substantial investments. For example:

- Microsoft is in the midst of constructing some 20 data centers around the world, at an estimated cost of $500 million to $1 billion each, to serve as its own "cloud computing" platform.[65]
- Akamai, Limelight, and other content delivery networks regularly build data centers and add network capacity.[66]
- Amazon, Facebook, and other Web companies are building their own cloud computing capabilities.[67]
- Equinix, the largest "neutral" data center company, has invested around $2 billion in the last five years.[68]

However, cumulative investments made by "edge" companies over the last few years have been dwarfed by those made by broadband service providers. Indeed, by one estimate broadband service providers have invested ten times as much in capital expenditures than edge companies.[69]

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[61] Id.

[62] *Wireless Industry Overview*.

[63] See A.T. Kearney, *Internet Value Chain Economics*, in *The Economics of the Internet*, at p. 6, Vodafone Policy Paper Series, No. 11 (April 2010) ("*Internet Value Chain Economics*").

[64] *See* Craig Labovitz et al., *2009 Annual Report*, Atlas Internet Observatory/Arbor Networks (Oct. 2009), *available at* http://www.nanog.org/meetings/nanog47/presentations/Monday/Labovitz_ObserveReport_N47_Mon.pdf.

[65] *See* Microsoft, MS Data Centers blog, http://blogs.technet.com/msdatacenters/default.aspx.

[66] *See* company financial reports.

[67] *See* company financial reports.

[68] *See* company financial reports.

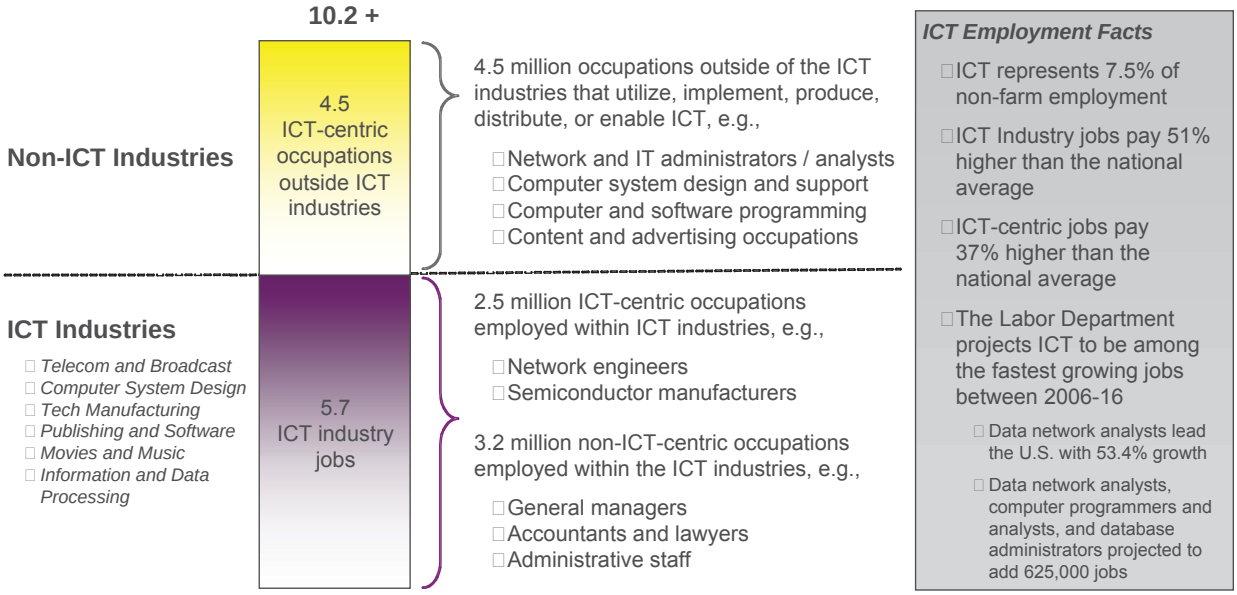
[69] *Swanson NN Comments – April 2010* at p. 9-10 (aggregating and comparing investments of those companies in favor of the FCC's proposed network neutrality rules and those against the rules).

2.2.2 *Jobs in the Broadband Space*

In recent years, broadband has been a major driver of job creation. After the millennial telecom crash, the major policy changes described in section 2.1 rationalized the investment incentives across various portions of the network – core, edge, and last-mile. As a result, most disincentives to invest in last-mile broadband were removed or relaxed, and broadband investment grew rapidly. These investments drove job creation. By some estimates, broadband directly created and sustained 431,000 new jobs between 2003 and 2009.[70]

Broadband service providers in the United States directly employ more than one million people.[71] But the employment impact of broadband goes far beyond the men and women who make the communications equipment and build, operate, and service the networks. The broader ICT sectors, including ICT-centric occupations, employ around 10.2 million Americans, or 7.5 percent of the non-farm labor force.[72] Chart 3 provides an overview.

Chart 3 – U.S. ICT Sector Employment



The relatively stable policy environment of today has allowed network, application, Web, and device markets to develop more rationally and organically. Policy does not push investment or creative energy in any particular direction. The markets, therefore, can experiment and self-correct before bubbles inflate (and burst). Apple's "App Store" for the iPhone offers a useful example of recent – and perhaps unexpected – broadband-related job growth. Launched in July

[70] *Crandall & Singer Jobs Paper – 2010* at p. 2.

[71] Figures compiled by U.S. Telecom, using data from the Bureau of Labor Statistics, Occupational Employment Statistics, *available at* http://www.bls.gov/OES.

[72] Id.

2008 with about 500 applications, the App Store currently includes over 215,000 applications;[73] the total number of App Store downloads exceeded one billion in April 2009,[74] two billion in November 2009,[75] three billion in January 2010,[76] and five billion by June 2010.[77] The market for these types of add-on applications, which essentially began with the launch of the App Store, is expected to grow nearly fourfold over the next several years, increasing from a $1 billion a year business in 2009 to $4 billion per year by 2012.[78] The App Store thus created a whole new market – and with it, opportunities for thousands of large and small software developers to build the hundreds of thousands of apps now available on multiple mobile operating systems.

2.2.3 *Cap Ex, Revenue and Profits in the Broadband Sector*

Capital expenditures (cap ex) by communications service providers were approximately $61 billion across the sector in 2009, including $40 billion in wireline and $21 billion in wireless.[79] Revenues across the U.S. communications market were approximately $420 billion in 2009.[80] In particular, wireless service revenue was estimated to be $163 billion, while consumer wireline revenue was around $155 billion, and business and other wireline revenue was around $104 billion.[81]

Within the telecom market, one major trend most analysts forecast is the decline of wireline revenue and the rise of wireless revenue. As depicted in chart 4, telecom wireline revenue outpaced wireless revenue by about $39 billion in 2008, when telecom revenues totaled around $345 billion.[82] However, some project that telecom wireline and wireless revenues will cross in

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[73] *See* 148Apps.Biz, App Store Metrics, http://148apps.biz/app-store-metrics/ (as of June 12, 2010).

[74] *See* Arik Hesseldahl, *Almost a Billion iPhone Apps Downloaded*, BusinessWeek, Byte of the Apple blog, April 10, 2009, http://www.businessweek.com/technology/ByteOfTheApple/blog/archives/2009/04/almost_a_billio.html.

[75] *See* Jim Dalrymple, *Apple Reaches 100,000 Apps, 2 Billion Downloads*, CNET News, Nov. 4, 2009, http://news.cnet.com/8301-13579_3-10390454-37.html?tag=newsLatestHeadlinesArea.0.

[76] *See* Brad Stone, *Apple's App Store Tops 3 Billion Downloads*, N.Y. Times, Bits Blog, Jan 5, 2010, *available at* http://bits.blogs.nytimes.com/2010/01/05/apples-app-store-tops-3-billion-downloads/.

[77] *See, e.g.* MG Siegler, *Apple Has Paid $1 billion to App Developers (and Other Key Stats)*, Tech Crunch, June 7, 2010, *available at* http://techcrunch.com/2010/06/07/ipad-ibooks-app-store-stats/.

[78] *See* Douglas MacMillan, Peter Burrows & Spender E. Ante, *Inside the App Economy*, Business Week, Oct. 22, 3009, *available at* http://www.businessweek.com/magazine/content/09_44/b4153044881892.htm.

[79] *See* Brett Feldman, *Deutsche Bank estimates*, Dec. 16, 2009.

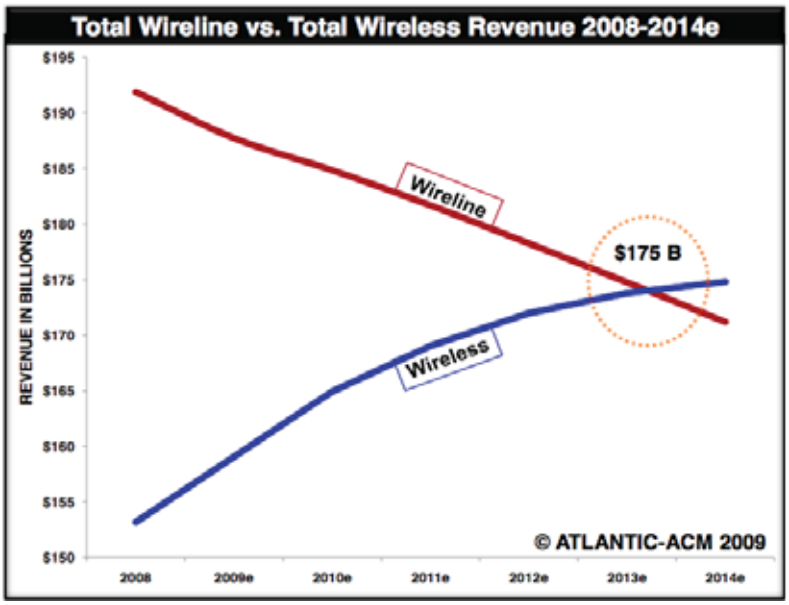
[80] Id.

[81] Id. This breakdown stems from an analyst's estimate that cable TV operators and DBS represent about 70% of the consumer wireline market, while telecom companies are the remaining 30%.

[82] The chart was originally published in the Atlantic-ACM report *U.S. Telecom Wired and Wireless Sizing and Share: 2009-2014*, *available at* http://www.atlantic-acm.com/index.php?option=com_content&view=article&id=480:total-wireless-revenues-to-eclipse-total-wireline-revenues-by-2014-reveals-latest-edition-of-atlantic-acm-sizing-and-share-analysis-&catid=6:press-releases&Itemid=5.

2013 at around $175 billion.[83] The projected combined total of $350 billion in 2013 is just $5 billion more than in 2008.[84]

Chart 4 – Wireline and Wireless Revenue, 2008-2014



Profitability among communications service providers, although not uniform, is near or perhaps slightly lower than the average profitability of the S&P 500. *Capital expenditures and employment are far larger than that of content companies, but profitability is less than half, and closer to one-third, than that of leading Web content companies.* Table 1 demonstrates that the leading wireless and broadband providers approach the S&P 500 averages.[85] The smaller broadband and wireless companies, however, are far less profitable or lose money.

[83] Id.

[84] Id.

[85] *See* George S. Ford and Lawrence J. Spiwak, *Substantial Profits in the Broadband Ecosystem: A Look at the Evidence*, Phoenix Center for Advanced Legal and Economic Public Policy Studies, Perspective 10-04 (April 2010), *available at* http://www.phoenix-center.org/perspectives/Perspective10-04Final.pdf.

Table 1 – Profitability Comparison of Companies in the Broadband Ecosystem

Profitability Comparison (%)

	S&P 500	T	VZ	S	Q	CMCSA	TWC	GOOG	EBAY	WMT	CL
NPM	10.2	10.4	9.6	-7.6	5.4	10.2	6.1	28.3	27.4	3.7	15.6
NPM 5-yr	12.2	10.6	9.9	-18.5	6.0	8.0	-5.0	24.7	19.0	3.6	13.1
ROE	13.5	12.7	8.8	-12.8		8.8	8.3	20.7	19.2	21.2	96.4
ROE 5-yr	9.9	10.9	12.3	-20.2		5.8	-3.0	20.1	12.5	21.1	105.9
ROA	5.0	4.8	4.8	-4.3	3.3	3.2	2.4	18.5	14.1	8.9	22.7
ROA 5-yr	4.5	4.4	4.8	-8.9	3.3	3.2	-1.4	18.1	9.7	8.7	18.8

NPM is net profit margin; ROE is return on equity; ROA is return on assets; T is AT&T; VZ is Verizon; S is Sprint-Nextel; Q is Qwest; CMCSA is Comcast; TWC is Time Warner Cable; GOOG is Google; EBAY is eBay. Wal-Mart (WMT) and Colgate-Palmolive (CL) were added by the original authors for illustrative purposes.[86]
Source: Phoenix Center

Most analysts continue to note the extremely competitive price pressures in both the wireless and broadband markets. These have been spurred largely by the competitive market forces described above, which have also generated a number of non-price points of competition. For example, in the wireless realm, service providers, faced with a nearly saturated marketplace, are competing for customers by offering a wider array of price plans, service options, and handsets, as well as touting customer service and the overall consumer experience a company can offer.[87] In light of this rapidly changing marketplace, broadband service providers will have to find additional sources of revenue in order to maintain both capital investments and some measure of profitability.

2.3 Assessing the Impacts of Shifts in Consumer Preferences and Utilization Patterns on Broadband Service Providers

Much of the success described in section 2.2 stems from the ability of broadband service providers to rapidly alter business models in order to accommodate shifts in consumer preferences for and utilization patterns of broadband. This flexibility has been essential given the rapid pace at which the communications marketplace has evolved since the turn of the 21st century. For some perspective, consider that, in 2000:

[86] Id.

[87] *See, e.g.* Charles M. Davidson, *Losing the Forest for the Trees: Properly Contextualizing the Use of Early Termination Fees in the Current Wireless Marketplace*, N.Y. Law School, ACLP Scholarship Series (June 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Early%20Termination%20Fees%20-%20June%202009.pdf.

- Less than five percent of households had adopted broadband.[88]
- Wireless penetration was approximately 38 percent, representing a total national subscribership of just over 100 million.[89]
- Only a negligible amount of wireless subscribers – three percent – had "cut the cord" and relied only on their mobile phone to make calls.[90]
- The six nationwide wireless carriers collectively had approximately 2.5 million mobile Internet users at the end of 2006. These providers offered data transfer speeds in the range of 9.6 to 19.2 kilobits per second (kb/s).[91]
- The total number of end-user switched access lines (i.e. telephone lines) in service was over 192 million.[92]

Over the past decade, the market has been radically transformed by exploding consumer demand for more advanced broadband-enabled services and rising competition among broadband service providers. As a result, broadband service providers have had to adjust the business models that they employed in 2000, which catered to less data-intensive consumer demand. For example, traditional wireline telephone service is being quickly replaced by alternative voice service, particularly wireless telephony. As noted above, there were approximately 192 million telephone lines in service in 2000; by 2008 that number had dropped to 154 million.[93] By contrast, the number of households that had "cut the cord" and shifted to wireless telephony for voice calls grew to nearly 25 percent of all households by the end of 2009, up from three percent in 2000.[94]

This general shift has had three key impacts. First, traditional telephone providers had to determine the best way to assure continued revenue growth in the wake of rising numbers of households terminating their basic telephone service and switching either to cable competitors offering VoIP or to wireless service only. This spurred traditional telephone companies to speed deployment of more advanced fiber networks in order to support more robust broadband and video services, the latter of which many traditional telephone companies now offer to

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[88] *Pew Home Broadband Adoption 2009* at p. 11.

[89] *See* CTIA – The Wireless Association, Wireless Quick Facts: As of Dec. 2009, http://www.ctia.org/advocacy/research/index.cfm/AID/10323 ("*CTIA Quick Facts - Dec. 2009*").

[90] *See* In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Sixth Report, at p. 32, FCC 01-192 (2001).

[91] Id. at p. 82.

[92] *See* Local Telephone Competition: Status as of June 30, 2008, at Table 1, FCC, Industry Analysis and Technology Division, Wireline Competition Bureau (July 2009) ("*FCC Telephone Stats – June 2008*").

[93] *FCC Telephone Stats – June 2008* at Table 1.

[94] *See* Stephen J. Blumberg & Julian V. Luke, *Wireless Substitution: Early Release of Estimates from the National Health Interview Survey: July-December 2009*, at p. 1, Centers for Disease Control (May 2010), *available at* http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201005.pdf.

customers.[95] Similar competitive concerns have driven key investments across the entire broadband sector.[96]

Second, those companies that also provide wireless service had to grapple with more intensive wireless uses (e.g., rapidly increasing use of basic data services like text messaging[97]) and the demand for more advanced wireless data services. Indeed, between June 2005 and June 2008, the number of mobile wireless high-speed lines increased from just over 350,000 to nearly 60 *million*.[98] This spurred a marked increase in wireless infrastructure investment over the last several years,[99] the development of more advanced smartphone devices, and a robust market for add-on applications.[100]

Third, cable operators responded to these competitive pressures in kind by bolstering existing broadband infrastructure and by making available VoIP service, which was of value to consumers interested in purchasing a bundle of communications services from the same provider. These adjustments proved to be very popular among consumers. For example, in 2006 Comcast reported that the number of customers subscribing to its VoIP service increased fivefold in one year, and that 80 percent of those subscribing to its voice service did so as part of a triple play bundle.[101]

The pace of these myriad developments across the broadband space led the FCC to conclude in 2008 that the deployment of such advanced services was "reasonable and timely" as a result of the "industry's extensive investment in broadband deployment" and commitment by broadband service providers to "continu[e]...mak[ing] significant investments in broadband facilities going forward."[102] In general, these shifts in consumer preferences and utilization patterns parallel other trends throughout the entire communications sector. As a result, the current communications market bears little resemblance to the market of 2000. Indeed, recent data indicate that:

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[95] *See, e.g.*, Peter Grant & Dionne Searcey, *Verizon's FiOS Challenges Cable's Clout*, Wall St. J., Oct. 24, 2007

[96] As discussed in section 2.2, *supra.*

[97] The average number of texts sent monthly increased from 14 million in December 2000 to nearly 10 *billion* in December 2005 to over 150 *billion* in December 2009. *CTIA Quick Facts – Dec. 2009.*

[98] *See* Industry Analysis and Technology Division, Wireless Competition Bureau, FCC, High-Speed Services for Internet Access: Status as of June 30, 2008, at Table 1 (2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf.

[99] *CTIA Quick Facts – Dec. 2009;* Robert C. Atkinson & Ivy E. Schultz, *Broadband in America: Where it is & Where it is Going*, at p. 29-30, Report to the FCC, Columbia Institute for Tele-Information (Nov. 2009) ("*CITI Broadband Report*").

[100] *See, e.g.*, Everett M. Ehrlich, Jeffrey A. Eisenach, and Wayne A. Leighton, *The Impact of Regulation on Innovation and Choice in Wireless Communications*, Rev. of Network Economics, Vol. 9, No. 1, Art. 2, at p. 4-21 (demonstrating that the market for wireless services is amply competitive).

[101] *See Annual Report on Form 10-K: 2006*, at p. 8, Comcast, *available at* http://www.cmcsk.com/common/download/sec.cfm?companyid=CMCSA&fid=1193125-07-39301&cik=1166691.

[102] *See* In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Fifth Report, at para. 59, FCC 08-88, GN Docket No. 07-45 (rel. June 12, 2008).

- 65 percent of households had adopted broadband by the end of 2009.[103]
- Wireless penetration was approximately 91 percent by December 2009.[104]
- Most wireless service providers currently offer some form of mobile data service. On average, the FCC reports that "mobile data users typically receive download speeds ranging from hundreds of kilobits per second to about one megabit per second."[105]
- By 2007, YouTube was using as much bandwidth as the entire Internet in 2000.[106] In 2010, 24 hours of video were being uploaded to YouTube every *minute*.[107]
- Monthly Internet use at home increased from 15 hours in 2000 to 29 hours in 2009.[108]

This new marketplace presages several important long-term trends that are forcing broadband service providers to experiment with new business models in an effort to identify new revenue streams and to remain competitive.

First, some estimate that "U.S. Internet and IP traffic [will] grow at a compound annual rate of around 56 [percent] through 2015."[109] This means that the Internet will be some 50 times larger in 2015 than it was in 2006.[110] Much of this growth will result from continued increases in consumption of online video. Indeed, online video content currently accounts for more than 70 percent of traffic on the consumer Internet, but generates less than 10 percent of total revenues for broadband service providers.[111] In the wireless realm, it is estimated that data traffic will increase by more than 100 percent each year through 2014.[112] Much of this growth in the short-term is being driven by a very small minority of users, many of which consume large amounts

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[103] See John Horrigan, *Broadband Adoption and Use in America*, at p. 3, FCC OBI Working Paper Series No. 1 (Feb. 2010).

[104] *CTIA Quick Facts - Dec. 2009.*

[105] *National Broadband Plan* at p. 39.

[106] *See* Robert McDowell, Commissioner, FCC, *Luncheon Address to Broadband Policy Summit III*, at p. 13, June 7, 2007.

[107] *See* YouTube, Fact Sheet, http://www.youtube.com/t/fact_sheet.

[108] *National Broadband Plan* at 16.

[109] *See* Bret Swanson, *Rapid Internet Traffic Growth Continues in U.S. and Around the Globe*, at p. 1, Technology Note, Entropy Economics (March 2009).

[110] *See* Bret Swanson & George Gilder, *Estimating the Exaflood*, at p. 3, Discovery Institute (Jan. 2008), *available at* http://www.scribd.com/doc/6483200/Estimating-the-Exaflood-012808-by-Bret-Swanson-George-Gilder.

[111] *Internet Value Chain Economics* at p. 2.

[112] *See* Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update 1, Cisco White Paper (2009), *available at* http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf (estimating a global compound annual growth rate in mobile data traffic of 131 percent between 2008 and 2013).

video.[113] In order to ensure reliable connectivity for all users and to assure adequate returns on disproportionate uses by some users, broadband service providers are experimenting with a variety of new business models in an effort to provide consumers with service options that match consumption levels. For example, some broadband service providers have experimented with metered services,[114] while others are rolling out tiered wireless data plans that cater to different types of users.[115]

Second, as subscription levels reach saturation and as usage levels continue to increase, broadband service providers will have to determine how to assure increased revenue streams to support continued investment in infrastructure and new lines of business.[116] Indeed, one recent report suggested that average annual increases in the broadband adoption rate will slow considerably over the next five years.[117] As a result, broadband service providers will require wide latitude to experiment with new business models that ensure that revenue streams adequately support more data-intensive uses by customers. A useful point of comparison is the wireless sector, which has already begun to respond to decreasing voice revenues by enhancing mobile data services. To this end, the amount of revenue derived from wireless data services continues to increase each year, while revenues per minute of voice service continue to decrease.[118] Indeed, between 2004 and 2008, the average revenue per user ("ARPU") for wireless voice service decreased by 21 percent, while combined ARPU for wireless text and data services increased by 363 percent.[119] Chart 5 provides an overview of Morgan Stanley projections for wireless voice and data revenue trends over the next several years. As a result, demand for key inputs like spectrum and access to rights-of-way have increased as broadband service providers seek to bolster wireless infrastructure in an effort to accommodate consumer demand for more robust wireless data services.[120]

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[113] Id.

[114] Time Warner Cable tested metered broadband pricing in 2009. *See* Tom Lowry, *Time Warner Cable Expands Internet Usage Pricing*, Business Week, March 31, 2009.

[115] AT&T recently became the first major wireless provider to replace flat-rate all-you-can-eat data plans with lower priced plans that have caps on monthly data usage. *See* David Lieberman, *New AT&T Smartphone Users Won't Get One-Price Net*, USA Today, June 2, 2010 ("*AT&T Smartphone Users*").

[116] *Internet Value Chain Economics* at p. 14 (noting that revenue growth for broadband service providers is likely to flatten over the next few years, while revenue for online services is expected to grow considerably).

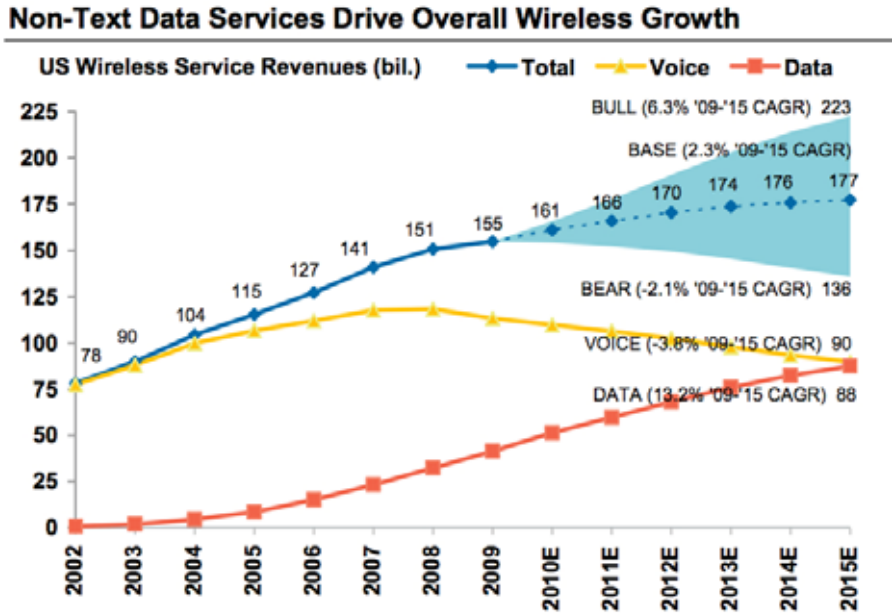
[117] *CITI Broadband Report* at p. 7.

[118] *See, e.g.*, In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Thirteenth Report, 24 F.C.C.R. 6185, para. 195, Table 12 (2009) (noting that "in the last half of 2007, data revenues made up 17.9 percent of total wireless service revenues, compared to 13.5 percent a year earlier, an increase of 33 percent."); Simon Flannery and Sean Ittel, *Wireless Data: The Torch Passes from Voice to Data*, at p. 4, Morgan Stanley Research, Telecom Services (June 1, 2010) (predicting that "Wireless data revenue growth (excluding upside from emerging devices) should offset the decline in voice revenues").

[119] *See* In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Fourteenth Report, FCC 10-81, at p. 11-12 (2010).

[120] *See, e.g.*, *National Broadband Plan* at p.77 (noting that "the growth of wireless broadband will be constrained if government does not make spectrum available to enable network expansion and technology upgrades."); p. 109-113 (noting that "the cost of deploying a broadband network depends significantly on the costs that service providers

Chart 5 – Wireless Voice & Data Revenue Trends, 2008-2015



	2008	2009	2010E	2011E	2012E	2013E	2014E	2015E
Voice Revenues								
Base	$118,276	$113,163	$109,757	$106,142	$102,355	$97,844	$93,364	$89,671
y/y growth	*0.5%*	*-4.3%*	*-3.0%*	*-3.3%*	*-3.6%*	*-4.4%*	*-4.6%*	*-4.0%*
Bull			111,508	109,556	107,334	104,240	101,052	98,586
Bear			106,254	99,475	92,865	85,938	79,392	73,844
Data Revenues								
Base	$32,321	$41,511	$51,306	$59,698	$68,121	$75,813	$82,339	$87,524
y/y growth	*39.1%*	*28.4%*	*23.6%*	*16.4%*	*14.1%*	*11.3%*	*8.6%*	*6.3%*
Bull			54,205	68,101	83,499	98,914	112,952	123,949
Bear			47,681	52,571	56,619	59,333	61,021	62,046

Source: Morgan Stanley Research, CTIA

In sum, broadband service providers are actively reassessing and altering business strategies to accommodate new consumer preferences and to vie for consumers more effectively in a competitive space. In addition to the efforts described above, these actions will also likely include allocating higher percentages of capital expenditures to bolstering broadband infrastructure,[121] making more robust broadband connections available to the vast majority of American households in order to further grow the consumer base,[122] and diversifying service plans and offerings to provide end users with a menu of options for accessing and consuming broadband services.[123] Moreover, broadband service providers are just beginning to understand

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incur to access conduits, ducts, poles, and rights-of-way on public and private lands" and outlining a variety of recommendations for streamlining access to these locations).

[121] *CITI Broadband Report* at p. 28.

[122] Id. at 7 (estimating that, by 2015, 90 percent of homes will have access to 50 megabit per second connections).

[123] *See, e.g.*, J. Gregory Sidak & David J. Teece, *Innovation Spillovers and the "Dirt Road" Fallacy: The Intellectual Bankruptcy of Banning Optional Transactions for Enhanced Delivery over the Internet*, 6 J. on Competition Law & Econ., at p. 15 (forthcoming 2010), working draft *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1593761&download=yes ("*Sidak & Teece 2010*") (noting that

the rising demand for their services in other sectors of the economy and how these trends will impact long-term strategies (see section 6.1 for further discussion).

2.4 Conclusions

The current broadband ecosystem has benefited greatly from the consistent implementation of a deregulatory framework by the FCC. This approach has provided innovators across the sector with the certainty that organic market forces, not policy interventions, will steer the sector towards maximum efficiency and consumer welfare. As a result, stakeholders have invested billions of dollars in broadband network infrastructure, which has in turn spurred the investment of additional billions of dollars in the development and deployment of advanced content that leverages available bandwidth. Further, device manufacturers have created a number of cutting-edge tools for accessing these networks and content.

The availability of advanced networks, content, and devices has spurred consumer demand for ever more innovative and bandwidth-intensive services and applications, making it necessary for service providers to continually tweak their business models in order to provide consumers with a reliable and affordable user experience. Yet, despite these obvious gains, the FCC appears determined to alter a proven regulatory approach to broadband. Its proposal, which is discussed in-depth in the next section, would not only reverse the current policy framework, it would also risk reversing or slowing the many gains described above.

3. THE RULES: AN OVERVIEW OF THE FCC'S PROPOSED APPROACH TO REGULATING BROADBAND SERVICE PROVIDERS

In order to provide consumers with a reliable and consistent user experience, broadband service providers have had to adjust network management techniques to accommodate the rising levels of bandwidth demand noted above. Fortunately, service providers have had the flexibility to adjust their business models in response to these shifts in consumer demand,[124] and network engineers have had the ability to adapt network management techniques in order to accommodate the growth in size, scope, and complexity of the Internet.[125] Moreover, broadband service providers responded to increasing consumer demand for a more robust online experience by deploying more advanced networks and implementing "new ways of network budgeting and engineering" to accommodate increased traffic and congestion.[126] This cycle of increased

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QoS agreements between service providers and content providers will assure optimal product differentiation, which will "unequivocally" make consumers better off "as a result of greater choices in real-time applications of the Internet.").

[124] *See, e.g.*, Shane Greenstein, *Glimmers and Signs of Innovative Health in the Commercial Internet*, 8 J. on Telecomm. & High Tech. L. 25, 30-32 (2010) (observing that dial-up Internet access placed a "restriction on the value of output" and that, as a result, service providers began to deploy broadband networks to increase revenues and to enhance consumer welfare) ("*Signs of Innovative Health*").

[125] *See, e.g.*, Robert M. McDowell, Commissioner, FCC, *Who Should Solve This Internet Crisis?*, Wash. Post, Op-Ed, July 28, 2008 (noting that the "Internet has flourished because it has operated under the principle that engineers, not politicians or bureaucrats, should solve engineering problems").

[126] *See* Andrew Odlyzko, *Internet Growth: Myth and Reality, Use and Abuse*, p. 1, iMP: Information Impacts Magazine, Nov. 2000 (pre-print), *available at* http://www.dtc.umn.edu/~odlyzko/doc/internet.growth.myth.pdf.

network traffic and adaptation by broadband service providers to accommodate skyrocketing consumer demand has yielded a variety of business models that facilitate the delivery of content and provide a reliable user experience.[127] However, this freedom to adapt is threatened by the FCC's proposed network neutrality rules, which seek to impose an antiquated vision of regulation on the Internet.[128]

This section provides a brief overview of the FCC's approach to network management issues over the last few years and assesses the current set of proposed rules and their potential impacts on innovation and competition in the broadband ecosystem.

3.1 The FCC & Network Neutrality: A Brief Overview

Concomitant with the FCC's classification of broadband Internet access as an information service,[129] the Commission began to explore how it could ensure that "the various capabilities of [broadband] technologies are not used in a way that could stunt the growth of the economy, innovation and consumer empowerment."[130] To this end, in 2004 then-FCC chairman Michael Powell outlined four basic principles that would "preserve the freedom of use broadband consumers have come to expect."[131] These principles, which were eventually adopted by the FCC in a non-binding Policy Statement issued in 2005,[132] entitled consumers to:

- Access the lawful Internet content of their choice;
- Run applications and use services of their choice, subject to the needs of law enforcement;

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[127] *See, e.g.*, Philip J. Weiser, *The Next Frontier for Network Neutrality*, 60 Admin. L Rev. 273, 279-280 (2008) (observing that "Given the ability to deliver real-time services over the Internet – ranging from video conferencing to live video programming – it is important that the Internet evolve so that users can be guaranteed [Quality of Service (QoS)] assurances. After all, for commercial firms using the Internet to deliver valued communications services or offer premium content or services, the ability to ensure QoS is essential to their effective use of the Internet. Recognizing this point, the Internet Engineering Task Force--the standard-setting body charged with developing the basic Internet standards--has long evaluated new technologies to provide enhanced QoS." [citations omitted]).

[128] *See, e.g.*, Jasper P. Sluijs, *Network Neutrality Between False Positives and False Negatives: Introducing a European Approach to American Broadband Markets*, 62 Fed. Comm. L.J. 77, 83 (2010) (noting that "the end-to-end principle found its origins in the age of narrowband Internet, where most data packets are of approximately the same "weight" and timely delivery is not a necessity. The growth of broadband deployment, however, led to an increase in demand for high-bandwidth applications and services like streaming video, which is sensitive to delay." [citations omitted]).

[129] As discussed in Section 2.1, *supra*.

[130] *See* Michael Powell, Chairman, FCC, *Preserving Internet Freedom: Guiding Principles for the Industry*, at p. 2, Remarks at the Silicon Flatirons Symposium on "The Digital Broadband Migration: Toward a Regulatory Regime for the Internet Age," University of Colorado School of Law, Boulder, Colorado, Feb, 8, 2004, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-243556A1.pdf.

[131] Id. at p. 5.

[132] *See* Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Policy Statement, 20 F.C.C.R. 14986 (2005) ("*FCC Policy Statement – 2005*").

- Connect their choice of legal devices that do not harm the network; and
- Competition among network providers, application and service providers, and content providers.

Each of these principles was subject to reasonable network management.[133]

Until the FCC opened a proceeding against Comcast in 2007 to investigate an alleged violation of the first principle of its Policy Statement, the FCC had not received any complaints of unlawful or unreasonable conduct by broadband service providers.[134] In 2008, the Commission censured Comcast for, according to the FCC, unreasonably managing peer-to-peer traffic.[135] Comcast immediately appealed this decision, arguing that the Commission lacked the authority to enforce a non-binding policy statement.[136] In 2009, with an appeal of this ruling pending in federal court, the FCC initiated a rulemaking to adopt network neutrality rules in order to "provide greater clarity regarding the Commission's approach to these issues."[137] In particular, the FCC sought to codify the original four principles included in the 2005 Policy Statement and proposed adopting two additional principles – one regarding nondiscrimination and one regarding transparency of broadband service providers.

Up until this current rulemaking, most major broadband service providers had come to support the FCC's four original principles. However, the emergence of two additional principles and the Commission's underlying rationale for adopting the entire set of six principles has pushed the FCC's approach to the extreme. What began as an attempt by the Commission to protect consumers has metastasized into a wholesale overhaul of the FCC's regulatory approach to broadband.

Indeed, the original intent of the FCC's 2005 Policy Statement was to offer stakeholders in the marketplace "guidance and insight into its approach to the Internet and broadband."[138] The Commission explicitly stated that it would only "incorporate the…principles into its ongoing

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[133] Id. at fn. 15.

[134] *See* In the Matter of Broadband Industry Practices, Notice of Inquiry, at para. 3, WC Docket No. 07-52 (rel. April 16, 2007). The Commission did, however, mediate a settlement in a case involving the blocking of VoIP traffic by an ISP. *See* In the Matter of Madison River Communications LLC and Affiliated Companies, Consent Decree, 20 F.C.C.R. 4295, 4296 (2005).

[135] *See* Memorandum Opinion & Order from the FCC, In the Matters of Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications and Broadband Industry Practices Petition of Free Press et al. for Declaratory Ruling that Degrading an Internet Application Violates the FCC's Internet Policy Statement and Does Not Meet an Exception for "Reasonable Network Management," WC Docket No. 07-52, FCC 08-183 (rel. Aug. 20, 2008) ("*FCC Comcast Order – 2008*").

[136] The Court of Appeals for the D.C. Circuit recently vacated the *Comcast Order*, holding that the Commission failed to demonstrate that its authority to enforce its policies was "reasonably ancillary to the…effective performance of its statutorily mandated responsibilities." Comcast v. FCC, 600 F.3d 642 (D.C. Cir. 2010) (citations omitted).

[137] *FCC Net Neutrality NPRM* at para. 6.

[138] *FCC Policy Statement* – 2005 at 14987.

policymaking activities," not codify them.[139] The focus was squarely on providing consumers with notice of what they were entitled to expect from Internet service providers. Significantly, the FCC further declined to adopt "prophylactic rules" when it censured Comcast in 2008.[140] The FCC reasoned that it was unwise to adopt rigid rules since its principles were meant to provide guidance to consumers and industry and not to "unduly [tie its] hands should the known facts change."[141] The Commission's current proposal to codify formal rules contradicts this initial approach and signifies an affirmative attempt to intervene in the marketplace.[142] This is a dramatic departure for an agency that had consistently expressed reluctance to intervene in any aspect of the broadband sector over the last decade.[143]

3.2 Assessing What the FCC's Network Neutrality Proposals Mean for the Marketplace

Perhaps the most puzzling element of the FCC's proposed approach to network neutrality is that the entire set of proposals and accompanying rationale represent a deliberate policy choice to limit the ability of broadband service providers to experiment with and implement new business models. These new business models have had the practical effect of altering traditional network management techniques in order to meet rising consumer demand for more advanced services.[144] By erecting these formidable policy barriers, the FCC would effectively foreclose innovation by network owners and would do so in the absence of clear evidence that broadband providers are engaging in "pernicious" activities that negatively impact competition.[145] Moreover, this approach explicitly exempts the business models of other stakeholders in the ecosystem that leverage broadband networks, indicating that the Commission has positioned itself as an industrial planner with the exclusive authority to anoint business practices.[146] As a result, the many gains across the broadband ecosystem described above in section 2 are at risk of being reversed under this new regulatory rubric.

Many of the most troubling elements of the FCC's new approach to broadband stem from its proposed fifth principle. This principle creates an affirmative obligation for broadband service

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[139] Id. at 14988.

[140] *FCC Comcast Order – 2008* at para. 30.

[141] Id.

[142] The FCC's intent was further clarified in its announcement that it will seek to reclassify broadband Internet access services as "telecommunications services" subject to common carrier regulations included in Title II of the Communications Act. *Genachowski – Third Way*.

[143] *Off the Hook* at p. 564 (noting that the *Comcast Order* represented the beginning of "a significant departure from the agency's longstanding reticence to impose binding obligations on Internet-based providers").

[144] *See* Christopher S. Yoo, *Network Neutrality after* Comcast, in NEW DIRECTIONS IN COMMUNICATIONS POLICY 58 (May ed. 2009) ("*Network Neutrality after* Comcast").

[145] *See* Christopher S. Yoo, *Beyond Network Neutrality*, 19 Harv. J. Law & Tech. 1, 7 (2005) (citing N. Pac. Ry. Co. v. United States, 356 U.S. 1, 5 (1957)).

[146] Indeed, the FCC has aggressively asserted that its current approach to broadband regulation does not encompass content providers. *See, e.g.*, Austin Schlick, General Counsel, FCC, *A Third-Way Legal Framework for Addressing the* Comcast *Dilemma*, p. 1, 3 (rel. May 6, 2010).

providers to "treat lawful content, applications, and services in a nondiscriminatory manner."[147] While each of the proposed principles is subject to reasonable network management, unfettered implementation of the fifth principle could have enormously negative impacts on broadband service providers and the wider broadband ecosystem. The following section provides a general overview of how the implementation of a literal version of the fifth principle will impact current and emerging business practices of broadband service providers. Section 5 attempts to quantify the negative impacts of these rules on capital expenditures, job creation, and economic output across the ecosystem.

3.2.1 *The Practical Impacts of Nondiscrimination in the Broadband Ecosystem*

Consistent with its *de facto* case-by-case approach to alleged violations of the 2005 Policy Statement,[148] the FCC did not have occasion to propose a nondiscrimination rule prior to opening the current rulemaking proceeding.[149] The case-by-case approach offered "the promise of allowing regulatory authorities to redress…anticompetitive harms without preventing the realization of the potential benefits."[150] Thus, the FCC's proposed nondiscrimination rule does not address specific harms evident in the marketplace. Instead, it effectively seeks to foreclose valuable and necessary business models that are necessary to realize the FCC's vision for broadband in America as set forth in its *National Broadband Plan.*

According to the FCC, "nondiscrimination" means that a broadband Internet access provider "may not charge a content, application, or service provider for enhanced or prioritized access to subscribers of the broadband Internet access service provider."[151] The Commission has introduced this principle in order to enumerate a "bright-line rule against discrimination," which may "better fit the unique characteristics of the Internet."[152] In developing its nondiscrimination approach, the FCC foresees a dual approach, one that combines an initial *ex ante* determination of what constitutes discriminatory behavior with a subsequent case-by-case approach to carve out exceptions.[153] The FCC believes that this approach will provide sufficient flexibility to accommodate new uses.[154]

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[147] *FCC Net Neutrality NPRM* at para. 104.

[148] Indeed, in the *Comcast Order*, the FCC explicitly stated that it was only ruling on the facts of the case and declined to investigate the propriety of prioritizing certain types of traffic or other such potentially discriminatory actions. *See FCC Comcast Order – 2008* at fn. 202.

[149] In April 2007, the FCC did seek comments on whether it should "incorporate a new principle of nondiscrimination" into its Internet principles. However, this inquiry remains open and has been folded into the FCC's official net neutrality rulemaking docket. *Broadband Industry Practices NOI* at para. 10.

[150] *Network Neutrality after* Comcast at p. 57.

[151] *FCC Net Neutrality NPRM* at para. 106.

[152] Id. at para. 109.

[153] Id. at para. 110.

[154] Id.

Regardless of the FCC's best intentions, the imposition of an *ex ante* nondiscrimination requirement would have an immediate chilling effect on established business practices, and would eliminate any flexibility that broadband service providers currently have to adjust their business models to accommodate new consumer demands. Specific areas of impact include:

3.2.1.1 Quality of Service

The nondiscrimination rule would prevent broadband service providers from engaging in quality of service (QoS) management that seeks to provide consumers with a reliable user experience.[155] As an overview, QoS "label[s] some traffic as higher priority than other traffic"[156] and encompasses a range of techniques for managing traffic, including prioritizing certain types of data packets and clearing congestion on networks.[157] These techniques, particularly the prioritization of certain types of information packets, reflect the diverse nature of the data flowing through modern broadband network infrastructure. Indeed, some data packets – e.g., those associated with e-mail – have a high tolerance for latency caused by network congestion, while data packets associated with real-time services like VoIP have a lower tolerance for latency.[158]

The FCC's nondiscrimination rule fails to appreciate the diverse nature of information flowing through modern broadband infrastructure. At least one commentator has observed that "preventing network providers from prioritizing certain content or applications over others may reduce innovation by making it more difficult for those innovations that depend on guaranteed quality of service from emerging."[159] Guaranteed QoS agreements matter for the emerging class of managed or specialized services discussed below since they would provide a content developer with an assurance that certain applications will be reliably delivered. This is essential for services like telemedicine that require guaranteed real-time delivery. Failure to reliably deliver health-related content could lead to injury or death.

Overall, assigning priority to certain types of content reflects the "increasing heterogeneity of end-user demand"[160] and rising levels of Internet traffic, which could congest networks if left

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[155] In the broadband context, QoS is a "protocol and application specific form of traffic engineering." *See* George Ou, *Managing Broadband Networks: A Policymaker's Guide*, at p. 31, Info. Tech. & Innov. Found. (Dec. 2008) ("*Managing Broadband Networks*").

[156] *See* J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet*, 2 J. of Comp. Law & Econ. 349, 365 (2006).

[157] These approaches are decidedly different, and more reflective of current network dynamics, than the traditional end-to-end approach to Internet traffic. Indeed, one commentator has observed that the "limitation of the end-to-end perspective is that it treats the network as a black box. The Internet must be "stupid" to allow data to pass freely between endpoints. The pathways in between are seen as unimportant. In reality, those connection points are critical." *See* Kevin Werbach, *Higher Standards Regulation in the Network Age*, 23 Harv. J.L. & Tech. 179, 187 (2009).

[158] *Sidak & Teece 2010* at p. 12.

[159] *See* Christopher S. Yoo, *Network Neutrality, Consumers and Innovation*, 2008 U. Chi. Legal F. 179, 182 (2008).

[160] *See* DANIEL F. SPULBER & CHRISTOPHER S. YOO, NETWORK IN TELECOMMUNICATIONS 376 (2009).

unmanaged.[161] Implementing a nondiscrimination rule would deprive broadband service providers of an essential tool for assuring reliable service and would further deprive end-users from contracting for the prioritized delivery of certain types of valuable content.[162] Moreover, an absolute ban of these techniques would contradict established network management practices that have been implemented on the Internet for decades.[163] Finally, the inability to guarantee the reliable delivery of certain types of time-sensitive content could chill innovation at the network's edge. Thus, nondiscrimination that forecloses QoS would have impacts throughout the broadband ecosystem.

3.2.1.2 Wireless Prioritization

Prioritizing content takes on additional salience in the wireless realm. Although the FCC has recognized inherent differences between the network dynamics of wired and wireless broadband infrastructures, the Commission has indicated that it will impose nondiscrimination requirements on wireless broadband service providers.[164] This is significant since the medium through which wireless broadband is delivered – spectrum – is a shared resource, which means that these networks are much more sensitive to increases in traffic and more apt to congest.[165] Even though wireless service providers continue to upgrade their networks to provide higher throughput data speeds, there is an upper limit as to how much bandwidth can be squeezed from a particular slice

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[161] *See, e.g.*, Richard Bennett, *Designed for Change: End-to End Arguments, Internet Innovation, and the Net Neutrality Debate*, p. 15-18, Info. Tech. & Innov. Found. (Sept. 2009) (describing the evolution of anti-congestion protocols that are currently used to manage Internet traffic and prevent against network congestion); *Managing Broadband Networks* at p. 13.

[162] *See, e.g.*, Comments of the Advanced Communications Law & Policy Institute at New York Law School et al., at p. 9, In the Matter of Preserving an Open Internet, GN Docket No. 09-191 (filed April 26, 2010) ("Consumers should have the ability to work with service providers to ensure that the content they demand is delivered without delay. For example, a senior household should have the ability to assign priority to its telemedicine services, while college students living in off-campus housing should have the ability to assign priority to movie download."). Some have argued that consumers currently lack the ability to "make capacity decisions" about how certain types of content are delivered to them. *See* Benjamin Lennett, *Dis-Empowering Users vs. Maintaining Internet Freedom: Network Management and Quality of Service (QoS)*, 18 Comm. L. Conspectus 97, 144 (2009). Regardless of whether this dynamic currently exists across all platforms and service plans, the implementation of a nondiscrimination rule by the FCC would preclude broadband service providers from experimenting with these types of arrangements, thus chilling the type of business model innovation that has developed in response to insatiable consumer demand for more bandwidth-intensive applications.

[163] *Managing Broadband Networks* at p. 3.

[164] *FCC Net Neutrality NPRM* at para. 13.

[165] *See, e.g.*, Roger Entner, *Considerations Around Wireless Net Neutrality: The Few Vs. the Many*, Nielsen Wire Blog, Oct. 12, 2009, *available at* http://blog.nielsen.com/nielsenwire/online_mobile/considerations-around-wireless-net-neutrality-the-few-vs-the-many/ (noting that wireless network's are increasingly challenged "when we move from bursty traffic to streaming."); Michael J. Santorelli, *Rationalizing the Municipal Broadband Debate*, 3 ISJLP 44, 53-63 (2007) (comparing the various modes of delivering broadband and noting that shared delivery mediums – Wi-Fi, cable broadband, and cellular 3G, among others - "can slow down with an increase in the number of users on an immediate network," at 54); *Managing Broadband Networks* at p. 35-36 (observing that "Not only is the capacity on wireless networks more scarce; wireless networks are far more shared than wired networks, which presents unique engineering challenges not present on copper DSL or fiber networks.").

of the airwaves.[166] As a result, wireless broadband service providers actively manage their networks to prevent slow-downs and outages. Indeed, many carriers manage traffic in such a way so that "large downloads can occur with lower priority, thus not affecting other active users."[167] This allows for carriers to assure a minimum quality of service for all customers. Despite the critical role that such techniques play in assuring a reliable user experience across a carrier's subscriber base, the FCC's nondiscrimination rule would foreclose this essential practice.

The FCC's approach to nondiscrimination in the wireless realm, moreover, does not account for the likely costs of imposing restrictive rules on wireless broadband service providers – costs that will ultimately be borne by consumers. Indeed, the costs of imposing these types of restrictions far outweigh any perceived benefit.[168] Conversely, the benefits derived from a carefully managed network outweigh any perceived costs because such practices provide end-users with a reliable experience and access to a growing universe of useful content.[169] Critically, current network management practices provide stakeholders throughout the ecosystem – innovators at the edge, device manufacturers, and consumers – with certainty regarding how certain types of data will be transmitted. As a result, innovators can adapt their offerings to meet existing guidelines. Prohibiting continued implementation of wireless network management techniques would upend this dynamic and inject uncertainty throughout the sector.

3.2.1.3 Partnerships with Content Providers

Implementation of a nondiscrimination rule would also codify a zero-price rule for broadband service providers, prohibiting them "from charging content providers to send information to consumers."[170] While some have observed that this approach to content by broadband service providers has become a *de facto* rule in the sector,[171] others have argued that the ability to forge partnerships with content providers that have a price associated with them is an inevitable outcome in two-sided markets like the broadband sector.[172] Moreover, preventing a broadband service provider from charging content or application providers for prioritized access to end users would deprive broadband service providers from "exercising pricing flexibility," which

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[166] *See, e.g.,* HSPA to LTE-Advanced: 3GPP Broadband Evolution to IMT-Advanced (4G), at p. 33-26, Rysavy Research / 3G Americas (2009) *available at* http://www.rysavy.com/Articles/2009_09_3G_Americas_RysavyResearch_HSPA-LTE_Advanced.pdf (describing a variety of network enhancements being implemented by wireless carriers to provide next-generation data speeds).

[167] Id. at p. 9.

[168] *See* Robert W. Hahn, Robert E. Litan & Hal Singer, *The Economics of "Wireless Network Neutrality,"* at p. 7, AEI-Brookings Joints Center for Regulatory Studies, Working Paper No. RP07-10 2007, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=983111.

[169] *Id.*

[170] *See* C. Scott Hemphill, *Network Neutrality and the False Promise of Zero-Price Regulation*, 25 Yale J. on Reg. 135, 137 (2008) ("*Hemphill on Zero-Price*").

[171] *See* Robin S. Lee & Tim Wu, *Subsidizing Creativity Through Network Design: Zero-Pricing and Net Neutrality*, 23 J. of Econ. Persp. 61, 62 (2009).

[172] *Network Neutrality after* Comcast at p. 74-75; *see also* Janusz A. Ordover, Greg Shaffer & Doug Fontaine, *The Economics of Price Discrimination*, in *The Economics of the Internet*, at p. 28, Vodafone Policy Paper Series, No. 11 (April 2010) ("*Economics of Price Discrimination*").

would likely result in higher costs for the end user.[173] The FCC appears to recognize this dynamic since it explicitly states that its nondiscrimination rules "would not prevent a broadband Internet access service provider from charging subscribers different prices for different services."[174]

Further, the FCC's nondiscrimination rule goes even beyond the pricing restrictions imposed on common carrier telephone service by effectively implementing the zero-price rule.[175] This is significant since the FCC's rule would artificially skew the pricing structure of broadband access developed by service providers.[176] To this end, the zero-price rule would preclude the pricing flexibility necessary to "increase the likelihood that network providers will recover a greater proportion of the costs of upgrading the network from content and applications providers" and thus "reduce…the burden borne by consumers."[177] Moreover, the adoption of this rule would foreclose a critical avenue for realizing additional revenue in the future. This is important since broadband service provider revenues are expected to flatten in the coming years.[178] As a result, prices would likely increase, reversing a trend of price declines over the last several years.[179]

In addition to negatively impacting broadband service providers, the FCC's proposed nondiscrimination rule would also impact content providers. For example, under the Commission's proposed framework, a high-tech start-up would not be able purchase prioritized access from a broadband service provider, thus foreclosing a potentially important avenue of competition in the content market.[180] This would have the unintended consequence of raising barriers to entry in the content sector, which would likely have negative impacts on other components of the broadband ecosystem (e.g., the device market). Similarly, restrictions on a broadband service provider's ability to price discriminate could have a "significant deleterious effect on the incentives…to undertake necessary investments in network innovation and expansion."[181] In other words, regulations that skew investment incentives could negatively impact innovation at the core of networks, which would in turn negatively impact innovators at

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[173] *Network Neutrality after* Comcast at p. 75.

[174] *FCC Net Neutrality NPRM* at para. 106.

[175] *Hemphill on Zero-Price* at p. 141-142 (noting that "Telephone companies charged higher rates to business customers and in large cities. And highly tailored service packages for large business customers have been held to satisfy the Communication Act's nondiscrimination rule, provided the filed tariff is available to other customers with the same needs." [citations omitted]).

[176] *Economics of Price Discrimination* at p. 35-36 (noting that price discrimination is welfare enhancing in two-sided markets and that "a seller who can price discriminate on one side of the market (e.g., to content and application suppliers) will have an incentive, in many cases, to lower prices to buyers on the other side of the market (e.g., to subscribers), resulting in additional benefits over and above those that price discrimination would generate in a one-sided market.").

[177] *Network Neutrality after* Comcast at p. 75.

[178] *Internet Value Chain Economics* at p. 17.

[179] *National Broadband Plan* at p. 38-39 (the FCC notes that while there is a "dearth of consistent, comprehensive and detailed price data" available, there is evidence of a "small decline in quality-adjusted national broadband prices.").

[180] *Sidak & Teece 2010* at p. 24.

[181] *Economics of Price Discrimination* at p. 28.

the edge of the networks who rely on robust connectivity to deploy new cutting-edge services and applications.

3.2.1.4 Managed Services

The FCC defines "managed services" as an amorphous category of "IP-based offerings (including voice and subscription video services, and certain business service provided to enterprise customers), often provided over the same networks used for broadband Internet access service, that have not been classified by the Commission."[182] The FCC observes that this group of services – which encompasses IP-based video and emerging technologies like specialized smart grid, telemedicine, and educational services – may warrant a "different policy approach," but that it would be vigilant to the "risk that growth of [these] services might supplant or otherwise negatively affect the open Internet."[183] In the short-term, the FCC appears willing to carve out an exemption for most managed services, but the implementation of a nondiscrimination rule would undermine these efforts.

Indeed, the FCC's nondiscrimination rule would negatively impact the development of a robust and vibrant class of managed or specialized services by creating disincentives for innovators to experiment with new services. For example, new telemedicine and smart grid services may not be developed since innovators would not be assured of prioritized or real-time delivery of time-sensitive tools.[184] The FCC ultimately envisions a future where a "patient's heart rhythm can be monitored continuously, regardless of her whereabouts, and diabetics can receive continuous, flexible insulin delivery through real-time glucose monitoring sensors that transmit data to wearable insulin pumps."[185] In order to be effective, however, many of these services must be delivered in real-time via broadband. Without guaranteed delivery of these services, innovators will lack the incentive to develop tools that must be delivered in real-time.[186]

The Commission's willingness to carve out exceptions to nondiscrimination for certain types of managed services on an ongoing basis also fails to assure continued innovation and investment in new services like health IT. A cursory review of recent policymaking efforts by the FCC demonstrates that the agency is incapable of keeping pace with the rapid pace of innovation in

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[182] *FCC Net Neutrality NPRM* at para. 148.

[183] Id. at para. 149.

[184] These and other broadband-enabled innovations in the healthcare and energy sectors are discussed in section 6.1, *infra.*

[185] *See* Julius Genachowski, Chairman, FCC, *Mobile Broadband: A 21st Century Plan for U.S. Competitiveness, Innovation and Job Creation*, Remarks to the New America Foundation, Feb. 24, 2010.

[186] This cyclical dynamic – broadband service providers invest in networks to make more bandwidth available, spurring innovation at the network's edges and, eventually, more innovation at the network's core in order to handle increased network traffic – has become a staple of the broadband sector. *See, e.g.*, Christopher Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition? A Comment on the End-to-End Debate*, 3. J. Telecomm. & High Tech. L. J. 23, 35-26 (2004) (noting that the "commercialization of the Internet has spurred the development of applications which place greater demands on network services" and that, as a result, network providers adjusted their business models to accommodate increased network traffic.).

the broadband ecosystem.[187] Even though the FCC proudly touts the flexibility inherent in its approach to network neutrality, the glacial pace of policymaking is insufficient to foster the high levels of innovation and encourage the large amounts of investment necessary to produce the types of specialized services at the heart of its *National Broadband Plan.*[188] Erecting barriers to further innovation and deployment of these services would have enormous economic impacts. For example, one study estimates that costs associated with preventing the full realization of broadband-enabled telemedicine services would be at least $15 billion annually.[189]

3.3 Conclusions

The FCC has repeatedly insisted that, since "government cannot predict the future…the role of government [vis-à-vis broadband] is and should remain limited."[190] Unfortunately, the FCC's proposed network neutrality rules belie this otherwise laudable view of the role of government in the broadband sector. In particular, the FCC's proposed nondiscrimination rule singles out broadband service providers in its ban on experimenting with new business models and effectively handling the many types of new services that the FCC so enthusiastically touts in its *National Broadband Plan.* While the FCC believes that its new approach to broadband will continue to "encourage private investment…promote competition, and foster innovation, economic growth, and job creation,"[191] history suggests otherwise. As discussed in the next section, the economic impacts of previous attempts by the FCC to micromanage a dynamic sector have been largely negative in nature.

4. PRECEDENT: EXAMINING THE ECONOMIC IMPACTS OF PREVIOUS FCC REGULATION ON THE COMMUNICATIONS SECTOR

Before assessing the potential negative economic impacts of the FCC's proposed network neutrality rules on investment, jobs, and economic output, it is useful to evaluate how past actions by the Commission to impose similarly rigid regulatory regimes affected stakeholders in

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[187] The Comcast proceeding offers a compelling case study. The FCC received the initial complaint about Comcast's alleged network management violations in late 2007. *See* Roy Mark, *Vuze Complains Comcast Violating Net Neutrality*, eWeek, Nov. 15, 2007. The FCC opened its inquiry into this violation quickly thereafter. However, by March 2008, Comcast announced a partnership with BitTorrent – the peer-to-peer service that Comcast was accused of discriminating against – to "more effectively address issues associated with rich media content and network capacity management." *See* Press Release, *Comcast and BitTorrent Form Collaboration to Address Network Management, Network Architecture, and Content Distribution*, Comcast, March 27, 2008, *available at* http://www.comcast.com/About/PressRelease/PressReleaseDetail.ashx?PRID=740. The FCC finally released its official censure of Comcast in August 2008.

[188] Some have argued for the development of a new regulatory model that is capable of addressing novel issues stemming from the digital marketplace. *See, e.g.,* Philip J. Weiser, *The Future of Internet Regulation*, 43 U.C. Davis L. Rev. 529, 536 (2009) (noting that "The future of Internet regulation depends on the ability of policymakers to embrace a new model of regulation that uses very different tools from the still dominant and traditional model of command-and-control regulation.").

[189] *See The Economic Impact of Digital Exclusion*, at p. 11-17, A Report by the Economic Impact Group & Econsult Corporation (March 2010).

[190] *National Broadband Plan* at p. 5.

[191] *Genachowski – Third Way* at p. 1

the communications market. Regulation, in the form of prescriptive policies that dictate certain behaviors by communications service providers, has typically resulted in discernibly negative impacts on the immediate market and the entire U.S. economy.[192] Conversely, a more hands-off approach by the FCC has resulted in robust competition and vibrant innovation. This section provides illustrative examples of both dynamics.

4.1 Illustrative Example of the Negative Economic Impacts Resulting from FCC Regulation: *The 700 MHz Spectrum Auction*

The regulation of markets requires a delicate balancing act by policymakers since their actions send crucial signals to market participants. How stakeholders interpret these signals is principally impacted by the rationale underlying regulations, how those regulations are implemented by the policymaking body, and whether the policies are consistently applied by regulators.[193] Over the past two decades, Congress has delegated to the FCC a wide array of powers to implement policies that impact the granular details of a communication company's business. Charged with such sweeping authority, the FCC has oftentimes erred in implementing these policies, both from a legal vantage and from an economic vantage.

The negative economic impacts of overly prescriptive FCC action were most recently evident in the Commission's auction of spectrum in the 700 MHz band.[194] In particular, the imposition of restrictive usage conditions on spectrum in the C-block and the D-block resulted in significant economic losses.

With regard to the C-block, the FCC integrated an "open access" condition into its auction rules, which required "licensees to allow customers, device manufacturers, third-party application developers, and others to use or develop the devices and applications of their choice, subject to certain conditions."[195] Even though this portion of spectrum was successfully auctioned off to Verizon Wireless, one study found that the imposition of this condition deterred more robust bidding and ultimately cost taxpayers upwards of $3.l billion in lost revenues to the U.S. Treasury.[196] Moreover, this study went on to estimate that universal imposition of such prescriptive rules, which effectively altered the business models of wireless carriers, could

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[192] For examples of this dynamic in addition to the ones provided in this paper, *see* Daniel L. Brenner, *Creating Effective Broadband Network Regulation*, 62 Fed. Comm. L. J. 13, 32-35 (2009).

[193] Shane Greenstein has noted that "private firms benefits from knowing how to anticipate the norms and standards employed by regulators to recognize the signs of health and unhealthy behavior in a situation that is changing so much [i.e., the Internet value chain." This interplay, between innovator and regulator, is essential to encouraging "innovative health." *Signs of Innovative Health* at p. 34.

[194] This portion of spectrum was made available as a result of the transition from analog to digital television transmission, which was completed in 2009. *See* Deficit Reduction Act of 2005, Pub. L. No. 109-171, 120 Stat. 4 (2006) (Title III of the DRA is the DTV Act).

[195] *See* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, Second Report & Order, at para. 195, WC Docket No. 06-150, FCC 08-128 (rel. May 14, 2008) ("*700 MHz Rules*").

[196] *See* George Ford, Thomas Koutsky & Lawrence Spiwak, *Using Auction Results to Forecast the Impact of Wireless Carterfone Regulation on Wireless Networks*, at p. 3, Phoenix Center Policy Bulletin No. 20 (2nd Edition) (May 2008), *available at* http://www.phoenix-center.org/PolicyBulletin/PCPB20Final2ndEdition.pdf.

suppress infrastructure by $50 billion over the next decade.[197] This projection rested on the assumption that the open access rule would negatively impact wireless revenues, which directly correspond to capital expenditures.[198]

With regard to the D-block, the FCC initially designated this portion of the airwaves for public safety purposes.[199] As originally designed by the FCC, the winning bidder of this block would be required to "partner with public safety constituencies to make use of the adjacent public safety broadband spectrum."[200] However, once the auction began, it quickly became clear that the limitations on how a company could use the spectrum were limiting the willingness of bidders to offer significant payments for it. After multiple rounds of bidding, the auction for the D-block failed to meet the reserve price set by the FCC.[201] An FCC audit of the auction later confirmed these suspicions and revealed that several bidders withheld bids because of "uncertainties and risks" stemming from the many usage requirements attached to the spectrum.[202] The FCC has twice attempted to revise its rules for a D-block auction, but by mid-2010 the spectrum remained unsold.[203] The FCC's *National Broadband Plan* identified this block of spectrum as a key tool for providing additional resources to wireless carriers,[204] and the FCC has indicated that it hopes to auction off the spectrum for commercial purposes in the first half of 2011.[205] However, the substantial delay in auctioning it off has deprived consumers of more robust connectivity and has delayed critical investments in network infrastructure by carriers, both of which directly impact the overall economy.[206]

4.2 Illustrative Example of the Positive Economic Impacts Resulting from FCC Deregulation: *The National Regulatory Framework for Wireless*

Oftentimes, the most effective policies for the advanced communications market are those that explicitly limit the ability of the FCC to impose onerous regulations. These types of frameworks

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[197] Id.

[198] Id. at p. 14. This relationship exists throughout broadband sector, as discussed in section 2, *supra*.

[199] *700 MHz Rules* at para. 322.

[200] *See* Blake Harris, *Larger Cities View FCC 700MHz "D Block" Public Safety Plan as Critically Flawed*, Govt. Tech., Oct. 28, 2009, *available at* http://www.govtech.com/gt/articles/426176.

[201] *See, e.g.*, Stephen Labaton, *Wireless Spectrum Auction Raises $19 billion*, N.Y. Times, March 19, 2008.

[202] *See* Kent R. Nilsson, *D Block Investigation*, at p. 2, FCC (2008), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-281791A1.pdf.

[203] *See* Service Rules for the 698-746, 747-762 and 777-792 Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, Second Further Notice of Proposed Rulemaking, WT Docket No. 06-150, PS Docket No. 06-229 (2008); Service Rules for the 698-746, 747-762 and 777-792 Bands; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, Third Further Notice of Proposed Rulemaking, WT Docket No. 06-150, PS Docket No. 06-229 (rel. Sept. 25, 2008).

[204] *National Broadband Plan* at p. 76.

[205] *See* FCC, Broadband Action Agenda, http://www.broadband.gov/plan/broadband-action-agenda.html.

[206] *See* Alan Pearce & Michael S. Pagano, *Accelerated Wireless Broadband Infrastructure Deployment: The Impact on GDP and Employment*, 18 Media L. & Pol'y 105, 105-106 (2009) (observing the positive impacts of new wireless broadband investments on U.S. GDP).

typically stem from a specific Congressional action that declares a certain segment to be beyond the reach of the Commission. Over the last two decades, a bipartisan Congress has twice recognized the importance of a hands-off approach – the first time in the context of the wireless market, the results of which are described below, and the second time in the context of the broadband sector, the results of which were described in section 2. In general, these approaches have explicitly limited the authority of policymakers at the state and federal levels to implement policies that might derail positive, fruitful, and organic market dynamics. The results have been enormously positive for consumers, the industry, and the entire U.S. economy.

In the wireless realm, it took the FCC the better part of a decade to determine the proper regulatory approach to this technology. *Indeed, it has been estimated that the regulatory dithering of the FCC during the 1980s and early 1990s resulted in annual consumer welfare losses of $50 billion due to the delay in the deployment of wireless networks and services.*[207] However, as wireless became more and more popular among consumers, and as policymakers realized that the technology represented a real competitor to traditional telephony, policies were reevaluated to ensure that innovators had ready access to key inputs and that the marketplace was afforded regulatory certainty. To this end, Congress in 1993 created a national deregulatory framework for wireless services,[208] which harmonized the regulatory treatment of a variety of wireless services and ceded the vast majority of regulatory oversight to the FCC, thus unburdening the market of inconsistent state-level regulations.[209]

The immediate results of the implementation of this framework, including additional FCC spectrum auctions, were impressive. Between 1993 and 1996, the number of wireless subscribers increased from just over 16 million to 44 million.[210] Over this same period of time, the average monthly bill dropped from $61.48 to $47.70.[211] The FCC observed that decreasing prices signaled competition in the market.[212] Lower prices enabled service providers to increase their customer bases, which in turn allowed companies to leverage economies of scale, bundle services, and distribute consumer welfare gains across the entire subscribership. Similarly, the

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[207] *See* Richard A. Posner, *The Effects of Deregulation on Competition: The Experience of the United States*, 23 Fordham Int'l L. J. 7, (2000), *citing* Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, Brookings Papers on Econ. Activity 1997: 1, Microecon. 35 (1997).

[208] Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 6002(b), 107 Stat. 312, 392 (codified in relevant part at 47 U.S.C. 332).

[209] Tom Hazlett has observed that a national regulatory framework for wireless is "efficient" because it reflects the move towards national networks by wireless carriers. The evolution of the wireless business model, away from local/regional operations and towards national ones, was "natural" as carriers sought to "homogenize their offerings and to exploit economies of scale in advertising and marketing." *See* Tom Hazlett, *Is Federal Preemption Efficient in Cellular Phone Regulation?* 56 Fed. Comm. L.J. 155, 169-172 (2003).

[210] *See* In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Eleventh Report, at Table 1, 21 F.C.C.R. 10947 (2006) ("*Eleventh CMRS Report*").

[211] Id. at Table 1.

[212] *See* In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Third Report, at p. 3-4, 13 F.C.C.R. 19746 (1998).

number of wireless carriers increased as the FCC made more spectrum available.[213] This put pressure on all carriers to invest heavily in their networks in order to ensure service quality, a key point of competition. For example, the number of cell sites nationwide increased 434 percent while the number of people employed by carriers jumped nearly 300 percent.[214]

The success of the wireless market has been attributed to the "competitive forces" of the private sector, which were enabled by the FCC's "deliberate dismantling of an old regulatory structure" that was marked by a rigid spectrum allocation policy.[215] This approach also had a direct impact on job creation in the sector. For example, in 1995 wireless carriers directly employed approximately 68,000 people;[216] by the end of 2009, this number had risen to approximately 250,000.[217] In addition, widespread adoption and utilization of wireless devices for voice and data services has had enormous economic impacts on productivity, consumer welfare, and overall economic output. Indeed, a 2008 study estimated that the total economic cost savings associated with robust adoption of wireless technology totaled over $33 billion in 2005, while the productivity gains generated by utilization of mobile wireless broadband services totaled $28 billion per year.[218] This study also estimated that the "productivity value of all mobile wireless services was worth $185 billion in 2005," and that by 2016 "the value of the combined mobile wireless voice and broadband productivity gains to the U.S. economy" would exceed $427 billion per year.[219]

4.3 Conclusions

A causal relationship exists between onerous FCC regulation and negative economic activity in the immediate communications sector and the broader U.S. economy. Further evidence of this relationship can be found in recent cable stock losses and ratings downgrades that occurred in the wake of the FCC's announcement that it will seek to reclassify broadband Internet access as a service regulated by Title II of the Communications Act.[220] Indeed, even the threat of onerous regulation and the likelihood of impending regulatory uncertainty cause reverberations well beyond the Beltway.[221]

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[213] Id. at 3 ("There are at least three mobile telephone providers in each of the 50 largest Basic Trading Areas ("BTAs") and 97 of the 100 largest BTAs. Currently, three or more mobile telephone operators are providing service in BTAs containing approximately 219 million people.").

[214] *Eleventh CMRS Report* at Table 1.

[215] *See* In re Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, First Report, FCC 95-317 (1995) 10 F.C.C.R. 8844 at para. 84.

[216] *CTIA Quick Facts - Dec. 2009*.

[217] Id.

[218] *See* Roger Entner, *The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy*, at p. 2, 9, A Report by Ovum to CTIA – The Wireless Association (2008).

[219] Id. at p. 2.

[220] *See* Jeffry Bartash, *Comcast, Cablevision Stocks Decline on Cloudy Outlook*, Wall St. J., May 10, 2010.

[221] *See* Jennifer Valentino-DeVries, *Cable Stocks Fall After news of FCC's Internet Plan*, Wall. St. J. Digits Blog, May 6, 2010 (quoting a prominent telecom analyst as saying: "Markets abhor uncertainty. Today we got uncertainty in spades" and that "this development is an unequivocal negative" for broadband service providers).

Similarly, there is a direct relationship between light FCC regulation and positive economic benefits in the form of job creation, increased consumer welfare gains, and overall increases in U.S. economic output. To date, the broadband market has operated under a deregulatory framework implemented by the FCC in response to the clear intent of Congress as indicated in several provisions of the 1996 Act.[222] As such, the FCC must overcome substantial evidence of an efficiently operating marketplace before it adopts new rules that are intended to dramatically shift a successful regulatory paradigm and burden the sector with unnecessarily ponderous and prescriptive regulations.

5. APOCALYPSE NOW? ASSESSING THE IMPACT OF PROPOSED NET NEUTRALITY RULES ON INVESTMENT & JOBS IN THE BROADBAND ECOSYSTEM

The analyses included in previous sections support three broad conclusions. First, the current regulatory framework for broadband – one that is largely deregulatory in nature and that has been consistently applied – has resulted in the development of a healthy, competitive, and innovative broadband ecosystem. As such, enormous consumer welfare gains have been generated and sustained. Second, this regulatory certainty has spurred investment across every component of the broadband ecosystem – from network infrastructure to access devices – which, in turn, has spurred job creation. As a result, the U.S. is well positioned to continue leading the world in ICT investment and innovation. Third, previous attempts by the FCC to micromanage a dynamic sector by imposing rigid rules on certain stakeholders in the marketplace have failed and have resulted in large-scale economic losses. In light of these dynamics, the stakes are incredibly high as the FCC considers imposing network neutrality rules on the broadband sector.

In order to appreciate the scale and scope of the likely negative impacts of network neutrality rules on the sector, section 5.1 provides an analysis of their potential economic impacts on three specific business models that are of value to broadband service providers. As noted in section 3, the imposition of the FCC's proposed rules would drastically limit the latitude of broadband service providers to adjust business models in response to rapid changes in consumer demand and network traffic. These restraints would have significant impacts on current and projected revenue streams, which, as discussed in section 2, are essential to supporting capital expenditures. Restricting revenue streams could result in job, output, and consumer welfare losses, along with a significant slowdown in the speed of innovation.

Section 5.2 outlines a range of possible losses in investment, jobs, and economic output that could occur as a result of the imposition of the FCC's proposed network neutrality rules. The scenarios included in this section support estimates of job losses in the thousands across the broadband ecosystem and economic output losses in the billions that would likely result under the FCC's proposed network neutrality regime.

[222] An overview of this regulatory approach is discussed in section 2.1, *supra*.

5.1 Economic Impacts of Net Neutrality on Broadband Service Provider Business Models: Three Illustrative Examples

Section 3.2.1 provided an overview of the FCC's proposed net neutrality rules and highlighted several potential impacts on broadband service provider business models. This section provides a more detailed economic analysis of how these rules would impact three business models that are either currently in use or likely to emerge over the next few years. As discussed below, network neutrality will severely impede the ability of service providers to structure new offerings and will restrict necessary flexibility to adequately plan for future investments.

5.1.1 *Facilitating Internet Video*

The FCC's proposed net neutrality rules could prohibit voluntary partnerships and transactions with upstream providers of content, applications, and services (CAS).[223] An inability to partner with CAS providers will necessarily place the entire cost of the network onto end-user consumers, some of whom might not be able to afford higher prices. The rational apportioning of value, cost, and price in multi-sided markets is essential. As a result, some new integrated high-end services, which require robust real-time delivery of packets, may not be possible at all. Internet video provides a compelling example.

Today, video accounts for 73 percent of consumer Internet traffic, but just 8 percent of consumer Internet revenue.[224] Over coming years, video will rapidly and asymptotically approach 100 percent of Internet traffic.[225] Clearly, this chasm between video traffic and video revenue is not sustainable. Part of the cost of transporting video will be paid for by basic broadband access charges. But because of the disparity of data density (and often latency-sensitivity) between video and every other form of network content, video will have to be accounted for in more granular ways. These more granular models may include any of the following (often in combination):

- Consumer capacity tiers;
- Consumer per-byte charges;
- Consumer purchases of special broadband packages including tiered video service;
- Consumer subscriptions to third party content;
- QoS guarantees paid by content providers; and
- Partnerships between broadband providers and content providers, among others.

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[223] *See* Section 3.2.1.3, *supra*, for additional discussion.

[224] *Internet Value Chain Economics* at p. 14.

[225] *See Visual Networking Index: Forecast and Methodology, 2009-2014*, Cisco (June 2010), *available at* http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360.pdf.

Of course, in a sense, much of today's Web video traffic *was* paid for by video revenues – cable TV revenues. The early and continuing lead of cable in broadband Internet service was made possible by its existing capacious coaxial cable networks, which are capable of delivering around one gigabit per second of broadcast content to homes.[226] They leveraged these networks to create new broadband cable modem services. Traditional telecommunications companies like Verizon and AT&T entered the video distribution business in order to convince their investors to support their own fiber-optic broadband builds.[227] But as cable TV and other video services are dis-intermediated, supplemented, and complemented by the Internet, the old video networks will not be able to fully support (financially or technically) Web video, which is more diverse, interactive, personalized, and platform neutral. The entire ecosystem will need new hybrid business models to successfully manage this historic transition. The FCC's proposed net neutrality rules, however, will prevent broadband service providers from experimenting with new hybrid models because the rules would only allow providers to charge one side of the market (i.e., consumers) and not the other (i.e., CASs).[228]

5.1.2 *Bolstering and Ensuring Wireless Quality of Service*

The proposed rules could also restrict the use of network management techniques that are crucial to both the technical functionality and business reality of wireless networks.[229] Indeed, in light of the physics associated with the provision of wireless service – namely, delivering content via the airwaves over dedicated swaths of spectrum – QoS techniques are essential in the wireless realm. As noted above in section 3.2.1.2, the FCC's proposed network neutrality rules would likely be applied with equal force to wireless networks. This would have enormous economic implications on many current and emerging business models.

For example, next generation mobile wireless networks – based on the LTE and WiMAX standards – employ sophisticated QoS capabilities to manage (1) voice and other latency-sensitive real-time services, (2) high-capacity services like video, and (3) low-capacity and time-*in*sensitive applications like email.[230] Because LTE and WiMAX are converged IP data platforms, all applications use the same network resources.[231] But not all applications are the same. Network management can accommodate all these applications and data types, delivering optimized service to numerous simultaneous users.[232]

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[226] Even without advanced coding (QAM), the bandwidth of HFC cable networks, which ranges from 5 MHz up to 860 MHz, can deliver close to 1 gigabit per second. With advanced coding techniques, such as 64- and 256-QAM on the physical layer, HFC networks can deliver more than 4 gigabits per second

[227] *See, e.g.*, Saul Hansell, *Verizon FiOS: A Smart Bet or a Big Mistake*, N.Y. Times, Aug. 18, 2008, *available at* http://www.nytimes.com/2008/08/19/technology/19fios.html; additional discussion in section 2.3, *supra*.

[228] *See* Section 3.2.1.3, *supra* (discussing the zero-price rule that would be implemented as a result of the FCC's proposed non-discrimination rule).

[229] *See* Section 3.2.1.2, *supra*, for additional discussion.

[230] *See, e.g.*, Wikipedia: Long Term Evolution, http://en.wikipedia.org/wiki/3GPP_Long_Term_Evolution.

[231] *See, e.g.*, *LTE – A Well Designed OFDMA Mobile IP Solution*, Qualcomm White Paper (Jan. 2008), *available at* http://www.qualcomm.com/common/documents/analyst/LTE_Mobile_OFDMA_IP_WhitePaper.pdf.

[232] Researchers find substantial capacity and performance benefits of using QoS techniques in LTE networks. *See, e.g.*, Iana Siomina and Stefan Wanstedt, *The Impact of QoS Support on the End User Satisfaction in LTE Networks*

A wireless network deprived of crucial network management tools is technically impotent and financially disastrous. The capacity of a wireless network without QoS could be quickly consumed by just a few users of bandwidth-intensive applications like peer-to-peer video or video conferencing. A wireless network shackled by the FCC's network neutrality rules would likely fall victim to the many changes in traffic patterns described above in section 2.3.
Qualcomm, an important wireless innovator of the last two decades, recently summarized the lethal threat network neutrality regulations pose to wireless in comments to the FCC:

> [I]mposing the proposed regulations on wireless network management is likely to create a tragedy of the commons on wireless networks. In writing applications for wireless networks on which they would be granted mandatory access via FCC rules, each individual application developer would not have any incentive to conserve bandwidth. To the contrary, the individual application developer's self-interest would be to write the most bandwidth-intensive applications to leverage the free shared resource, the wireless network. For a developer in a net neutrality regime, excessive bandwidth consumption is an externality. No individual developer bears the costs or other impacts of excessive bandwidth consumption. Likewise, consumers have no ability or incentive to conserve bandwidth, and the proposed rules will prevent the operators from taking technical or economic measures to promote bandwidth conservation to protect the aggregate interests of developers and consumers.[233]

Already the iPhone has demonstrated the challenges that come with popular new broadband services. AT&T, the wireless network provider for this device, reports that three percent of iPhone users generate over 40 percent of the traffic on its network, a situation it says is unsustainable.[234] Users in large cities – New York and San Francisco in particular – have experienced network congestion and thus slower data speeds and more dropped voice calls.[235] New traffic management techniques and pricing plans will be needed to rationalize the usage-price-value-service matrix.[236]

Without the ability to implement QoS techniques, one notable analyst recently estimated the high costs to service providers of accommodating unfettered surges in wireless data traffic:

With Mixed Traffic, Jan. 9, 2010, *available at* http://www.comsoc.org/files/Publications/Tech%20Focus/pdf/2010/jan/9.pdf.

[233] *See* Comments of Qualcomm Incorporated, at p. iii, GN Docket No. 09-191 (filed Jan. 14, 2010), *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=7020378228

[234] *See, e.g., AT&T to New York and San Francisco: We're Working On It*," Wall St. J. Digits blog, Dec. 9, 2009, *available at* http://blogs.wsj.com/digits/2009/12/09/att-to-new-york-and-san-francisco-were-working-on-it/ ("*Working on it*"); Matt Richtel, *AT&T to Charge More to Heavy Users of Data*, N.Y. Times, June 3, 2010; Andrew Dowell & Roger Cheng, *AT&T Dials Up Limits on Web Data*, Wall St. J., June 3, 2010.

[235] *Working on it.*

[236] As previously noted, AT&T recently became the first U.S. wireless provider to offer tiered pricing plans for wireless service services. *AT&T Smartphone Users*

> Unless a long-term plan is put in place that addresses and manages the traffic at a very granular level, the cost incurred due to an explosive demand will become unsustainable by 2013. At that point the revenue being generated could fall below the cost of sustaining such traffic. However, if the operators attack the problem using several different strategies, the growth can be managed and brought in line with the technology evolution such that the industry can take advantage of the falling per megabit costs.[237]

This analyst concluded that service providers need a multi-pronged approach, including large investments in high-capacity HSPA and LTE networks; offload strategies using Wi-Fi and pico- and femtocells; congestion management; QoS; handset optimization; content caching; broadcast mobile video; and new business plans.[238]

Further, restrictions on wireless network management and business plan experimentation would exacerbate existing problems and allow a tiny number of users and applications to completely dominate the network, degrading service and value for other users.[239] Wireless networks that are unable to deliver robust services to numerous and diverse users are not worth nearly as much as wireless networks that can make the most of their capacity. The results of poor quality for existing services and a lack of new services would be some mix of the following: fewer subscribers, lower overall ARPU, less innovation and diversity in new mobile devices and services, and less investment in wireless capacity and coverage.

At the same time, additional and diverse revenue streams are also needed. As discussed in section 2.3, wireless voice revenues are currently in decline. Video does not yet pay for its proportional use of network resources. But a number of specialized services and applications, sometimes connected to special-purpose devices, can provide incremental revenues important to the health of the network.[240] Many of these services, however, may require, or be based upon, devices or partnerships that are exclusive or discriminatory across one or more business or technical axes.

The implications of the FCC's proposed policies could arrive sooner rather than later. Chart 6 makes clear that, *without new strategies on both the cost and revenue vectors, some of which could be barred under the FCC's proposed net neutrality regime, wireless networks could quickly become unprofitable*. If wireless service providers look just a few years into the future

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[237] *See* Chetan Sharma, *Managing Growth and Profits in the Yottabyte Era*, at p. 15, Report (July 2009), *available at* http://chetansharma.com/Managing_Growth_and_Profits_in_the_Yottabyte_Era.pdf.

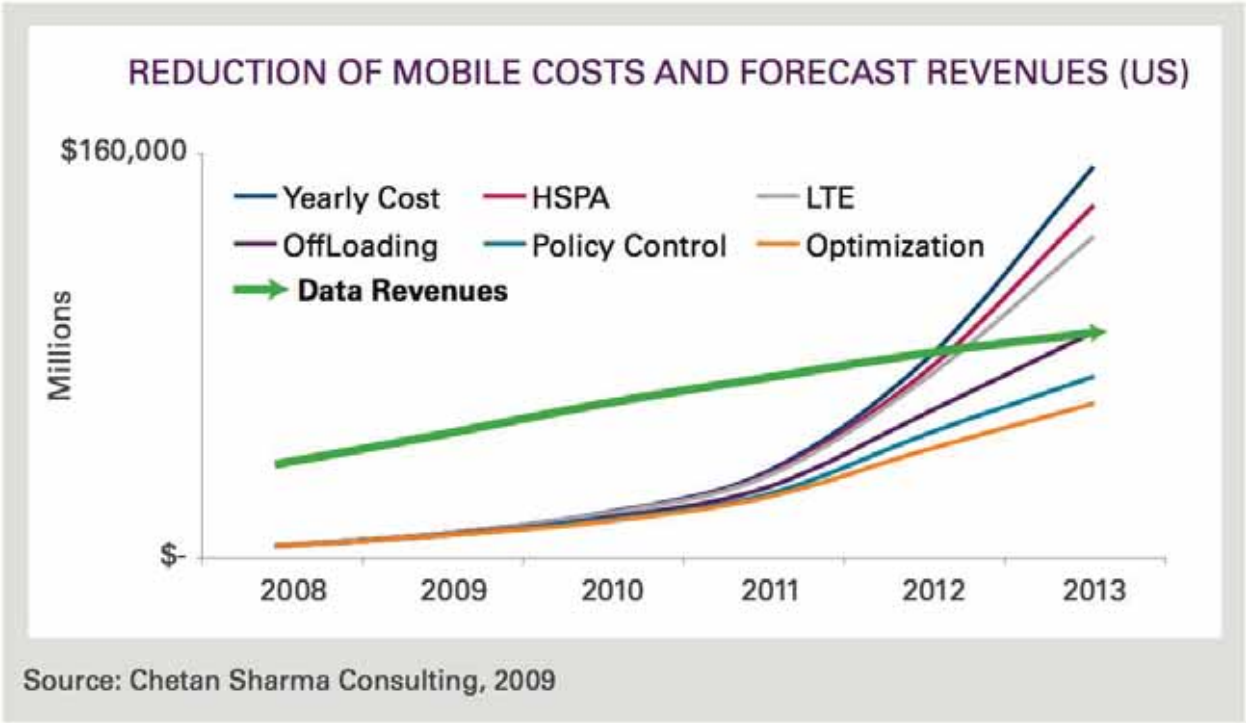
[238] Id.

[239] Indeed, the ability to alter business models to both monetize more intensive data users and to attract less intensive users led AT&T to reconfigure how it sells data plans for the iPhone. This move was warmly greeted by many customers, analysts and investors. *See, e.g.*, Brett Arends, *AT&T Signals Hope for Telecom*, Wall St. J., June 3, 2010.

[240] These devices and services may include medical monitors; remote sensors and cameras for a range of commercial and consumer uses; virtual windows; kiosks; specialty music, radio, and video devices; video conferencing stations; entertainment and educational devices for children; devices that may come with integrated background Internet access (like the Amazon Kindle's "WhisperNet" service); and too many others to mention or imagine.

and see they will not be able to deploy the technologies and execute the business plans that make the network both user-friendly and financially viable, they will not be able to convince their investors to supply the necessary tens of billions of dollars of new risk capital. Less capacity will be deployed, thus exacerbating the service quality challenge and slowing innovation in content, applications, and mobile devices.

Chart 6 – Reduction of Mobile Costs and Forecast Revenues, 2008-2013



This chart shows estimated total yearly cost of accommodating wireless data traffic (top blue line). The lines below show how various technologies and strategies could reduce this total cost to bring expenses more in line with data revenues and thus ensure a rational business model.

5.1.3 *Providing Adequate Network Security*

Cybersecurity is increasingly important for the smooth functioning of our modern economy, not to mention for the protection of personal privacy and national security. The same technologies that are useful to maintain robust quality of service by discriminating among data packets and flows are also used to "scrub" networks to detect harmful intrusions, viruses, malware, denial of service attacks, and "botnets." The economic impact of a less secure Internet is difficult to quantify, but a failure to protect the network and its users from cyber vandals and cyber criminals could be enormous.[241]

[241] *See, e.g.*, *Securing Cyberspace for the 44th Presidency*, Center for Strategic and International Studies, White Paper (Dec. 2008), *available at* http://csis.org/files/media/csis/pubs/081208_securingcyberspace_44.pdf.

Many policymakers have suggested or asserted that any network neutrality rules should contain an exemption for cybersecurity.[242] That is good and necessary, but not quite sufficient. If the technologies that make cybersecurity possible are prohibited for other uses in the network, like QoS for managed services, then these technologies will become vastly more expensive to deploy and will therefore be less widely used. The security of the network could be put in greater jeopardy.

5.2 Estimated Economic Impacts of Net Neutrality Rules on Investment and Jobs in the Broadband Ecosystem

The severe impact of the 2000-2003 telecom/tech crash and the widespread economic damage that it engendered demonstrated that the fates of all stakeholders in the ICT sector – including telecommunications companies, Internet startups, and others in the high-tech sector – are intertwined. They depend on each other, build upon one another, and when one falters, the others do, too. Moreover, they are all equally susceptible to the unintended consequences of intrusive policies forged by the FCC. Policies that favor (or disfavor) one sector, one set of companies, one portion of the network, or one segment of the ecosystem disrupt the natural evolution of this highly symbiotic and rapidly advancing market.

The current Internet ecosystem is markedly different from the fledgling market that was just emerging during and after the telecom crash at the turn of the century.[243] Indeed, it is a much more balanced space where investments in networks and applications are based on real business strategy, not regulatory arbitrage. Because today's environment is healthier, one could posit that a negative shock to the industry would not produce consequences as severe as the millennial crash of the tech/telecom market. However, the FCC's proposed net neutrality regulations are far broader and more intrusive than any that flowed from the immediate implementation of the 1996 Act, which mostly targeted the provision of traditional telephony. The FCC's proposed net neutrality rules would affect a far larger portion of the network and, indeed, the wider ecosystem – from wired and wireless technologies to vendor relationships to entire business models. Moreover, the FCC's net neutrality proposals would impose substantial regulation on the Internet for the first time. Over a period of years, net neutrality could contribute to the same sorts of distortions and misallocations of energy and resources that led to the last industry crash.

5.2.1 *The Business of Broadband*

Broadband service provision is a high fixed-cost business. Companies must commit to large, long-term infrastructure projects and recover their investments over long periods of time. They do this by charging prices above marginal costs. But today's broadband arena is not like the utility world of old – or, for that matter, the utility world of today. It is a competitive, highly dynamic industry, with substitutes and overlapping and constantly changing partial substitutes. The industry is comprised of endless interweaved layers and mixes of hardware, software, content, and service provision, using varied network architectures, all with quickly changing absolute and relative prices.

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[242] *See, e.g.*, *FCC Net Neutrality NPRM* at para. 133-134.

[243] *See* section 2.3, *supra*, for additional discussion.

The choices made in designing and building networks, and pricing the services they deliver, are complex and profound. Because networks require such large upfront investments, a small loss of subscribers (induced, say, by artificial price controls) could have a devastating effect on the financial viability of the project. Indeed, as two commentators recently noted:

> "To recover their substantial fixed costs, broadband network operators must charge prices that exceed marginal cost. Put differently, broadband network providers have high price-cost ratios. Under high price-cost ratios, the relative losses that a network operator would incur if it degraded quality of service, which is equivalent to a quality-adjusted increase in price, and induced subscribers to switch to other networks would be greater than losses under marginal cost pricing. Because a large proportion of the network operator's costs are fixed or sunk – and consequently unavoidable – if it loses subscribers, its costs do not decrease proportionally . . . .
>
> High price-cost ratios, in combination with the high degree of rivalry and effective (even if not perfect) competition among providers, ensure that broadband network operators cannot degrade quality of service while holding price constant without risking an unsustainable loss in subscribership. Because variable costs are relatively low in the broadband industry, "a relatively small percentage of 'marginal customers' willing to discontinue service or switch to alternative providers in the face of a price increase may [be] sufficient to defeat a price increase."[244]

The same forces that tend to hold down prices in this competitive market setting – namely, the potential catastrophic loss of subscribers – would be reversed if the implicit and explicit price controls of net neutrality were imposed. To pay for the infrastructure without managing capacity via QoS and without voluntary partnerships with content providers, not only would the entire cost of the networks fall on consumers, the full cost would fall on consumers in an irrational manner in which a minority of heavy network users could degrade the experience for the majority of average or light network users. In this rigid atmosphere of constrained pricing and network management, consumer prices would likely be dangerously high, excluding a substantial number of customers and threatening the viability of the entire infrastructure project.

Bernstein Research analyst Craig Moffett addressed these issues in the context of the FCC's proposed reclassification of broadband as a common carrier service and the net neutrality regulations it is meant to enable. Referring to Verizon's FiOS fiber-optic broadband build-out, Moffett concluded that "one could safely assume it would be stopped in its tracks. Similarly, AT&T's U-Verse deployments would likely slow. Who knows what would happen to Clearwire."[245]

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[244] *Sidak & Teece 2010* at p. 39-40 (citing Thomas W. Hazlett and Dennis L. Weisman, *Market Power in U.S. Broadband Services*, at p. 8, George Mas. Law and Econ. Research Paper Series No. 09-69 (Nov. 2009).

[245] *See* Craig Moffett, *U.S. Cable: Pulling the Plug . . . Regulatory Uncertainty Clouds Terminal Growth Rates; Downgrading Sector to Neutral*, Bernstein Research Note, May 10, 2010.

5.2.2 *The Theoretical Case*

Fortunately, the reverse is true. A broadband sector capable of delivering diverse and robust services will make every part of the industry better off. To this end, a recent economic experiment is useful in determining the relative benefits of the current regulatory approach vis-à-vis the imposition of onerous net neutrality rules.

Economists Jan Krämer and Lukas Wiewiorra built a formal model of a two-sided market with consumers and content providers on either side of an ISP.[246] They accounted for network congestion, network capacity, ISP profits, content provider profits, the number of content providers, consumer surplus, prices paid by consumers for Internet access, prices paid by content providers for best-effort service and for priority service, among other factors. Moreover, they assumed for simplicity that the ISP is a monopoly provider. Yet they still found overall higher welfare, higher ISP profits, more network investment, *and more content innovation*.

According to their analysis, the authors found that the existing world of pricing, product, and network flexibility looks much better than a rigid world with net neutrality. In particular, the authors concluded that:

- "In the long-run *network discrimination will lead to more innovation*"[247];
- "Compared to a neutral network regime, the ISP will . . . provide higher transmission capacity"[248];
- "*Network discrimination is generally welfare enhancing*"[249]; and
- "Our formal analysis reveals that *ISPs have a stronger incentive to invest into network infrastructure under a discriminatory regime*."[250]

5.2.3 *The Practical Case – Job & Investment Loss Estimates*

In order to estimate the possible employment effects of the FCC's net neutrality proposals, the "baseline assumptions" by Crandall and Singer for 2010 through 2015 are used.[251] They utilized the expected broadband investments to come over the next five years, as projected in a report to the FCC prepared by the Columbia Institute for Tele-Information,[252] and then extrapolated the effect on jobs and GDP using conventional economic multipliers. This is Scenario 1.

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[246] *See* Jan Krämer and Lukas Wiewiorra, *Network Neutrality and Congestion-Sensitive Content Providers: Implications for Service Innovation, Broadband Investment, and Regulation*, Karlsruhe Institute of Technology (Aug. 2009), *available at* http://mpra.ub.uni-muenchen.de/22095/1/MPRA_paper_22095.pdf.

[247] Id. at p. 4 (emphasis in the original). The authors expanded on this point later in the paper, noting that "discrimination is more likely to foster innovation at the edge instead of hindering it." Id. at p. 20.

[248] Id. p. 20.

[249] Id. at p. 4 (emphasis in the original).

[250] Id. at p. 5 (emphasis in the original).

[251] *Crandall & Singer Jobs Paper – 2010* at p. 38-43.

[252] *CITI Broadband Report.*

Scenario 1 – Broadband Baseline – 2010-2015

	Cap Ex	Jobs	GDP
Wireline	16.1	299,000	49.2
Wireless	14.3	210,000	41.1
Total	30.4	509,000	90.3

Average annual increase, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

As mentioned, Crandall and Singer also estimated the effects of a possible aggressive expansion of fiber-optic network deployment by the two largest U.S. telecom companies, Verizon and AT&T, beyond their existing plans. The broad expansion of fiber-optic networks to most of the two companies' service areas would require massive wireline investment, implying an industry total of some $35 billion per year, or more than double the expected wireline baseline. The estimates included herein are more conservative, where the effects of a 20 percent expansion of both wireline and wireless investment are modeled. This 20 percent increase over the Baseline is Scenario 2.

Scenario 2 – Expanded Broadband – 2010-2015

	Cap Ex	Jobs	GDP
Wireline	19.32	358,800	59.04
Wireless	17.16	250,800	49.32
Total	36.48	609,600	108.36

Average annual increase, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

As an illustrative exercise, Crandall and Singer also estimated the effects of a 5 percent increase in capital investment by non-broadband industries that would be obvious beneficiaries of expanded broadband coverage and capacity. These effects could be complementary and additive to either of the first two Scenarios. This is Scenario 3.

Scenario 3 – Spillover Effects – 2010-2015

	Cap Ex	Jobs	GDP
Spillovers	18.1	452,081	53.8

Average annual increase, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

It should be noted that Crandall and Singer estimated that an $18.1 billion annual increase in upstream industry capital expenditures could translate into an employment increase of 452,000 jobs.[253] Compare this to an estimate by the Information Technology & Innovation Foundation (ITIF) of a $10 billion increase in broadband investment yielding a broad economy-wide employment increase of 498,000.[254] Of this total, ITIF estimated around 64,000 jobs would be directly created in the broadband and capital equipment sectors, while some 166,000 would come from "indirect and induced" effects and 268,000 new jobs would result from economy-wide "network effects."

ITIF's estimate of "direct" and "indirect" jobs (230,000) per $10 billion in additional investment is roughly proportional to Crandall and Singer's estimate (509,000 * 10 / 18.1 = 281,215). Although broader network effects are difficult to count or forecast precisely, they too are real.

If one were to imagine some scenarios where a healthy broadband market leads to modestly larger investments from upstream industries, then estimates of broadband's effects beyond the telecom sector become evident. ITIF's "network effects" (268,000 jobs per $10 billion) are similar in magnitude to the possible "spillovers" envisioned by Crandall and Singer (452,081 * 10 / 18.1 = 249,769). In Scenario 4, the Baseline Scenario 1 is added to the Spillover Scenario 3.

Scenario 4 – Broadband Baseline + Spillovers – 2010-2015

	Cap Ex	Jobs	GDP
Wireline	16.1	299,000	49.2
Wireless	14.3	209,000	41.1
Spillovers	18.1	452,081	53.8
Total	48.5	960,081	144.1

Average annual increase, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

The possibility that expanded broadband, compared to the Baseline scenario, could encourage an increase in upstream industry investment should also be considered. In this case, the combined effects of Expanded Broadband and a 5 percent increase in annual Upstream Spillovers are shown. Scenario 5 may not be the likeliest of outcomes, but it is within the realm of possibility. Moreover, it is the type of high-growth result the industry and policymakers should be aiming for.

[253] Id.

[254] *See* Robert D. Atkinson, Daniel Castro & Stephen J. Ezell, *The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America*, at p. 1, Info. Tech. & Innov. Found. (Jan. 2009), *available at* http://www.itif.org/files/roadtorecovery.pdf ("*Digital Road to Recovery*").

Scenario 5 – Expanded Broadband + Spillovers – 2010-2015

	Cap Ex	Jobs	GDP
Wireline	19.32	358,800	59.04
Wireless	17.16	250,800	49.32
Spillovers	18.1	452,081	53.8
Total	54.58	1,061,681	162.16

Average annual increase, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

5.2.3.1 The Negative Shock

A net neutrality policy that puts into question the profitability of long-term investment projects and reduces the revenue prospects of broadband service providers could cause an almost immediate retrenchment in capital expenditure plans. Less communications capacity and less flexibility to experiment with and execute new business models could result in a negative shock to the Internet ecosystem.

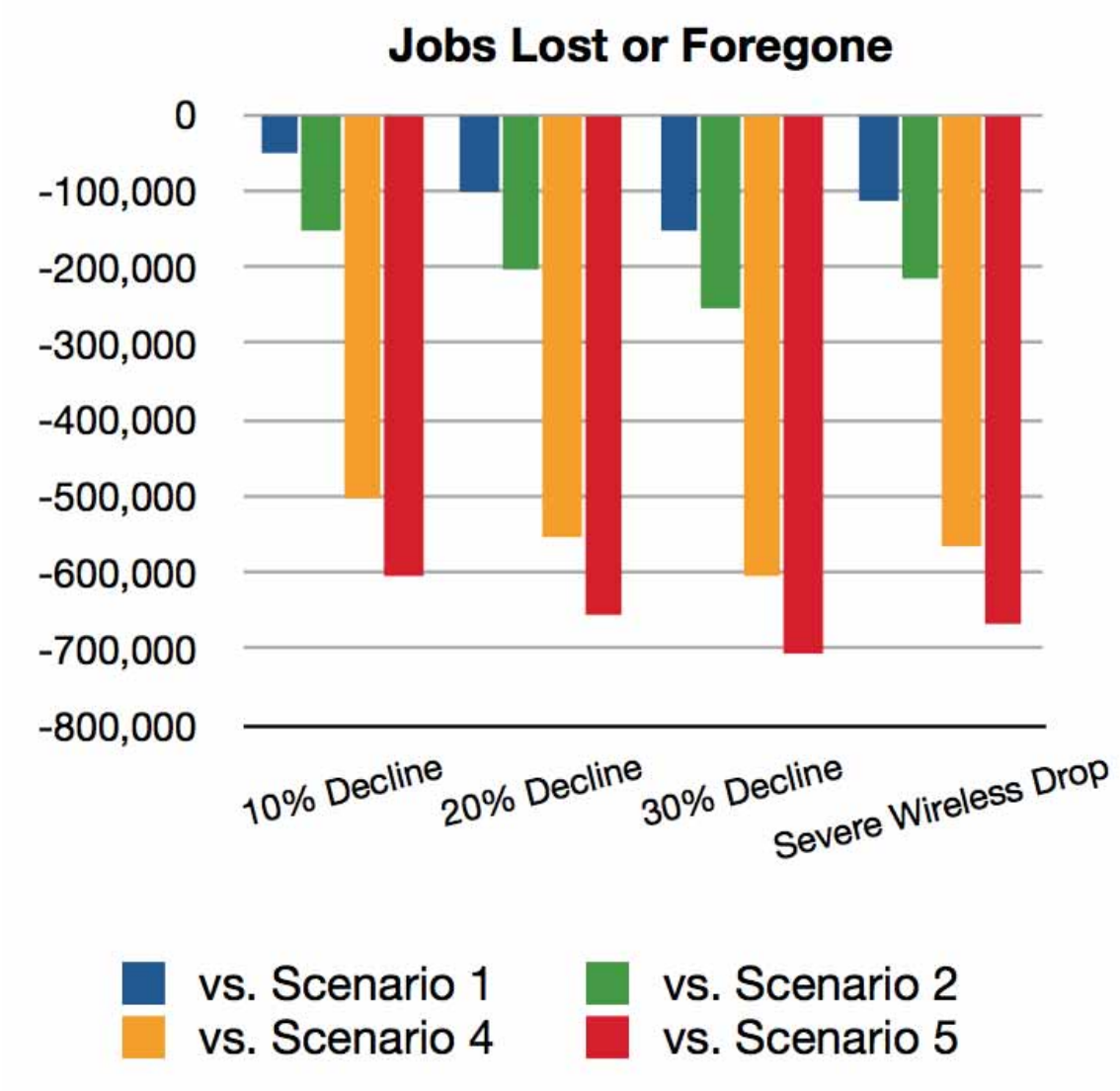
Here, the possible effects of a negative shock to the Internet are estimated. A range of possible outcomes is possible depending on how narrowly or broadly the estimates of investment on jobs are drawn.

In Scenario X, the effects of a very modest decrease – 10 percent – in wireless and wired investment, compared to the Baseline Scenario 1 above, are estimated. In Scenario 2X, the possible effect of a 20 percent decline versus the Baseline is shown. Scenario 3X, likewise, represents a 30 percent shortfall compared to the Baseline. In Scenario 4X, a particularly severe impact on wireless investment (-40 percent), but a less severe impact on wireline investment (-10 percent), is illustrated.[255]

Within each of these adverse scenarios, the drop in investment to the positive scenarios described above is compared. Chart 7 summarizes the estimated impact on jobs.

[255] *See* the Appendix for the data underlying Scenarios X – 4X.

Chart 7 – Estimated Jobs Lost or Foregone as a Result of the FCC's Proposed Network Neutrality Rules



These are only some of the scenarios possible along a wide and complex spectrum of possible outcomes. Scenarios in which investment in upstream industries actually *fell* from current levels were not considered. But such an outcome is possible and could exacerbate the negative scenarios.

Are these rough estimates realistic? It should be noted that in the 2000-2003 crash, annual investment in communications equipment and structures fell 35.6 percent from peak to trough.[256]

[256] *See National Economic Accounts*, Tables 5.5.5U and 5.4.5U, U.S. Bureau of Economic Analysis, *available at* http://www.bea.gov/national/nipaweb/index.asp.

Total annual ICT investment fell 15.1 percent.[257] These are average drops across large sectors. But drops in particular sub-sectors were far larger than 35 percent. This is the possibility with specific broadband technologies (e.g., 4G wireless) and Internet infrastructure (e.g., cloud computing centers that depend on broadband), which could be affected by the net neutrality proposal. In the 2000-2003 crash, the telecom sector alone suffered 500,000 job losses, and more than one million jobs were lost in the broader high-tech sector.

As previously noted, Coleman Bazelon of The Brattle Group recently estimated potential economic and job losses resulting from the imposition of the FCC's proposed net neutrality regime. He estimated that these rules could slow broadband revenue growth by "about one-sixth over the next decade."[258] The result would be a loss of more than 342,000 jobs by 2020 *in broadband alone*.[259] Bazelon estimated that *economy-wide* job losses by 2020 could total 1.45 million.[260] The estimates included in this paper, as described in this section, are thus within the range projected by Bazelon.

Thus, it is likely that the FCC's proposed net neutrality policy would cost the U.S. economy at least 100,000 to 200,000 jobs per year over the next five years. The policy could also foreclose on the possibility of an expansion of broadband investment beyond the expected Baseline, in addition to a modest expansion of upstream industry investment. In such a scenario, jobs lost or foregone could total 500,000 to 700,000. Depending on how the ripple effects spread throughout the digital economy and beyond, jobs lost or forgone could be even greater.

6. WHY IT MATTERS THAT THE FCC CONTINUES TO GET IT RIGHT: AN OVERVIEW OF WHERE THE BROADBAND ECOSYSTEM IS HEADED

To date, broadband service providers have met consumer demand for more advanced services by investing billions of risk capital in their networks in order to provide end users with an array of options for accessing the Internet and to assure reliable delivery of cutting-edge content.[261] As a result, a vibrant ecosystem of interrelated components has developed, providing consumers with an ever-expanding array of devices, services, and applications that leverage robust Internet connectivity.[262] The continued growth and evolution of this ecosystem is beginning to shift consumer preferences and utilization patterns of broadband. Broadband service providers are continuously adjusting strategies for accommodating these new, more bandwidth-intensive uses and for offering product to more casual users.[263]

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[257] Id.

[258] *Bazelon Study*.

[259] Id.

[260] Id.

[261] As discussed in sections 2 and 4, *supra*.

[262] *National Broadband Plan* at p. xi ("Fueled primarily by private sector investment and innovation, the American broadband ecosystem has evolved rapidly.").

[263] One example of a dynamic approach to managing network traffic is "statistical multiplexing," which refers to a network management technique that continuously adjusts bandwidth allocations to end-users in order to assure a consistent and minimum level of service for all consumers. *Managing Broadband Networks* at p. 12.

Broadband is also seeping into the business models of companies across myriad sectors of the wider U.S. economy. Indeed, these organizations are beginning to leverage broadband to support and deliver more advanced services to a wider array of consumers. While businesses have long used broadband for a variety of enterprise uses (e.g., corporate data functions), whole sectors are starting to explore how to use this technology as a platform to deliver key services. Section 6.1 highlights how two of the largest sectors of the U.S. economy - healthcare and energy - are using broadband to facilitate new lines of business and to provide consumers with ready and affordable access to cutting-edge new tools. In order to support these types of new uses, broadband service providers will require as much flexibility as possible to ensure that time-sensitive and increasingly vital services like real-time telemedicine applications are consistently delivered.

The economic impacts of current usage and demand trends on broadband service providers are explored in section 6.2. In particular, this section provides an overview of how, in the absence of net neutrality rules, the broadband sector is expected to continue growing via network investments that will provide consumers with robust access to a growing universe of content. These investments will have direct impacts on employment within the immediate communications sector and beyond as broadband is used to support new jobs and to generate significant amounts of economic output.

6.1 Broadband as a Driver of Economic Growth in Key Sectors of the U.S. Economy

In addition to providing consumers with more robust and interactive services and applications, next-generation broadband networks are also being increasingly leveraged by stakeholders in key sectors of the U.S. economy. Indeed, Congress and the FCC see broadband as a critical platform for realizing certain "national purposes" in the fields of healthcare, energy, education, public safety, and government, among others.[264] Effectively integrating broadband into these sectors could help America realize "world-leading high performance," key cost savings, and necessary increases in access to quality and affordable services.[265]

The FCC also realizes that this stage of evolution in the broadband ecosystem will impact service providers by further increasing the amount of traffic flowing through their networks. For example, in its *National Broadband Plan*, the Commission explicitly states that it is "premature" to place limits on how broadband service providers choose to handle increased traffic levels.[266] Even though the FCC's proposed nondiscrimination rule seems to contradict this *laissez-faire* attitude, the essential point is that broadband is poised to be a critical platform for transforming key industries going forward. This section provides a brief overview of how broadband will impact two key sectors of the U.S. economy: healthcare and energy.

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[264] *National Broadband Plan* at p. 193 (citing to section 6001(k)(2)(D0) of ARRA, Pub. L. No. 111-5, 123 Stat. 115).

[265] Id.

[266] Id. at p. 194.

6.1.1 *Healthcare*[267]

Broadband promises to transform the healthcare sector in two key ways. First, broadband will be used to enhance an array of administrative operations like back-office functions and managing patient prescriptions. Indeed, it has been found that e-prescribing increases prescription accuracy,[268] which contributes to overall increases in quality of care.[269] In addition, broadband will support the development of robust electronic health record systems (EHRs).[270] EHRs store an individual patient's medical history – test results, doctor recommendations, medications, etc. – in a digital form.[271] These and other health IT tools facilitate better communication among healthcare providers, which in turn allow doctors to provide their patients with more comprehensive care.[272] Studies have estimated that robust utilization of EHR systems could lead to annual cost savings of between $77 billion[273] and $80 billion.[274] Equally as important, increased investment in health IT tools could result in job gains. To this end, a recent study estimated that an investment of $10 billion in health IT in one year would create or retain 212,000 U.S. jobs.[275]

Second, broadband will support more robust and cutting-edge telemedicine services. In particular, broadband will enable the development and deployment of a wide array of remote monitoring tools and services that allow healthcare providers to observe a patient's vital signs and other health metrics in real-time. These tools encompass a wide range of services, including

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[267] The FCC dedicated Chapter 10 of its *National Broadband Plan* to examining how broadband will be used to transform healthcare in the U.S.

[268] Computerized physician order entry could save up to $1.1 billion nationally through a 13% decline in duplicate tests. *See FCC Broadband Taskforce Presentation*, at Slide 102, FCC, Sept. 29, 2009, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293742A1.pdf ("*FCC Broadband Taskforce Presentation*").

[269] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Telemedicine*, A Report to the U.S. Chamber of Commerce (April 2009) ("*Broadband & Telemedicine*").

[270] Id. at p. 11.

[271] Id. at p. 3.

[272] *See e.g.*, Press Release, *National Survey of Radiologists Reveals Systemic Problems Hurting Industry and Patient Care*, Compressus, Dec. 3, 2008, *available at* http://www.compressus.com/PDF_Press%20Releases/FH%20Compressus%20Survey%20Release%20Final-120208.pdf (reporting the results of a survey that found, among things, that "Ninety-four percent [of surveyed radiologists] connected the inability of medical imaging systems to communicate with information systems of physicians and hospitals with missed or delayed diagnosis" and "[71] percent of radiologists consider this failure to share data with other physicians and hospitals as a growing crisis for the industry.").

[273] *See* Sharona Hoffman & Andy Podgurski, *Finding a Cure: The Case for Regulation and Oversight of Electronic Health Records Systems*, 22 Harv. J. L. & Tech. 104, 116 (2008) (citing Jan Walker et al., *The Value of Health Care Information Exchange and Interoperability*, 25 Health Affairs W5-10, W5-16 (2005)).

[274] *See* Richard Hillestad et al., *Can Electronic Medical Record Systems Transform Healthcare? Potential Health Benefits, Savings, and Costs*, at 24 Health Affairs 1103 (2005). It is estimated, however, that implementing EHRs across the entire U.S. healthcare system could cost upwards of $100 billion. *See* David Goldman, *Obama's Healthcare Challenge*, CNN Money, Jan. 12, 2008, *available at* http://money.cnn.com/2009/01/12/technology/stimulus_health_care/index.htm.

[275] *Digital Road to Recovery* at p. 1.

the use of sensors to record movements, the use of wireless devices to monitor vital signs and symptoms (e.g., glucose levels[276]), and the use of cameras and software to remotely monitor several intensive care patients at once.[277] A recent study estimated that "a full embrace of remote monitoring alone could reduce healthcare expenditures by a net of $197 billion (in constant 2008 dollars) over the next 25 years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[278]

The FCC recognizes that broadband networks will play a key role in facilitating the deployment of advanced health IT and telemedicine tools. However, the Commission also notes that it is "the ecosystem of networks, applications, devices, and individual actions that drive value" in this space.[279] That notion of interconnectedness suggests that overly burdening one component of the ecosystem with stifling rules would negatively impact all other components, which would ultimately undermine the realization of the FCC's vision for broadband in the healthcare sector.

In addition, the FCC's proposed nondiscrimination rule would prevent health IT innovators from working with broadband service providers to assure priority delivery of time-sensitive tools. The impacts of this rule on innovation of managed or specialized services were discussed above in section 2.2.1.4. Nondiscrimination would also likely increase medical liability claims and other such tort cases, which have consistently inflated costs and insurance premiums across the healthcare sector.[280]

6.1.2 *Energy*[281]

In the short term, broadband will be used to modernize the electric grid by enabling "smart" technologies that provide energy providers and consumers with real-time consumption information. The deployment of a national, interoperable, broadband-enabled "smart grid" will have a number of immediate impacts on the energy sector. Indeed, many agree that the smart

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[276] MedApps, for example, has released an FDA-approved product that allows for information gleaned from its glucose measuring to be sent via Bluetooth to a patient's cell phone and transmits the information to a central server in near real-time. *See* MedGadget.com, *MedApps D-PAL Remote Patient Monitoring System for Diabetes*, July 12, 2007, *available at* http://medgadget.com/archives/2007/07/medapps_dpal_remote_patient_monitoring_system_for_diabetes.html.

[277] *See* Laura Landro, *The Picture of Health*, Wall St. J. Oct. 27, 2008, (describing an electronic ICU [eICU] program that "uses two-way video cameras and software that tracks patients' vital signs and instantly registers any changes in lab test results or physical condition. That enables doctors in the command center to spot early warning signs that a patient is taking a turn for the worse, advise bedside staff on giving medications and treatments, and point out potential errors or oversights." Further, a recent study found that average cost savings flowing from eICU programs was $5,000 per case.).

[278] *See* Robert Litan, *Vital Signs via Broadband: Remote Health Monitoring Transmit Savings, Enhances Lives*, at p. 2 (Oct. 2008), *available at* http://www.betterhealthcaretogether.org/Library/Documents/VITAL%20SIGNS%20via%20BROADBAND%20FINAL%20with%20FOREWORD%20and%20TITLE%20pp%2010%2022.pdf.

[279] *National Broadband Plan* at p. 199.

[280] *Broadband & Telemedicine* at p. 47-48.

[281] The FCC dedicated Chapter 12 of its *National Broadband Plan* to examining how broadband will be used to transform the U.S. energy sector.

grid could result in more efficient energy distribution,[282] lower carbon emissions,[283] and more rapid integration of intermittent energy sources (e.g., wind) into the fuel supply.[284]

Over the long term, innovators will leverage the vast amount of data generated by the smart grid to develop a wide array of "smart home" applications that will empower consumers to more actively manage energy consumption in an effort to drive down costs. For example, the constant flow of real-time usage data, and a consumer's ability to access that data via an online portal, will allow the customer to alter usage patterns and lower their bills via responsive pricing programs.[285] The Federal Energy Regulatory Commission estimates that the potential reduction in consumption due to demand-response programs is approximately 41,000 MW per year.[286]

In the aggregate, these efforts, combined with others focused on energy efficiency, could yield impressive economic and employment gains. For example, some have estimated that "better use of this sort of real-time information across the entire electrical grid could allow at least a 20 percent improvement in energy efficiency in the United States."[287] In addition, McKinsey estimates that, "assuming roughly $290 billion is invested in deployment of labor-intensive efficiency measures in residential and commercial sectors between 2009 and 2020," approximately 500,000 to 750,000 jobs could be created.[288]

At present, the amount of bandwidth needed to support a nationwide smart grid and the universe of smart home applications enabled by it is uncertain. However, the FCC observes that narrowband solutions are inadequate and that some type of two-way, real-time broadband connection will be necessary to facilitate the deployment of these services.[289] Moreover, since

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[282] *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Barriers to Broadband Adoption,* at p. 51, A Report to the Federal Communications Commission, N.Y. Law School, Advanced Communications Law & Policy Institute (Oct. 2009) ("*Barriers Report*").

[283] The U.S. Department of Energy estimates that robust use of the smart grid could equate to eliminating fuel and greenhouse gas emissions from 53 million cars. *See The Smart Grid: An Introduction,* at p. 7, Litos Strategic Communication (2008), *available at* http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages.pdf. In addition, the FCC has estimated that use of the smart grid may save between 60MM and 480MM tons of carbon emissions per year, while annually creating $6 billion to $40 billion in value. *FCC Broadband Taskforce Presentation* at slide 108.

[284] *Barriers Report* at p. 53.

[285] *See, e.g., Primer on Demand-Side Management,* at p. 30-32, Charles River Associates (Feb. 2005), *available at* http://siteresources.worldbank.org/INTENERGY/Resources/PrimeronDemand-SideManagement.pdf (describing a real-time pricing pilot project in Chicago).

[286] *See Smart Grid System Report,* at p. 30, U.S. Dept. of Energy (July 2009), *available at* http://www.oe.energy.gov/DocumentsandMedia/SGSRMain_090707_lowres.pdf (citing a Dec. 2008 FERC staff report on advanced metering and demand response).

[287] *See* Bracken Hendricks, *Wired for Progress: Building a National Clean-Energy Smart Grid, Version 1.0,* at p. 31, Center for American Progress (Feb. 2009), *available at* http://www.americanprogress.org/issues/2009/02/pdf/electricity_grid.pdf.

[288] *See* Hannah Choi Granade et al., *Unlocking Energy Efficiency in the U.S. Economy,* at p. 99, McKinsey Global Energy and Materials, McKinsey & Co. (2009), *available at* http://www.mckinsey.com/clientservice/electricpowernaturalgas/downloads/US_energy_efficiency_full_report.pdf.

[289] *National Broadband Plan* at p. 251.

these technologies are so new and still emerging, some have cautioned that current bandwidth estimates are likely inadequate to support the full range of smart energy tools envisioned by the FCC.[290] Thus, in order to assure the realization of the many economic benefits associated with a national smart grid, broadband service providers must have sufficient flexibility to experiment with business models and network management strategies in order to guarantee reliable delivery of time-sensitive consumption data and energy efficiency applications.

6.2 What this Means: Estimating the Economic Impacts of the Likely Evolution of Broadband on Jobs and Investment

In the absence of network neutrality rules – i.e., under the current regulatory approach – the broadband ecosystem is expected to continue thriving. In particular, capital expenditures by broadband network owners and other innovators in the ecosystem are expected to continue apace. Consequently, the number of jobs created or sustained by the fruits of these investments and innovations is also expected to rise.

With regard to capital expenditures, two economists estimate that probable investments between 2010 and 2015 under the current regulatory rubric will continue to increase. They projected annual average capital expenditures of:

- $12.5 billion in fiber-to-the-home and fiber-to-the-node;
- $3.6 billion in cable broadband, including DOCSIS 3.0;
- $14.0 billion in wireless; and
- $300 million in satellite broadband.[291]

Total broadband investment over the five-year period could thus reach $152 billion.

These economists also estimated the corresponding job creation through 2015. They found that, absent new regulation that discouraged investment, broadband is likely to create and sustain 509,000 new jobs.[292] Similarly, a January 2009 report from the ITIF examined the broader impact of broadband investment, including "network effects." To this end, ITIF estimated that an increase of just $10 billion in broadband capital investment could spur the creation or retention of 498,000 jobs.[293] These include direct employment at telecom and cable service providers, employment from manufacturing capital goods, induced and indirect job gains, and network effects that lead to greater productivity and opportunity throughout the economy.

These large potential impacts logically follow both from the deeply interconnected nature of the digital world and from the positive "network effects" that broadband offers the rest of the economy. Key American technology companies like Qualcomm, Cisco, and Corning – the

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[290] Id. (citing comments by Southern California Edison).

[291] *Crandall & Singer Jobs Paper – 2010* at p. 38.

[292] Id.

[293] *Digital Road to Recovery* at p. 5.

respective world leaders in the fields of wireless, networking, and optics – have written critically of the FCC's proposed rules.[294] These are the companies whose technologies make broadband communications – and thus all wonders of the Web, from software apps to high-definition multimedia – possible.

The technologies of Qualcomm and Cisco, and their many competitors, are specifically designed to enable differentiated treatment of digital packets and applications – in real time, billions of times per second. Prohibiting these companies from performing their essential tasks would devastate their businesses.

Corning is the chief innovator in fiber optics, the most important bandwidth-expanding technology in history. Today, a single optical fiber can transmit 69 terabits per second over a distance of 240 kilometers.[295] Sixty-nine terabits (approximately eight terabytes) was twice the monthly traffic of the entire Internet in 1991.[296] Corning is a central player in wiring the world with broadband. Its fiber not only connects cities to one another and brings fiber to the home, but increasingly connects cell towers and broadband wireless nodes. This backhaul function is one of today's critical bottlenecks that must be resolved to expand wireless broadband coverage and capacity. Corning is highly dependent on capital investment by the large infrastructure players, and any decrease in cap ex decisions would directly affect its employment prospects.

These are just several high-profile examples of non-service provider companies that would bear the impact of net neutrality regulation.

At nearly 14 percent of all U.S. fixed investment, the software portion of the digital economy is even larger.[297] Yet it is just as dependent on robust broadband as other components of the ecosystem. Indeed, as more applications and services move into "the cloud," software will become ever more dependent on fast and ubiquitous broadband links to data centers, enterprise clusters, peripheral devices and displays, and end-users.

As a result of the completion of several large-scale labor-intensive capital projects over the next few years, namely Verizon's FiOS and AT&T's Uverse fiber deployments, the Bureau of Labor Statistics (BLS) estimates that, because of these and other factors, total direct

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[294] *See, e.g.*, Comments of Qualcomm Incorporated, GN Docket No. 09-191 (filed Jan. 14, 2010), *available at* http://fjallfoss.fcc.gov/ecfs/document/view?id=7020378228; Comments of Cisco Systems Inc., GN Docket No. 09-191 (filed Jan. 14, 2010), available at http://fjallfoss.fcc.gov/ecfs/document/view?id=7020374147; Comments of Corning Incorporated, GN Docket No. 09-191 (filed Jan. 14, 2010), available at http://fjallfoss.fcc.gov/ecfs/document/view?id=7020376304.

[295] See Press Release, *World Record 69-Terabit Capacity for Optical Transmission over a Single Optical Fiber*, NTT Japan, March 25, 2010, *available at* http://www.ntt.co.jp/news2010/1003e/100325a.html (noting the new technical advance).

[296] *See* Minnesota Internet Traffic Studies (MINTS) for historical traffic estimates, *available at* http://www.dtc.umn.edu/mints/home.php.

[297] *See National Economic Accounts*, Tables 5.5.5U and 5.4.5U, U.S. Bureau of Economic Analysis, *available at* http://www.bea.gov/national/nipaweb/index.asp.

telecommunications employment may decline over the next decade.[298] However, the wider digital economy, which is enabled by the nation's broadband infrastructure, is expected to grow faster than almost any other sector. The BLS projects "management, scientific, and technical consulting services" will produce more new jobs than any other occupational segment between 2008 and 2018, and "computer systems design and related services" will create the third most.[299] These two segments, which could alone add 1.5 million new jobs by 2018, are almost completely dependent on a robust broadband ecosystem.[300]

6.3 Conclusions

More intensive utilization of broadband by consumers and by industries like healthcare and energy are prompting broadband service providers to alter business models and investment strategies in an effort to accommodate these new uses. As noted above, broadband service providers are preparing to meet seemingly insatiable consumer demand for new services with increased investment in networks. These investments will not only yield better and more reliable broadband service, they will also result in the creation of hundreds of thousands of jobs in the coming years. Thus, as demonstrated in sections 2 and 6.2, the impacts of business model and investment decisions by broadband service providers reverberate throughout the U.S. economy, generating jobs, spurring innovation, and contributing to the nation's overall economic output.

Perhaps more importantly, the analysis provided above indicates that the velocity of evolution in the broadband sector is rapidly increasing. Indeed, the pace of change and innovation in the broadband sector is remarkable. One need only examine the incredible rise of Apple's App Store to see how quickly the present market is evolving.[301] As previously noted, the mobile phone applications market went from zero to a billion-dollar-per-year industry in less than two years. This happened as a result of the efficient interplay of components in the broadband ecosystem: an advanced device (here, the iPhone) was developed to leverage a robust data network, which in turn spawned a vibrant content market. Stakeholders in the healthcare, energy, and other sectors are actively seeking to adapt this model as they begin to leverage broadband to launch new lines of business and to enhance old ones.

As a result, all members of the broadband ecosystem require the flexibility to adjust to rapid and oftentimes unpredictable changes in consumer demand and other market forces. Assuring such flexibility will result in continued innovation and consumer welfare gains. However, as described in section 5, restraining such flexibility by imposing the FCC's proposed net neutrality rules will be catastrophic not only for broadband service providers but for others in the ecosystem, consumers, and the entire U.S. economy.

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[298] *See BLS Biennial 10-year Employment Projections*, U.S. Bureau of Labor Statistics, *available at* ftp://ftp.bls.gov/pub/special.requests/ep/ind-occ.matrix/occ_xls/occ_00-0000.xls.

[299] *See* Press Release, *BLS Biennial 10-year Employment Projections*, U.S. Bureau of Labor Statistics, Dec. 10, 2009, *available at* http://www.bls.gov/news.release/pdf/ecopro.pdf.

[300] Id.

[301] Discussed in section 2.2.2, *supra*.

7. CONCLUSION

In light of the analyses included in this paper, the FCC fails to make a compelling case for radically altering the current regulatory framework for broadband. This is significant for four important reasons. First, the lack of actual evidence of a market failure and the absence of a convincing rationale in support of its proposed rules and reclassification of broadband send signals to the marketplace that the regulatory environment will be uncertain and volatile going forward.[302] As noted throughout this paper, such uncertainty has direct and negative impacts on investment, job creation, and innovation.

Second, such seemingly baseless action lessens the willingness of innovators to undertake essential "economic experiments," which are generally fostered by regulatory stability and which are crucial to a healthy, innovative marketplace.[303] Moreover, these experiments have yielded important innovations across the ecosystem (e.g., the development of a robust marketplace for add-on mobile applications) and have provided consumers with enormous welfare gains. Since these innovations are reliant on a robust and adequately managed broadband infrastructure for reliable delivery, rules that have the practical effect of lessening that reliability will negatively impact incentives for innovators to continue producing new services.

Third, the FCC's proposed network neutrality rules will likely undermine the health of the very medium that the Commission has repeatedly cited as a critical input for continued economic prosperity. Indeed, the lofty aspirations set forth in the *National Broadband Plan* and the policy and economic rationales set forth in the Commission's proposed regulations do not square. Faced with such dissonance, the FCC could have withdrawn its proposed rules and allowed organic forces in the broadband ecosystem to continue driving investment, innovation, and job creation. Unfortunately, the FCC panicked and is now attempting to further alter the regulatory landscape by imposing century-old common carrier requirements developed for basic telephony on broadband. Such actions reflect only a selfish determination to consolidate regulatory power within an agency that has proven time and again to be incapable of micromanaging a dynamic sector like broadband.

Finally, recent FCC actions around the issues of network neutrality and reclassification have further undermined confidence in this regulatory agency. Long derided as an institution vulnerable to "capture" by the very companies it regulates,[304] the Commission's recent actions have demonstrated a new willingness to ordain winners and losers in the broadband ecosystem. By limiting the ability of broadband service providers to adapt business practices in order to meet shifting consumer demands, the FCC would take the bold and unprecedented step of favoring one type of business (i.e., content) over another (i.e., broadband service). As discussed throughout this paper, these actions would have severely negative impacts on the U.S. economy and would fundamentally undermine the very notion of an ecosystem that the Commission so passionately touts.

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[302] An industry analyst recently warned investors not to underestimate the potential negative consequences of broadband regulation via reclassifying the technology as a common carrier subject to regulation under Title II of the Communications Act. *See* Craig Moffet, *Weekend Media Blast*, Sanford Bernstein, May 29, 2010.

[303] *Signs of Innovative Health* at p. 42-46.

[304] *See, e.g.*, Philip Weiser, *Institutional Design, FCC Reform, and the Hidden Side of the Administrative State*, 61 Admin. L. R.675, 683-684 (2009).

APPENDIX

This appendix shows a detailed breakdown of the negative scenarios considered, compared to the Baseline and positive scenarios considered.

Scenario X – 10% Decline Versus Baseline – 2010-2015

	Cap Ex	Jobs	GDP
compared to Scenario 1			
Wireline	-1.61	-29,900	-4.92
Wireless	-1.43	-20,900	-4.11
Total	-3.04	-50,800	-9.03
compared to Scenario 2			
Wireline	-4.83	-89,700	-14.76
Wireless	-4.29	-62,700	-12.33
Total	-9.12	-152,400	-27.09
compared to Scenario 4			
Wireline	-1.61	-29,900	-4.92
Wireless	-1.43	-20,900	-4.11
Spillovers	-18.1	-452,081	-53.8
Total	-21.14	-502,881	-62.83
compared to Scenario 5			
Wireline	-4.83	-89,700	-14.76
Wireless	-4.29	-62,700	-12.33
Spillovers	-18.1	-452,081	-53.8
Total	-27.22	-604,481	-80.89

Average annual decrease, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

Scenario 2X – 20% Decline Versus Baseline – 2010-2015

	Cap Ex	Jobs	GDP
compared to Scenario 1			
Wireline	-3.22	-59,800	-9.84
Wireless	-2.86	-41,800	-8.22
Total	-6.08	-101,600	-18.06
compared to Scenario 2			
Wireline	-6.44	-119,600	-19.68
Wireless	-5.72	-83,600	-16.44
Total	-12.16	-203,200	-36.12
compared to Scenario 4			
Wireline	-3.22	-59,800	-9.84
Wireless	-2.86	-41,800	-8.22
Spillovers	-18.1	-452,081	-53.8
Total	-24.18	-553,681	-71.86
compared to Scenario 5			
Wireline	-6.44	-119,600	-19.68
Wireless	-5.72	-83,600	-16.44
Spillovers	-18.1	-452,081	-53.8
Total	-30.26	-655,281	-89.92

Average annual decrease, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

Scenario 3X – 30% Decline Versus Baseline – 2010-2015

	Cap Ex	Jobs	GDP
compared to Scenario 1			
Wireline	-4.83	-89,700	-14.76
Wireless	-4.29	-62,700	-12.33
Total	-9.12	-152,400	-27.09
compared to Scenario 2			
Wireline	-8.05	-149,500	-24.6
Wireless	-7.15	-104,500	-20.55
Total	-15.2	-254,000	-45.15
compared to Scenario 4			
Wireline	-4.83	-89,700	-14.76
Wireless	-4.29	-62,700	-12.33
Spillovers	-18.1	-452,081	-53.8
Total	-27.22	-604,481	-80.89
compared to Scenario 5			
Wireline	-8.05	-149,500	-24.6
Wireless	-7.15	-104,500	-20.55
Spillovers	-18.1	-452,081	-53.8
Total	-33.3	-706,081	-98.95

Average annual decrease, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

Scenario 4X – 40% Wireless Decline Versus Baseline / 10% Wireline Decline – 2010-2015

	Cap Ex	Jobs	GDP
compared to Scenario 1			
Wireline	-1.61	-29,900	-4.92
Wireless	-5.72	-83,600	-16.44
Total	-7.33	-113,500	-21.36
compared to Scenario 2			
Wireline	-4.83	-89,700	-14.76
Wireless	-8.58	-125,400	-24.66
Total	-13.41	-215,100	-39.42
compared to Scenario 4			
Wireline	-1.61	-29,900	-4.92
Wireless	-5.72	-83,600	-16.44
Spillovers	-18.1	-452,081	-53.8
Total	-25.43	-565,581	-75.16
compared to Scenario 5			
Wireline	-4.83	-89,700	-14.76
Wireless	-8.58	-125,400	-24.66
Spillovers	-18.1	-452,081	-53.8
Total	-31.51	-667,181	-93.22

Average annual decrease, 2010-2015.
Cap ex and GDP in billions of US$.
Jobs are defined as "created or sustained."

Attachment #6

THE IMPACT OF BROADBAND ON EDUCATION

A Study Commissioned by the U.S. Chamber of Commerce

DECEMBER 2010

A REPORT TO THE U.S. CHAMBER OF COMMERCE

THE IMPACT OF BROADBAND ON EDUCATION

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The views expressed herein are those of the authors and do not necessarily represent those of New York Law School.

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1. EXECUTIVE SUMMARY

Enhancing the educational opportunities available to students of all ages in the United States has long been a priority for policymakers, educators, and parents. Progress, however, has been slow. Indeed, a landmark study commissioned by the U.S. Department of Education in 1983 tersely concluded that the nation was "at risk" because "the educational foundations of our society [are] being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people."[1] Twenty-five years later, a follow-up study concluded that, despite successes in improving the quality of education and various test scores across most demographics,[2] the nation remained at risk, especially at a time when the "rising demands of our global economy, together with demographic shifts, require that we educate more students to higher levels than ever before."[3]

Many recent proposals for overhauling the nation's educational system – including President Obama's[4] – center on using technology to not only enhance the educational experience of students, but also to gather better data on student performance, streamline administrative processes, make educational services more widely available, and "foster critical thinking, problem solving, and the innovative use of knowledge."[5]

Among the many technologies that have been heralded as a transformative solution for education in the United States – e.g., radio, television, and the computer – *broadband has perhaps the greatest potential. This technology provides students, parents, administrators, and educators with a platform for enabling a wide range of innovative tools, services, applications, and hybrid approaches to teaching and learning.* This report focuses on the ability of broadband to affect fundamental change in education, the many positive impacts that this technology is currently having in a variety of educational settings, the barriers to further adoption and utilization, and recommendations for policymakers as they develop forward-looking educational policies. While broadband is not a panacea for education reform, it is positioned to serve as an essential vehicle for delivering content and tools that can be used to spur student engagement, enhance learning outcomes, facilitate collaboration and innovation among educators, and enable cost savings in the administration of education.

1.1 Education in the United States: Key Trends

Education in the United States is a lifelong pursuit that encompasses a wide range of activities, from pre-Kindergarten programs to continuing education classes for professionals. Recent studies have found that more than half (53 percent) of children aged three to four are enrolled in some sort of educational program,[6] while a similar percentage (54 percent) of adults aged 16 to 64 participate in a formal educational class

or program.[7] In coming decades, these numbers will continue to rise as the student population increases and diversifies:

- *Preschool enrollment is increasing*. Enrollment in pre-Kindergarten rose 614 percent between 1985 and 2007, from 0.2 million students to 1.1 million students.[8]
- *Enrollment in Public K-12 schools is increasing.* Public elementary school enrollment (pre-K to 8th grade) rose by 29 percent between 1985 and 2009, while secondary school enrollment increased by 20 percent.[9] Enrollment in public elementary and secondary schools is expected to set new records each year over the next decade, rising from 49.8 million students in 2009 to nearly 54 million in 2018.[10]
- *Post-secondary enrollment continues to rise.* College enrollment set a new record in 2009, with a projected 19.6 million students. Enrollment is expected to continue setting new records from fall 2010 through fall 2018, when it will total 21.3 million students.[11]
- *The student population is diversifying at a rapid rate.* Between 1988 and 2008, the percentage of white students enrolled in public schools fell from 68 percent to 55 percent, while the percentage of Hispanic students rose from 11 percent to 22 percent. During this same period, the percentage of African-American students enrolled in public schools remained almost unchanged, reaching 16 percent in 2008.[12]
- *A significant number of students with disabilities are being served.* In the 2007-08 school year, 6.6 million students were served under the Individuals with Disabilities Education Act (IDEA), comprising 13 percent of total public school enrollment.[13]

Despite the seemingly positive connotations associated with increasing student enrollments, several negative trends persist:

- *A significant number of students continue to drop out of school*. Although U.S. public school graduation rates have generally improved over the past decade, 3 out of every 10 public school students fails to finish high school with a diploma. This equates to 1.3 million students failing to graduate each year.[14] In some urban schools, more than half of students leave school.[15] Completing high school is a prerequisite for admission to college and often has a direct impact on long-term income levels.[16]
- *Demographic disparities exist in high school graduation rates*. According to a 2009 study, over three-fourths of white and Asian students earn a

high school diploma, compared to just 55 percent of Latino, 51 percent of African-American, and 50 percent of Native American students.[17]

- *Considerable demographic achievement gaps exist.* According to a 2009 report, African-American and Hispanic students lag two to three years of learning behind white students of the same age.[18] Likewise, impoverished students (i.e., those eligible for federally subsidized free lunches) are about two years behind their "better-off" classmates of the same age.[19]
- *College readiness among high school graduates is inadequate*. For those who stay in school, the quality of their education has come under increasing scrutiny. Indeed, by some estimates, less than half of students who do graduate from high school are adequately prepared for college or the workforce.[20] Moreover, nearly 40 percent of "all students who enter college must take remedial courses."[21]
- *U.S. students lag behind their international counterparts*. U.S. students have generally underperformed on a number of exams testing a variety of skills,[22] especially those in the math and science fields.[23] According to the Program for International Student Assessment, 17 countries have higher average mathematics test scores and lower income-based inequality than the United States.[24] In addition, the United States has lower high school and college graduation rates than many other industrialized nations.[25]
- *Schools are generally failing to instill 21st century skills in students.* According to one report from 2006, "the future U.S. workforce is…woefully unprepared for today's (and tomorrow's) workplace."[26]

These trends presage a looming, if not current, crisis in the quality of education offered to students of all ages in the United States. A number of solutions have been offered to reverse these trends. Foremost among these have been efforts to increase educational funding at all levels of government. Indeed, some have suggested that additional funding per student is necessary to spur achievement.[27] *However, despite a fourfold increase in funding per pupil over the last four decades, overall student achievement has "remained largely flat."*[28]

At a time of increasing globalization and technological dependence in all facets of life, failure to adequately prepare students will limit their ability to compete for jobs that require not only the mastery of traditional skills, but also a new level of literacy that involves creative, innovative problem-solving and the ability to use a variety of advanced information and communication technologies.[29] As the Federal Communications Commission (FCC) recently observed in its *National Broadband Plan*, "the demands of the new information-based economy require substantial changes to the

existing [education] system."[30] Broadband is poised to be the foundation upon which many of these changes will be realized.

1.2 Broadband and Education: Transformative Potential

Broadband-enabled technologies are redefining traditional notions of education and are leading to the development of a new, learner-centric education paradigm. In particular, broadband-enabled technologies:

- Improve the effectiveness of instruction and enhance learning outcomes through more engaging, interactive activities.[31]
- Encourage innovation in how education is delivered, which has resulted in a number of hybrid approaches to teaching (e.g., blended learning).
- Enable a wider array of professional development opportunities for educators and adult learners.
- Enhance access to quality education via distance learning programs, online learning modules, and the availability of relevant content from any location.
- Provide for more individualized learning by allowing students to engage in activities – such as educational modules and video games – that are targeted at refining or bolstering certain skills.[32]
- Enable a range of administrative efficiencies. For example, a number of affordable cloud computing services are streamlining and automating numerous administrative functions.
- Facilitate the collection and analysis of greater amounts of student data to more accurately track student performance.

Such impacts, however, are dependent on the wide availability and robust adoption of broadband and educational technologies inside and outside of the classroom, as well as on the willingness and ability of educators to incorporate these technologies into lesson plans. Unfortunately, there is no "one size fits all" solution to assuring widespread connectivity and utilization of these tools. Educators, administrators, students, and parents face a number of barriers to effectively utilizing broadband for educational purposes.[33] Yet, as discussed below, a number of inventive schools and forward-thinking teachers are using broadband to provide students with effective educational experiences and train them for the 21st century marketplace. In addition, a number of innovative stakeholders, including state and federal policymakers and leaders in the nonprofit sector, are forging creative solutions to integrating new technologies in an effort to disrupt the traditional education paradigm. Closely examining these and other

successful approaches yields useful best practices for educators as they continue to integrate new technologies into schools and curricula, and guiding principles for policymakers as they consider reforming rules governing education across the country.

1.3 Overview of the Report

Section 2 provides an analysis of how educators and other stakeholders have leveraged new technologies for educational purposes over the last century. This section also examines how the proliferation of digital technologies like the computer and the Internet has impacted educational environments. The manner in which educators have grappled with new technologies in the past helps inform how new broadband-enabled educational tools can be effectively integrated into modern classrooms.

Section 3 analyzes the current state of broadband availability and adoption across the education sector. This section assesses how students, educators, and administrators are utilizing broadband from preschool to corporate learning environments. The analysis is bifurcated and focuses first on detailing how broadband is being used by stakeholders and then, more thematically, on the array of impacts that these uses are having. Despite an upward trend in utilization and largely positive impacts stemming from these uses, fundamental barriers remain to further integrating these technologies into educational programs.

Section 4 provides a more granular discussion of the array of specific approaches being taken by various stakeholders to further integrate and utilize broadband for educational purposes. This section includes examples from:

- Pre-K through elementary school;
- Middle and high school;
- Higher education (e.g., college and graduate school); and
- Professional development and other adult learning programs.

As a result of these efforts, a vibrantly innovative educational technology industry has developed to provide educational institutions and stakeholders with ready access to an expansive universe of broadband-enabled content, tools, and applications.

Section 5 discusses the near-term and long-term impacts that more robust broadband availability and utilization will have on education. Near-term innovations at the broadband network level will provide more robust connectivity for students in the classroom, at home, and wherever else learning occurs. Several trends stemming from increased connectivity and utilization, including online learning and social learning, are examined. In the long-term, broadband will serve as a platform for significantly shifting

the education paradigm toward more individualized and interactive learning experiences, much of which will be accessed and consumed via mobile technologies. In addition, traditional institutions like colleges and universities are being transformed by ubiquitous broadband connectivity. These long-term successes, however, are dependent upon near-term innovations at the network level and the evolution of attitudes toward the use of technology for educational purposes.

Section 6 offers recommendations to policymakers at the local, state, and federal levels on how to overcome barriers to more robust adoption and utilization of broadband in education. A variety of cost-related initiatives, including fundamental reform of the federal E-rate program, will be required to support the significant investments that are necessary in the near-term to provide stakeholders with adequate broadband connections, computers, and other equipment. Additional reforms are necessary to bolster computer access, provide educators with sufficient training to effectively use broadband for educational purposes, and overcome the hesitancy or skepticism of some educators regarding the value of using broadband-enabled technologies in the classroom.

1.4 Foundational Principles

A number of *foundational principles* are discussed throughout this report and should drive public policymaking vis-à-vis broadband in education:

- Education in the United States is at a critical crossroads as the quality of education and student achievement continues to stagnate.
- Broadband is an essential component in shifting the current educational paradigm from closed, static, teacher-centered methods of education and toward learner-centered models that are more interactive, individualized, and openly accessible to all.
- Broadband is facilitating the development of a new generation of educational tools, services, and devices, which are reshaping the delivery of educational services and enabling significant benefits for students, teachers, and institutions.
- Broadband expands access to educational resources for teachers, creates efficiencies in the administration of education, and bolsters efforts to collect and analyze student performance data.
- An array of public and private sector initiatives is spurring innovation, deployment, and use of broadband-enabled education services across the nation. Public-private partnerships geared toward delivering equipment and services have been particularly effective at increasing the use of technology for educational purposes.

- Opportunities exist for local, state, and federal government to implement adaptive policies and practices that encourage continued innovation and use of broadband technologies in education. These include increased and more targeted funding for new and existing efforts, as well as the implementation of a forward-looking strategy for technology integration.

2. Educational Technology: Why it Matters & The Role of Digital Technologies in Modern Education

Over the last century, many new and emerging technologies have been adapted for use in education.[34] This section first provides an historical overview of these uses and assesses their impacts. Understanding how educators experimented with using new technologies for instructional purposes and the scope of their impacts on traditional educational paradigms provides relevant context for assessing current efforts centered on leveraging digital technologies – e.g., computers and broadband – to enhance education in the United States.

This section then examines how two specific digital technologies – the computer and the pre-broadband Internet – have impacted the way students learn and how educators teach. The myriad issues and concerns associated with using digital technologies in modern educational settings offer a number of insights and "lessons learned" for broadband policy in the education arena.

2.1 Why Technology Matters in Education: An Historical Analysis

Throughout the 20th century, new communications and mass media technologies had profound impacts on how education is structured, delivered, and consumed. Indeed, in the early part of the century, radio, film and television quickly emerged as viable mediums for the delivery of educational content and enabled significant change in traditional notions of teaching and learning. For example, film and radio were initially employed during the First and Second World Wars to train the nation's military[35] and to develop a skilled workforce at home.[36]

After the Second World War, a rising birthrate and rapidly swelling public school enrollment spurred a reevaluation of past instructional methods, which resulted in a revamped approach to school curricula – one that began to incorporate available technologies to supplement classroom activities.[37] By mid-century, television had emerged as a practical medium for instruction.[38] Also during this period, film was frequently used in schools for the depiction of historical events,[39] while radio was used

to provide recordings of classroom lectures, weather reports, and other such productions.[40]

The rapid adoption and use of these technologies for educational purposes spurred further inquiry into the effectiveness of these tools and their impacts on learning.[41] Over the next several decades, the resulting studies yielded important insights and helped educators devise new ways of using media to deliver educational content in an array of contexts.[42] *While some reluctant educators saw little value in incorporating these types of technologies into instruction,*[43] *there was a clear trend in using new media to enhance educational instruction and learning both inside and outside of school*. Foremost among these efforts was the push to leverage the ubiquity of television to deliver relevant content directly into the home.

Perhaps the most significant contribution to this emerging body of research was a report commissioned by the Carnegie Corporation regarding the "potential uses of television in preschool education." Authored by Joan Ganz Cooney, this paper built the foundation upon which *Sesame Street* was eventually developed and produced.[44] Among the many key observations and recommendations included in this paper, Cooney stressed the importance of using media – i.e., television – to "intellectually stimulate" preschool-aged children in order to ensure that a broader swath of them were ready for Kindergarten.[45] Television was a key medium because of its ubiquity, its popularity, and its ability to both entertain and educate via a carefully constructed format. Moreover, television was seen as a potentially interactive mass medium that could be leveraged to help in the development of critical skills among young viewers.[46]

In addition to positively impacting student performance in school,[47] *Sesame Street* and its progeny of educational television programs impacted in-classroom teaching methods.[48] Indeed, a study from 1974 found that these types of programs were influencing how educators taught children in Kindergarten and first- and second-grade.[49] Educators were encouraged to build upon and incorporate the lessons and themes included in these programs into their own teaching methods and curricula.[50] Even today, as computers and Internet connections continue to diffuse across the globe, some feel that television remains one of the best and most reliable educational technologies available.[51]

The popularity and effectiveness of many of these innovative approaches fostered the creation and growth of a vibrant marketplace for educational technology that, to this day, continues to thrive and proliferate. For example, as discussed below, this market has been adept at evolving parallel to the communications and information technology sector and providing parents, teachers, and students with innovative new tools like educational software and games.[52] As a result, these types of technologies have become a critical component of educating students from preschool through college.

These and other modern educational technologies have impacted traditional notions of education in a number of ways, including:

- Extending learning into the home;
- Supplementing traditional in-school education with targeted content tailored to the needs of children of a certain age or demographic group;
- The production and wide-scale dissemination of engaging and interactive educational content;
- Increased experimentation among educators regarding how to best use technology in the classroom and how to build upon the lessons being learned by students at home;
- The importance of leveraging technologies to aid in the development of critical skills before entrance into formal schooling; and
- The creation of a marketplace for educational technologies, which has spurred healthy competition and robust innovation.[53]

Despite the many positive impacts of these technologies and the new teaching methods they have inspired (see sections 3 & 4), challenges to further incorporating technology into the teaching and learning paradigm exist. Indeed, institutional resistance to change and a number of other human factors have often prevented the large-scale implementation of such tools (see section 3).[54] The emergence and increasing prevalence of a variety of digital tools – notably the computer and the Internet – have begun to assuage some of these concerns and to correct some of these negative perceptions.

2.2 The Emergence of Digital Technologies & Their Impacts on Education

In the past several decades, a second generation of educational tools – digital technologies like the computer and the Internet – has further reshaped traditional teaching and learning paradigms. Understanding how teachers, students, and parents adapted educational techniques and expectations to successfully leverage these technologies informs how broadband and broadband-enabled tools should be further integrated into the modern educational paradigm.

2.2.1 The Computer

Computers became increasingly commonplace in educational settings beginning in the late 1960s and 1970s.[55] Early uses of computers were focused primarily on "mathematics, science and engineering."[56] Educators and researchers eventually began

to expand these uses by developing programs that used the computer as a way to teach and enhance reading and as a medium for more individualized instruction.[57] Other efforts focused on assessing the impact of the computer on learning outcomes. One study from this era found that computer-based education could "increase [test] scores from 10 to 20 percentile points and reduce time necessary to achieve goals by one-third."[58] As such, "researchers were looking for new educational paradigms to take advantage of breakthroughs in computer technology" throughout much of this time period.[59]

The number of schools with computers continued to increase throughout much of the 1980s and 1990s, but their integration into instruction was fragmented because of the low number of computers per school. In 1981, about 18 percent of public schools had at least one computer for instruction; by 1990 that number grew to 97 percent.[60] However, the median number of computers in these schools was just three for K-6 schools and 16 in high schools in 1985.[61] As a result, students were not exposed to computers on a regular basis. For example, in 1987, students used the computer for just one hour per week on average.[62] In addition, educators were using the available computers to teach basic skills like word processing[63] and for "rote learning through drill-and-practice programs."[64] By the 1990s, the number of computers in schools continued to increase, but a survey of teachers in 1995 found that computers were still not widely used for instructional purposes.[65] In addition, one report found that just half of all teachers had taken part in professional development for technology usage in the classroom.[66] Yet, despite these trends, educational technology was "perceived as a major vehicle in the educational system reform movement."[67]

During this period, schools began to investigate the impacts associated with providing each student with a computer. So-called "one-to-one" (or 1:1) computing began in earnest in the United States in 1997 when Microsoft launched its "Anytime Anywhere Learning" program, which partnered with some one thousand schools to deploy laptops to each student.[68] Even though this program eventually floundered as a result of many schools being unable to sustain 1:1 initiatives, laptop use continued to expand in schools, replacing bulky and outdated desktop computers.[69] Currently, about 6 percent of public schools[70] and 12 percent of higher education institutions provide laptops to individual students.[71] These numbers will likely rise over the next few years as initiatives supported by federal stimulus funding are deployed (see sections 5 and 6). Moreover, some states have gone so far as to mandate 1:1 computing in schools (see Case Study #1).[72]

CASE STUDY #1
Maine's One-to-One Laptop Initiative

Maine was the first state in the country to implement a 1:1 computing initiative on a state level. In 2001, the state convened a Task Force to recommend how best to structure and deploy this program. The Task Force recommended that the state "pursue a plan to deploy learning technology to all of Maine's students and teachers in 7th and 8th grade and then to look at continuing the program to other grade levels." The program was officially launched in 2002 after passage of a state law that created a Technology Endowment to fund the program.

The impacts of this initiative have been closely studied by researchers. A report issued after the program's first phase (2002-2004) found ample evidence of positive impacts and concluded that "there is already substantial self-reported evidence that student learning has increased and improved." Subsequent studies have consistently found positive impacts on overall learning outcomes and student enthusiasm. Moreover, several pilot programs leveraging the 1:1 initiative have resulted in positive impacts on the teaching and learning of science and math.

In addition to assessing the positive impacts of this statewide initiative, the state and several research institutions have identified best practices associated with effectively implementing 1:1 computing initiatives. These include ensuring adequate teacher teaching, providing ongoing professional development, and making technical support resources widely available.

The impacts of one-to-one computing have been closely studied for much of the past decade. Even though some have argued against the "technotopian" vision underlying 1:1 computing,[73] many studies have found that well-designed initiatives can have positive impacts on student learning and educational performance. For example, a 2005 study found that students with personal laptops "tended to earn significantly higher test scores and grades for writing, English-language arts, mathematics, and overall Grade Point Averages."[74] Another study compared schools with 4:1, 2:1, and 1:1 student-computer ratios, and found that a 1:1 ratio had a number of advantages.[75] The study found, for example, that students with a laptop used the computer more frequently at home for academic purposes and received less large group instruction in a one-to-one learning environment.[76] A 2006 study observed that a key component of successful 1:1 initiatives was an engaged teaching faculty that viewed the laptops as a positive learning tool.[77] A series of studies published in January 2010 confirmed many previous findings.[78] The general conclusion across each of these studies was that, even though there are many variables involved in effectively deploying a 1:1 laptop program,[79] those initiatives that allowed students to take their computers home had the largest impact on performance.[80]

Laptops and other individual computing devices (e.g., cellphones and smartphones) are increasingly leveraging wired and wireless broadband networks to further enhance the overall learning experience of students (see sections 3 and 5 more additional discussions).

2.2.2 The Internet

Although the Internet was first developed in the 1960s by the U.S. Department of Defense in collaboration with several research institutions,[81] it took until the 1990s for primary and secondary schools to begin adopting and using this important technology.[82] Indeed, only 35 percent of public schools were connected to the Internet in 1994.[83] However, as a result of wide commercial appeal and rapid consumer adoption of this technology, along with federal funding via the E-rate program, the percentage of public schools that were connected to the Internet exploded in the late 1990s, reaching 95 percent in 1999 and 100 percent in 2003.[84] Internet at the classroom level also increased exponentially over the same period of time, rising from just three percent of public school instructional rooms in 1994 to 94 percent in 2004.[85] However, the number of public school computers with Internet access available per student remained low through the end of the century.[86]

Despite these limitations, the Internet showed significant potential in education. For example, the emergence of the World Wide Web in the 1990s provided access to "an unprecedented volume of information" for use in teaching and learning regardless of location.[87] As a result, educators at every level began to explore how to use the Internet in their instruction, and innovators developed new tools that leveraged this new technology. National Geographic's KidsNet, for example, was created in 1987 to foster inquiry-based learning amongst elementary school children.[88] Through the program, students performed scientific experiments, analyzed trends, and communicated with practicing scientists through e-mail, and sent the results of their experiments to be combined with national and international results. The vast majority of participating teachers – more than 90 percent – found that "using KidsNet significantly increased students' interest in science, and that their classes spent almost twice the amount of time on science than they otherwise did."[89] By 1991, KidsNet was being used in over 6,000 classrooms in 72 countries.[90] These types of online tools demonstrated the potential for computers and the Internet to "create a global classroom."[91]

During this same period, the Internet was increasingly used to deliver educational courses and content to remote areas. Between 1994 and 1995, enrollment in distance education courses in higher education nearly doubled.[92] Further, 78 percent of public four-year higher education institutions offered distance learning at this time.[93] Distance education was widely viewed as a "low-cost means of providing instruction to students who might not otherwise have had access,"[94] and served as a precursor to current broadband-enabled online educational models (see section 3).

2.3 Conclusions

The potential impacts of technology on education have long been subject to hyperbole. For example, Thomas Edison in the 1920s predicted that "the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks."[95] Similarly, a 1982 article in *Time* magazine hailed the arrival of "microcomputers" and heralded an "electronic revolution" in the education of young children.[96] Despite these misguided predictions, technology has always played an important role in education. *Among other things, new technologies challenge the status quo and spur innovation in teaching and learning.* More recently, the availability of more affordable computers and access to an expanding Internet of Web content has spurred rapid adoption and use of digital technologies in educational settings across the continuum.

Technology is thus an important and vital component of education so long as it is effectively integrated. Experimentation in 1:1 laptop programs and online learning is still ongoing, and the emergence of robust broadband networks is driving similar innovation in schools and homes across the country. *As discussed in section 3, broadband is having wide and profound impacts on the education sector and is poised to fulfill the promise of its technological predecessors.*

3. Broadband & Education: Assessing Broadband Adoption & Analyzing the Impacts of its Use Across the Continuum of Education

Broadband Internet access is poised to fundamentally alter the education paradigm in the United States. Indeed, several recent inquiries by federal agencies like the Federal Communications Commission (FCC) and the U.S. Department of Education (DOE) have positioned broadband as an essential component of 21st century learning. For example, U.S. Secretary of Education Arne Duncan has stated that "broadband access and online learning…presents a huge opportunity that can be leveraged in rural communities and inner-city urban settings, particularly in subjects where there is a shortage of highly qualified teachers. At the same time, good teachers can utilize new technology to accelerate learning and provide extended learning opportunities for students."[97] To this end, robust connectivity to and effective utilization of broadband is at the heart of the DOE's *National Education Technology Plan.*[98] Similarly, the FCC has observed that broadband "can be an important tool to help educators, parents and students meet major challenges in education. The country's economic welfare and long-term success depend on improving learning for all students, and broadband-enabled solutions hold tremendous promise to help reverse patterns of low achievement."[99]

The potential impacts of effectively harnessing the numerous broadband-enabled tools and applications for educational purposes are enormous across the continuum. Yet, despite its seemingly limitless upside, several barriers exist to further adoption and use of these technologies by educators and institutions. Indeed, the FCC has observed that "the education community needs better aligned incentives to realize the potential of broadband in schools."[100]

Section 3.1 assesses current levels of availability and adoption of broadband in education. Accurately gauging these levels assists in identifying gaps that exist between schools that are actively leveraging broadband for student gains inside and outside of the classroom and schools that have access to broadband but that, for whatever reason, have chosen not to utilize it. This section also identifies several barriers to more robust adoption and utilization of broadband by schools, teachers, and students.

Section 3.2 providers a more granular analysis of how broadband is being used and how it is impacting users. In particular, this section assesses levels of use by and impacts of broadband on:

- Students from pre-Kindergarten through High School;
- K-12 Educators;
- Students and Educators in Higher Education;
- The Administration of Education; and
- Adult Education.

* * * * *

3.1 The Availability and Adoption of Broadband in Education

As discussed in section 2, digital technologies have transformed how educational content is delivered, used, and consumed by educators, parents, and teachers. Broadband-enabled educational tools, devices, and applications are having enormous impacts on students from pre-Kindergarten through adult education courses (these impacts are discussed in section 3.2). However, in order for the full range of benefits to be realized, such technologies must be universally available and adopted on a wide scale by all stakeholders in the education space.

This section examines a wide array of data to assess current levels of availability and adoption of broadband for educational purposes. Even though broadband is widely available and is increasingly being adopted by schools and households, *significant gaps remain between adopters and non-adopters.* As such, this section also explores the various

factors impeding more robust adoption and utilization of broadband in schools and at home (section 6 articulates recommendations for overcoming these barriers).

3.1.1 Availability of Broadband for Education

Deployment of broadband has progressed considerably in recent years, due largely to intense competition among broadband providers and the current regulatory framework. Indeed, several recent studies released by the FCC have found that broadband is available to nearly every household in the United States.[101] Moreover, recent research suggests that lack of available broadband prevents just a small percentage – some four percent – of the population from accessing the Internet.[102] Yet, even though broadband providers continue to invest billions of dollars in physical infrastructure,[103] broadband service still remains relatively scarce in some areas with very low population densities.[104] Overall, however, broadband is widely available to schools, universities, households with children, and other stakeholders who wish to use their Internet connection for educational purposes.[105]

In order to spur broadband deployment to truly unserved areas of the country, the federal government has placed a national priority on network build-out to these parts of the country. To this end, billions of dollars were included in a 2009 federal stimulus bill for broadband network build-out.[106] In addition, the FCC has issued a rural broadband strategy to spur deployment and adoption in these areas; enhancing educational opportunities in these areas via broadband is a key component.[107] Existing programs – e.g., the Distance Education and Telemedicine Program administered by the Department of Agriculture's Rural Utilities Service – also provide funding and other support for broadband deployment and adoption for educational purposes in rural areas.[108] As discussed in section 6, targeted policymaking and market-driven efforts will be critical to further expanding the availability of broadband.

3.1.2 Adoption of Broadband in Education

Large-scale deployments of computers and basic Internet access in educational institutions across the country over the past decade have positively impacted adoption of broadband in most contexts. Indeed, many school districts have "invested heavily in the infrastructures required to accommodate computers and the Internet [and have] commandeered resources to purchase software and technical support for students and staff."[109] As a result, broadband adoption rates in educational settings across the continuum have grown rapidly in recent years. *Yet, despite such improvements, research suggests that many educators still lack the necessary technical support and professional development for effective classroom instruction.*[110] *In addition, low per-student bandwidth rates and lack of adequate computer access may inhibit greater adoption and usage of broadband for educational purposes.*[111]

Nearly all schools in the United States are currently connected to the Internet. Estimates regarding school Internet connectivity range from 97 percent[112] to 100 percent.[113] Of those public schools with Internet access, 97 percent used broadband connections to access the Internet in 2005, up from 80 percent in 2000.[114] Yet, even though many schools report broadband connectivity, most of these connections support many concurrent users.[115] As a result, the bandwidth available per student is often very low and significantly below the minimum threshold that the FCC has designated as basic broadband.[116] One study has estimated the national average access speed per student to be just 6.5 Kbps.[117] At these speeds, many of the potential cost-savings, quality improvements, and cutting-edge educational applications are inaccessible.[118]

A fundamental barrier to more robust broadband adoption is a lack of adequate computer access in some schools. By fall 2008, there was an average of three instructional computers per classroom in schools across the United States.[119] Approximately 58 percent of schools supplemented these computers with laptops on carts, which can be wheeled from classroom to classroom as needed.[120] Only six percent of schools made computers available to students to take home.[121] A 2008 study found that over 54 percent of public school teachers reported having two computers or less in their classrooms and observed that this number is inadequate to effectively use computers for instructional purposes.[122] A variety of individual computing approaches, including 1:1 laptop programs, have been launched in recent years to close this gap (see section 2.2.1).

School and classroom access to computers is critical since many students lack such equipment and broadband connections at home. While home broadband adoption and computer ownership rates have consistently increased over the last several years, certain demographic groups still lag behind. Fully 75 percent of parents with a minor child in the home had broadband access in 2009, compared to the 65 percent national average reported by the FCC.[123] Despite this, *the adoption rates of African-Americans and low-income families still lag behind the general population.* Only 56 percent of African-Americans and 45 percent of households with incomes under $30,000 had adopted broadband by early 2010, compared to 66 percent of all adults.[124] Children in these households are thus more likely to be without a broadband connection than most other demographic groups.[125] As a result of these disparities in home connectivity, some students are more dependent upon utilizing the Internet at school and in the library. Indeed, low-income students,[126] African-American, and Hispanic children utilize the Internet from school much more regularly than other children.[127]

The costs associated with adopting and integrating broadband-based programs and services, such as 1:1 laptop programs and more robust broadband connections, may be prohibitive for many schools and universities. According to one estimate, technology integration programs can cost $15,000 per classroom and have a four-year lifespan.[128] This would total $150 per student per year in a classroom of 25 students.[129] Moreover,

the initial implementation costs for broadband access can range from several thousands of dollars to hundreds of thousands of dollars depending on a variety factors including the type of connection and the number of students served.[130] For many schools, these initial development and delivery costs are a significant barrier to greater broadband adoption.[131] In addition to implementation costs, the amount of time it takes to integrate new technologies into the curriculum and train teachers to become comfortable with the tools can significantly add to program costs.[132] Schools are overcoming such high expenses in innovative ways. Many are applying for grants and working with private organizations that agree to sponsor a classroom or school.[133] Others use E-rate funds, while some schools are beginning to allow students to bring their own devices to school.[134]

Cost issues are further exacerbated by a lack of targeted federal funding mechanisms. Though schools receive funding from a variety of sources – including the Enhancing Education Through Technology (EETT) Program (Title II, Part D of the No Child Left Behind Act), the federal E-rate program, broadband-specific stimulus funds, and education-specific stimulus funds – several issues may prevent schools from benefiting from these funds. These issues include a lack of funding overall, concerns regarding the eligibility of schools for federal funding, a lack of targeted allocation mechanisms, and cumbersome application procedures. Several recent initiatives and proposals, including the U.S. Department of Education's Race to the Top program, offer promising approaches to encouraging and rewarding innovation (see section 6 for further discussion).

> ***"I have just one computer in my classroom, though there are thirty students. And students are unable to access it, as it is situated on my desk. The computer lab is also ill-equipped for instructional purposes. So it's difficult to incorporate technology in the classroom when there aren't enough resources to go around."***
>
> ~ Steve, Teacher, 9th Grade Geography, GA

Additional barriers impede more robust adoption of broadband for educational purposes. These include lack of training and other support for teachers to effectively use broadband in their instruction, a variety of organizational barriers that may be holding educators and schools back from using technology more frequently, and an overall lack of clear standards for encouraging the development of 21st century skills among students of all ages (these are discussed in more detail section 3.2).

3.2 Uses and Impacts of Broadband in Education

Over the last decade, broadband has begun to fundamentally change the way millions of students are educated both inside and outside of the traditional classroom setting. Students of all ages are able to access vast amounts of educational content online for use in the classroom, during other school-related activities, at home, and for personal exploration. In some cases, broadband-enabled learning has replaced the traditional

classroom entirely, as evidenced by the fact that many students utilize high-speed Internet connections to take classes and complete advanced degree programs online.

Educators are using broadband-enabled tools to augment classroom curricula and provide more individualized, interactive, and real-world learning opportunities via a variety of blended learning approaches.[135] Educators are also able to access professional development resources through the Internet to enhance their instruction. Similarly, institutions of higher education are improving access to educational content by providing both free course material and traditional coursework for enrolled individuals online.

This section provides a comprehensive survey of how broadband is being used by and the impacts that these uses are having on stakeholders in an array of educational contexts, including:

- Pre-K to 12th Grade Students;
- Educators;
- Higher Education;
- Administrative Functions; and
- Adult Learners.

3.2.1 Broadband and Pre-K to 12th Grade Students

Students from pre-Kindergarten through high school are using broadband to pursue a wide array of activities online, which are enabling a number of improvements in student learning. This section: (1) provides a broad overview of these uses, and (2) assesses their impacts on students from pre-Kindergarten through high school. Snapshot #1 provides a brief overview.

SNAPSHOT #1
Uses & Impacts of Broadband Among Students in Pre-K through 12th Grade

Uses	Impacts
▪ Gaming ▪ Online learning ▪ Blended learning ▪ Mobile learning	▪ Increased number of learning environments ▪ Enhanced opportunities for disabled students ▪ Personalized instruction ▪ Enhanced learning outcomes ▪ 21st century skill development

3.2.1.1 Usage among Pre-K to 12th Grade Students

Technology is an integral part of academic life for many students. In 2005, 96 percent of children ages 8 to 18 had gone online.[136] Seventy-four percent had Internet access at home, and 61 percent used the Internet on a daily basis.[137] Over the last five years, overall media consumption by children in this age range has increased dramatically. A study released in 2010 found that children in this age group consume nearly eight hours of media each day.[138]

Technology and broadband use among younger children in particular is increasing rapidly. A study from 2007 found that 2 percent of households with newborns and children aged 1 to 4 had a computer with Internet access in those children's rooms, and 4 percent had computers with Internet access in the rooms of children aged 4 and 5.[139] About half of children age six or younger had used a computer, and 27 percent of children ages 4 to 6 spend over an hour at a computer each day.[140] Not surprisingly, children age 6 or younger spend nearly the same amount of time consuming digital media as they do playing outside.[141]

Teenagers have the highest Internet usage rates of any other age group.[142] Of the 93 percent of teenagers that are online, 63 percent go online daily.[143] Seventy-seven percent go online from schools.[144] Teenagers typically use broadband to communicate with peers, participate in educational activities, and complete school assignments. Indeed, 87 percent of teenagers ages 12 to 17 utilize electronic personal communication, in the form of text messaging, sending emails or instant messages, and commenting on social networking sites.[145] Ninety-four percent of teens use the Internet for school-related

research, and 48 percent report doing so once a week or more.[146] In addition, more than half of teens are more likely to revise and edit their work when writing with a computer.[147] Indeed, broadband-enabled tools have become so integral in daily life for most teenagers that parents have begun "digitally grounding" their children by suspending access to the Internet and cellphones.[148]

Teenage participation in other types of online activities, however, is less intensive than older and younger cohorts. For example, only eight percent of teenagers visit virtual worlds[149] and actively use Twitter.[150] In addition, teens have proven to be fickle when it comes to using certain types of online tools that could develop critical skills, like writing. For example, the percentage of online teens who maintain a blog decreased from 28 percent to 14 percent between 2006 and 2009.[151]

Broadband-enabled technology is thus a critical and increasingly indispensible component of daily life for digital "natives," students who "live most of their lives online."[152] As a result, students are using broadband and broadband-enabled tools in a variety of ways to enhance their education at home and in school. The following provides an overview of some key uses.

- **Gaming**

Casual game playing is an extremely popular activity for students. According to a recent report, three-fourths of American children play computer and video games.[153] Such tools have been shown to help children master course content and develop 21st century skills such as literacy and complex problem solving.[154] Moreover, such activities "allow teachers to tap into students' enthusiasm for digital games to engage, expand, and empower them as learners."[155] Seventy percent of casual gamers believe that games provide valuable educational benefits.[156] To illustrate, a study by the Education Development Center found that preschool students "developed early reading skills when their teachers used videos and interactive games from public television shows in the classroom."[157]

Participation in multiplayer virtual worlds is an increasingly popular trend among younger users. These games typically involve three-dimensional computer-based environments that allow first-person interaction with educational content.[158] These range widely in terms of scope and complexity. Basic offerings for young children include Disney's *Club Penguin* and *Whyville*.[159]

- **Online Learning**

Overall, a significant number of K-12 students are participating in online learning programs that provide individual courses, programs of study, and tutoring services over the Internet. A survey released by the U.S. Department of Education in 2009

estimated that more than one million K–12 students took online courses during the 2007 school year.[160] This figure is expected to increase as demand for these programs rises. A study from 2007 suggests that there is a fair amount of pent up demand for online learning programs. This study of educators, parents, and students from across the country found that more than half of high school students and one-third of middle school students "[were] interested in taking courses online that [were] not offered at their schools."[161] By 2019, about 50 percent of all courses may be delivered online.[162]

- **Blended Learning**

Blended learning programs, which combine online learning with face-to-face instruction, are also being utilized.[163] Through such programs, students are able to access high quality educational content via broadband regardless of location, income level, and other lifestyle factors. To this end, some teachers are using Web 2.0 technologies like blogs, wikis, and Twitter to supplement in-classroom learning.[164] For example, a high school teacher at the University Laboratory High School at the University of Illinois has asked students to comment on Dante's *Inferno* via Twitter.[165] Educators are increasingly using these types of approaches to leverage student interest in these types of tools for educational purposes (see section 3.2.2)

- **Mobile Learning**

With each passing year, cellphone ownership rates among children and teenagers increase dramatically.[166] Some two-thirds of all children between the ages of 8 and 18 "own their own cell phone, up from 39 percent five years ago."[167] Thirty-one percent of children aged 8 to 10 have their own cell phone, compared to 69 percent of 11-14-year olds and 85 percent of children between the ages of 15 and 18.[168] Mobile learning uses handheld devices to provide learning "anywhere, anytime," reach underserved students, improve "21st century social interactions," link students to online learning environments, and deliver more personalized learning experiences.[169] Through broadband-enabled smartphones like the iPhone and Droid, students are able to engage in a number of activities, such as accessing course assignments, completing activities, playing games, reading educational materials, and communicating with teachers and classmates.

3.2.1.2 Impacts on Pre-K to 12th Grade Students

The many and varied uses of broadband by students in pre-Kindergarten through high school have had discernible impacts on student achievement and development of real-world skills. This section identifies many of these impacts.

- **Increases the Number of Learning Environments**

Increased and diverse utilization of broadband by students, via formal channels (e.g., in the classroom) and via informal channels (e.g., at home), diversifies and increases the number of learning environments for educators, parents, and students. For example, since educational information is increasingly shared through online social networking and virtual communities, teachers are leveraging the popularity of these tools to supplement in-classroom learning by using an array of Web 2.0 tools such as wikis, blogs, videoconferencing, and podcasting.[170] These tools can be used to enable a variety of blended learning experiences, including virtual work teams, which allow individuals to work together on specific projects.[171] Case Study #2 provides an example.[172]

CASE STUDY #2
The Virtual Hall of Science

The New York Hall of Science and the Greater Southern Tier BOCES SciCenter program have launched a program aimed at working with ethnically and economically diverse young people to create a Virtual Hall of Science (VHOS). This group will collaborate to design and build the VHOS and maintain it after launch. Participants will be "trained as exhibit designers, builders, active exhibit guides and mentors." The goal of this project is to teach students much-needed science, technology, engineering and math (STEM) skills, as well as provide them with hands-on experience with information and communications technology."

The program will employ 20 high school "Explainers" and 20 middle school students, while engaging hundreds more through an online virtual world that will support the VHOS. Participating students will receive 70 hours of training in order to develop and launch the VHOS. Students will also train middle school students, create a management plan, and perform a beta test with their families before the public launch. The skills learned and developed through this project are those have been identified as critical for 21st century readiness by the International Society for Technology in Education. These include creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving and decision making, digital citizenship, and technology operation concepts. In addition, the project is expected to advance knowledge of virtual environments as an educational and workforce preparation tool.

Additional information can be found at: http://www.nysci.org/learn/research/vhos.

Broadband-enabled online learning programs are also having discernible impacts on students. By offering courses and programs of study over the Internet, students are provided greater choice and flexibility. Advanced learners are no longer limited by the courses offered by their school and can obtain the coursework they need through online opportunities.[173] Indeed, a recent survey of over 10,000 school districts found that 70 percent of respondents viewed distance learning as important for expanding access to courses not currently offered in their schools, while sixty percent cited the importance of distance learning for access to AP courses.[174] Moreover, recent studies suggest that

"online high school graduates are twice as likely to go to college as those who are not online."[175]

- **Enhances Educational Opportunities for Disabled Students**

The flexibility and ubiquitous nature of broadband-enabled learning is of particular importance to students who may have a limited ability to travel or who otherwise require home schooling. For many people with disabilities, online learning is critical.

According to the U.S. Department of Education, 13.4 percent of school children – approximately 6.6 million – participated in some kind of disabilities program in the 2007-08 school year.[176] In general, people with disabilities have completed less schooling than people without disabilities[177] and, as a result, earn less as a group than people without disabilities.[178] Broadband enables a wide array of educational opportunities for students with disabilities, including online learning and access to a variety of specialized services.[179] In addition, a number of the assistive technology features found on computers can provide students with disabilities the same access to course material as their non-disabled peers.[180]

- **More Interactive & Personalized Instruction**

Broadband-enabled educational tools enable more interactive, personalized instruction, which has been found to improve learning outcomes.

Traditional classrooms often lack in interactivity. With an average of less than 0.1 questions asked per hour, students often become disengaged and disinterested.[181] Through the innovative use of broadband, however, it is possible to "provide learners with anytime, anywhere content and interactions."[182] Indeed, computer-based instruction and tools utilized outside of the classroom encourage students to ask questions, retain student attention, and tailor content to meet various learning styles.[183] Rather than just having information fed to them from the teacher or via textbooks, students are able to actively participate in the learning process.[184] Tools such as gaming and virtual role-playing allow students to step into their textbooks and interact directly with the material and with other individuals to bolster the learning experience.[185]

Students are further engaged when instructors use technology to personalize instruction. To this end, it has been observed that "computers offer a way to customize instruction and allow students to learn in the way they are best wired to process information, in the style that conforms to them, and at a pace that matches their own."[186] This is particularly valuable for underperforming students, English language learners, and students with disabilities.[187] Several barriers, however, are holding back the creation and dissemination of more robust online educational content.[188] These are discussed in more detail in section 6.

- **Enhances Learning Outcomes**

Studies have consistently found that Internet-based technologies and tools enhance learning outcomes. For example, a 2002 study found that, in households with broadband connections, "children ages 6-17 reported that high-speed access affected both their online and offline activities, including schoolwork."[189] According to this study, since getting broadband, 66 percent of participating children spent more time online, 36 percent watched less TV, and 23 percent [improved their] grades."[190] Moreover, a recent report by the U.S. Department of Education concluded that, "[o]n average, students in online learning conditions performed better than those receiving face-to-face instruction."[191] Additional studies have found similarly positive impacts of Internet usage on student achievement in reading, literacy, mathematics, and science.[192]

A number of other studies have found that increased computer and broadband utilization among low-income households have particularly discernible impacts on learning outcomes. For example, a study by the American Psychological Association found that low-income children who used the Internet on a regular basis performed better on standardized tests of reading achievement and had higher grade point averages than did children who used it less.[193] A study of the Computers for Youth model, which provides low-income families with discounted laptops and Internet connections, also found a positive correlation between increased computer and Internet use and improved test scores.[194] (This model is discussed in more detail in section 4.1.5).

Moreover, several programs have seen marked improvements in learning outcomes as a result of Internet usage. For example, students at the Florida Virtual Schools outperformed other students on AP tests and scored 15 percentage points above the average on the state's standardized assessment test for 6th – 10th graders.[195] In Oregon, the Salem-Keizer School District has been able to re-enroll over half of high school dropouts and at-risk students through its online Bridge Program each year.[196]

- **Promotes Development of 21st Century Skills**

Broadband-enabled educational technologies play a critical role in the development of 21st century skills (see Snapshot #2).[197] Ensuring that these skills and digital literacy skills inure in students across the continuum will position the United States for continued economic prosperity in coming decades. As the FCC recently observed, "digital literacy is a necessary life skill, much like the ability to read and write."[198]

SNAPSHOT #2
Defining 21st Century Skills

Many agree that developing and honing 21st century skills is essential for all students in the United States in order to assure that they are able to compete in the global marketplace. In addition, there is wide agreement on the types of skills these will entail (e.g., creative thinking). Several organizations offer various definitions of what the full set of 21st century skills should encompass. Despite some minor differences, the following organizations agree that digital literacy is a central component of the 21st century skill set.

The Partnership for 21st Century Skills (www.21stcenturyskills.org) has articulated a framework for 21st century learning outcomes to help students garner the skills they will need to succeed in the 21st century work force. The outcomes that students should master for future success include: core subjects (e.g., English, government, and economics); 21st century themes (e.g., global awareness); learning and innovation skills (e.g., critical thinking); information, media, and technology (e.g., digital literacy); and life and career skills.

Reasoning that the "sheer magnitude of human knowledge, globalization, and the accelerating rate of change due to technology necessitate a shift in our children's education from plateaus of knowing to continuous cycles of learning," the North Central Regional Educational Laboratory and the Metiri Group have devised a similar framework that encompasses a critical set of skills for 21st Century students. These include: digital age literacy, inventive thinking, and high productivity.

By engaging students more directly in the learning process, students are able to more quickly master course content and become adept at problem solving and participating in the creation of their own content via various forms of media.[199] A variety of programs have been launched to support such skill development. For example, ThinkFinity, a Web-based educational portal supported by the Verizon Foundation, has aggregated a number of resources dedicated to driving 21st century skill development.[200]

Another unique approach is the Online Leadership Program by Global Kids.[201] This program "integrates a youth development approach and international and public policy issues into youth media programs that build digital literacy, foster substantive online dialogues, develop resources for educators, and promote civic participation."[202] In particular, Global Kids engages students in skill development via gaming, virtual worlds, digital media creation, and participation in Internet-based dialogues. Regarding the latter approach, participants in the Leadership Program are able to contribute to Newz Crew (http://newzcrew.org), which is an online discussion forum by and for students that hosts interactive conversations on an array of local, national, and global issues.

3.2.2 Broadband and Educators

Broadband is enhancing the quality and effectiveness of instruction and improving the delivery of education for teachers. Snapshot #3 provides a brief overview of how educators are using this technology and how it is impacting their ability to educate students. However, a number of challenges must be addressed before the full range of broadband-enabled tools is more fully integrated into curricula, classrooms, and schools across the country.

SNAPSHOT #3
Uses & Impacts of Broadband Among Educators

Uses	Impacts
▪ Access critical curricular & professional development resources ▪ Participate in professional development ▪ Planning ▪ Web 2.0 tools	▪ Enhanced curricula ▪ Resource sharing ▪ Increased effectiveness ▪ More interactive classrooms

3.2.2.1 Usage among Educators

Broadband enables a variety of beneficial applications for teachers. However, despite increasing utilization of many of these tools, several barriers are impeding more robust adoption. This section highlights key uses and identifies major obstacles to further use of broadband by educators.

- **Access Curricular & Professional Development Resources**

Educators are using broadband to access online information in an effort to enhance curricula, improve teaching methods, and participate in professional development programs delivered online. Many Web sites provide curriculum, lesson planning, and social support for teachers of all grade levels. Education World, for example, is a Web site offering educator resources for lesson planning, professional development, administration, technology integration, news regarding school issues, as well as an online marketplace.[203] Teachers are also using social networking sites like Ning to create

ad hoc working groups that facilitate swapping stories, advice, ideas, and lesson plans, among many other things.

A number of Web-based programs are also geared largely toward professional development and administrative support for educators. Indiana University, for example, offers fully accredited coursework online, which covers a variety of topics suited for elementary and secondary curricula.[204] Such professional development opportunities may allow educators to conveniently and cost-effectively continue their education.

- **Complete Administrative Tasks**

Educators are also using the Internet to complete certain administrative tasks and to deliver instruction. In 2008, approximately 99 percent of K-12 educators reported using computers and nearly 95 percent reported using the Internet in school at some point over the prior year.[205] The vast majority also reported using the Internet to provide data for teacher planning and "to provide assessment results and data for teachers to use to individualize instruction."[206] The portion of K-12 educators that use such technologies for administrative tasks on a daily basis is similarly high (76 percent).[207]

Teachers are also utilizing technology daily to communicate with other educators, post course information online for students, and communicate with parents through email.[208] However, less than half used technology for instruction-related activities.[209] Less than half of educators used technology daily to monitor student progress, for research and information, to instruct students, and to plan and prepare instruction.[210]

"I have 3 computers in my classroom and 20 students, so it's hard for all of my students to get computer time. I use a projector with my computer to show Web sites for science and social studies. My school has a portable "laptop lab" and I use that once a week. I love using that because all of my students are on the computers at the same time. I use a Web site called "Third Grade Skills" - it has numerous games to help reinforce skills (math and reading) that I teach each week. My kids love it!"

~ Rosemarie, 3rd Grade Teacher, Georgia

- **Leverage Web 2.0 Tools**

An increasingly popular use of broadband by educators is accessing the vast array of Web 2.0 tools for educational purposes. According to a recent study by the Consortium of School Networking (CoSN), "nearly three-quarters of [survey] respondents (superintendents and curriculum directors) said that Web 2.0 technologies had been a positive or highly positive force in students' communication skills and the quality of

their schoolwork."[211] A majority of educators surveyed by CoSN agreed that "Web 2.0 has value for teaching and learning" and that these tools have "positive or highly positive impact[s] on students' interest in school, interests outside of school, self-direction in learning… and homework habits."[212] However, concerns abound regarding the safety and effectiveness of these tools in educational settings. These are discussed more fully in section 6.

- **Barriers to More Robust Utilization by Educators**

Though increasing numbers of educators are integrating technology into their classrooms, many remain reluctant to utilize new educational technologies and to adjust their teaching methods in response to technological advances. To illustrate, one study found that 57 percent of faculty members who teach in "smart" classrooms (i.e., classrooms outfitted with advanced information and communications technologies) fail to use the technology on a daily basis.[213] Moreover, even though most students state that technology is an important aspect of learning, only 33 percent of faculty members report that technology is fully integrated into the education experience.[214] Several barriers to more robust adoption and utilization of broadband by educators explain this relatively low rate of usage.

Lack of training. The low level of technology usage in the classroom is due largely to a lack of relevant training for educators. In 2005, 83 percent of public schools with Internet access reported that their school or district trained teachers on how to integrate Internet technologies into the curriculum.[215] However, 34 percent of schools offering professional development had less than 25 percent of teachers attend the professional development courses within the previous year.[216] Moreover, a 2008 report found that, even when technology training is provided by school districts, educators believe that their training is more effective for administrative tasks, leaving them unprepared for instructional use.[217] Thus, a lack of proper educator training may be discouraging further adoption and integration of broadband-enabled technologies and tools in the classroom.

Lack of technical support. Technical support may also be in short supply, especially within schools in poorer areas. According to one study, 70 percent of educators report having sufficient technical assistance for technology use in their school, and just 67 percent report adequate help for troubleshooting or fixing problems with school technology.[218] However, a 2008 study found that educators in urban schools are more likely to report poor working conditions of school computers and less technical support to help with repairs.[219] Innovative approaches to addressing these problems have been developed in recent years (see section 4), but until they are deployed at scale, many teachers will likely be unprepared to tackle technical issues raised by broadband use at school.

Lack of supportive software. Many teachers also lack access to supportive software, which can help address questions or problems as they arise.[220] Studies have found that software tools designed specifically for educator needs "enhanced the motivation of teachers to use computers and promoted the emergence of innovative teaching practices."[221] However, throughout the education industry as a whole, "little effort has been invested to promote the maturity of educational software products, especially software designed to fulfill the instructional requirements of teachers."[222] Moreover, many federal funding programs, such as E-rate, do not provide for the software used in lesson planning, preparation, and individual instruction.[223]

Organizational barriers. Some experts claim that a number of organizational barriers are hindering further usage of broadband-enabled tools and services, such as online learning programs in the classroom.[224] While there is much support for a new "culture of learning,"[225] acceptance of technology-centered education remains a concern among many educators.[226] Cultural factors impacting broadband usage by educators include "beliefs about the nature of teaching and learning, recognition and awareness of their role as teachers based on this philosophy, and a perception of the vision that technology may produce as they engage in instruction or promote learning."[227] In addition, teachers may be "accustomed to teaching within the traditional education model and are simply satisfied with the status quo."[228]

In an effort to help educators overcome these barriers, several efforts by public and private stakeholders are focused on increasing access to technical training and support, while also emphasizing the many benefits of incorporating such tools into instruction. Some have suggested further funding of research to highlight the proven benefits of technology in education and promotes the sharing of best practices,[229] while others have suggested the need for a national public engagement effort to increase awareness of broadband-enabled tools among both public and private stakeholders.[230] These and other recommendations are discussed further in section 6.

3.2.2.2 Impacts on Educators

Broadband impacts educators in a variety of ways. For example, broadband-enabled applications are increasing both the efficiency and the quality of instruction. Teachers benefit from the variety of professional development and informative resources available online and transfer such skills into the classroom. Indeed, teacher effectiveness can be enhanced though a number of tools, such as school-based forum discussions and video libraries of best practices.[231] One study from 2006 found that an online teacher certification program prepared teachers just as successfully as traditional programs and was able to attract more diverse candidates.[232] The program was also more successful in recruiting math and science teachers.[233]

Moreover, a number of Web sites aid teachers in the creation of lesson plans and foster a culture of shared knowledge and expertise. Through such tools, professional development can become an institutional priority and be applied regularly throughout the entire year.[234] With teacher effectiveness increasingly tied to student achievement, such tools are likely to improve learning outcomes and foster the development of 21st century skills.[235]

However, one potentially negative impact of broadband-enabled innovation on educators is the speed with which these tools can change. Indeed, one recent study observed that few schools or educators are adequately trained to keep up with rapid changes in technology.[236] Such a rapid pace of change could undermine current attempts to train educators to use the current crop of tools and thus further entrench the shared skepticism of so many teachers vis-à-vis using new technologies in the classroom. However, training the next generation of educators to use broadband and broadband-enabled technologies by default, and providing all stakeholders with technical support and expertise in a more consistent manner, could help to overcome these and many other barriers to more robust adoption of broadband by educators (see sections 4 and 6).

3.2.3 Broadband and Higher Education

Higher education institutions are incorporating broadband-enabled technologies into educational models in a number of innovative ways and oftentimes at a more rapid pace than other educational institutions. These approaches are having a number of positive impacts and are redefining how post-secondary education is delivered and consumed in the United States. Snapshot #4 provides a brief overview.

SNAPSHOT #4
Uses & Impacts of Broadband in Higher Education

Uses	Impacts
▪ Research by students & educators ▪ Use in educational administration ▪ Planning & administrative tasks ▪ Online learning ▪ Mobile learning	▪ Changes in the Institutional roles of universities ▪ Creation of competitive online universities

3.2.3.1 Usage in Higher Education

Colleges in the United States have long been a locus of cutting-edge research, innovation, and utilization of new technologies.[237] For example, some of the earliest telemedicine experiments – i.e., using communications technologies to deliver healthcare services over long distances – were conducted on university campuses.[238] Similarly, the Internet was developed and used as a research tool on college campuses beginning in the 1960s.[239] As discussed below, this tradition continues with broadband.

- **Student Use**

In general, college students are using the Internet frequently and for a wide range of activities. Ninety-eight percent of undergraduate students currently own a computer, the vast majority of which are laptops that are one-year-old or less.[240] About 95 percent of undergraduate students use the Internet to access university library Web sites, and 83 percent of students report having downloaded music or videos online via their school Internet connection, with 11 percent doing so daily.[241] Content production is also a popular activity among college students. Around 45 percent of students report contributing to video Web sites, 42 percent to wikis, and about 37 percent to blogs.[242] In addition, about 38 percent of students use the Internet to make phone calls (e.g., via Skype).[243] Social networking sites are also increasingly popular, with about 96 percent of 18-24 year old students having used social networking Web sites.[244]

- **Administrative Uses**

Administrators are using broadband to deliver a variety of tools and services for use by students and educators. For example, course management platforms are widely used for the creation of online learning environments and facilitating the administration of education processes. Between 2000 and 2008, the percentage of college courses that utilized Course Management Software (CMS) or Learning Management Software (LMS) increased from about 15 percent to over 53 percent.[245] Blackboard, a top competitor in the CMS/LMS market, offers a Web-based course-management platform geared toward higher education. The platform can be used for full or partial course delivery, content management, community engagement, as well as outcomes assessment.[246] Blackboard recently introduced a mobile platform that is available on mobile devices such as the iPhone, iPod Touch, and BlackBerry.[247]

- **Open Content**

Access to educational information in higher education is also being enhanced through the provision of open content on the Web. For example, the MIT Open Courseware (OCW) initiative, launched in 2001,[248] offers open access to hundreds of undergraduate and graduate-level materials and modules, many of which are translated into over 220

languages.[249] A survey of educators using OCW found that 23 percent use the site to learn new teaching methods, while 20 percent download content to use in their own courses.[250] Moreover, M.I.T. has found that a diverse audience is accessing their open courses. Indeed, "just 9 percent of those who use M.I.T. [OCW] are educators. Forty-two percent are students enrolled at other institutions, while another 43 percent are independent learners."[251]

Hundreds of other institutions have followed MIT's example and now provide open access to educational resources.[252] Yale University, for example, currently provides free access to a selection of introductory lessons through Open Yale Courses (http://oyc.yale.edu). The project expands access to educational material for interested learners and provides lectures in video, audio, and text transcript formats.[253] Carnegie Mellon University has launched an Open Learning Initiative in order to help beginning college students through virtual simulations, labs, and tutorials that provide continuous feedback.[254] Through the initiative, Carnegie Mellon found that "blending" online learning with in-person instruction "can dramatically reduce the time required to learn a subject while greatly increasing course completion rates."[255] In addition, many universities around the world are utilizing online platforms provided by companies like Apple to offer lectures online. To this end, more than 350,000 individual classes are available through iTunes from 800 colleges and universities;[256] downloads of these offerings recently surpassed the 300 million mark.[257]

- **Online Learning**

Broadband is also being used in higher education to enable online learning, which has been embraced by students, educators, and administrators alike. More than one in four higher education students "now take at least one online course," a figure that increased 17 percent between 2007 and 2008.[258] It has been estimated that 12.2 million students have enrolled in college-level credit-granting distance education courses, and of these enrollments, 77 percent were reported online courses, 12 percent in hybrid/blended enrollments, and 10 percent were reported in other types of distance education courses.[259] Internet-based technologies were cited as the most widely used distance-learning technology.[260] Examples of online learning in higher education settings vary widely and range from Harvard University's Extension schools, a continuing education program,[261] to New York Law School's Online Mental Disability Program (see Case Study #3).[262]

CASE STUDY #3

New York Law School's Online Mental Disability Law Program

Long a pioneer in adapting classroom learning to suit the unique needs of a diverse student body, New York Law School has launched a first-in-kind Web-based clinic that offers a variety of courses on mental disability law. The Online Mental Disability Law Program currently offers twelve semester-long courses that provide "the most up-to-date information and interpretation of the civil, criminal, and constitutional law regarding the rights of persons with mental disabilities." This program is the only online program focused on mental disability law that has been accredited by the American Bar Association.

Courses are often delivered via streaming video and are supplemented with reading assignments, online chats, and blog postings. In addition, live-streamed seminars are held several times during the semester in order to "connect in person with program faculty in order to best integrate the course material learned through the recordings, readings, blogs, and chat rooms." Additional information is available at the law school's Web site: www.nyls.edu.

- **Mobile Learning**

Broadband has also spurred an upward trend in mobile learning across many higher education institutions. Indeed, over half of undergraduate students own an Internet-capable handheld device, and an additional 12 percent plan to own one in the next year.[263] Undergraduates use their devices to access email, student administrative services, and course or learning management systems.[264]

A number of pilot programs and other efforts are underway across the nation to study the use of handheld devices for various teaching and learning purposes in higher educational settings.[265] Abilene Christian University in Texas, for example, just ended the first year of a pilot program that equipped 1,000 freshman students with either a free iPhone or iPod Touch. The devices were used for a wide array of activities, including "[W]eb apps to turn in homework, looking up campus maps, watching lecture podcasts, and checking class schedules and grades."[266] The University also experimented with using these devices to enable classroom participation, including "polling software for Abilene students to digitally raise their hand [in class]."[267] By the end of the year, 48 percent of the student body was provided a free iPhone, and 97 percent of the faculty was using iPhones as well.[268] Several institutions, including Oklahoma State University, are experimenting with iPads as supplements to or replacements of hard-copy textbooks.[269] These follow several programs at other schools that experimented with e-readers like the Kindle.[270]

3.2.3.2 Impacts in Higher Education

Increased adoption and utilization of broadband and broadband-enabled technologies are having two major impacts on higher education in the United States. *First*, as an increasingly large amount of course content migrates online, the institutional role is being shifted away from the university being a supplier of educational content and toward the university being a provider of an overall learning experience. The traditional educational experience includes "student support, tutoring and mentoring, teaching and learning, and the quality of the assessment."[271] Traditional notions of higher education are rooted in perceptions of the "academy as a place" that drew together the best minds and best resources to spur creativity and learning.[272] However, the movement toward open content and online courses is likely to reshape this traditional paradigm, even though virtual approaches to education do employ similar notions of education, teaching, and learning.[273] As open access to software, course content, textbooks, and instructors increases, and as research begins to substantiate this new approach as effective for certain students and learning purposes,[274] the overriding impact is a slow shift in the educational paradigm upon which the modern university has been built.

Second, widespread availability and adoption of broadband has spurred the development of alternative institutions for higher education. One of the leading examples has been the University of Phoenix, which launched its "online campus" in 1989 and is currently the largest private university in the United States.[275] The decreasing costs associated with providing degree programs online, which has resulted in an array of affordable programs for students, has spurred a robust marketplace for online university degrees and has further shifted the traditional higher education paradigm.[276]

3.2.4 Broadband and the Administration of Education

Snapshot #5 provides an overview of the myriad ways in which broadband is used by administrators and how this technology impacts administrative processes in educational settings across the continuum.

SNAPSHOT #5
Uses & Impacts of Broadband for Administrative Purposes

Uses	Impacts
▪ Streamline back office functions ▪ Outsource data processes ▪ Aggregate, store, and analyze student data	▪ Enhanced efficiency in completing tasks ▪ Cost savings by moving to cloud computing ▪ More collaboration

Broadband is used for a number of cost-saving and efficiency-generating administrative purposes within educational institutions at every level. For example, data systems are increasingly being utilized to improve the monitoring and management of student progress and achievement.[277] Indeed, at least 31 states currently employ student databases to track academic progress, a substantial increase from just a few years ago.[278] Many student tracking tools rely on broadband connections to safely store and reliably deliver this information. Through open source management tools, forum discussions, database evaluations, and collaborative online documents, teachers, and administrators are gaining a more dynamic view of student learning. Such tools allow student performance to be tracked over time and in comparison with statewide and international standards.[279]

Broadband is also being used to facilitate the aggregation, storage, and analysis of student-generated data. Programs such as ARIS, which is being used in New York City, "provide educators with a consolidated view of student learning-related data and tools to collaborate and share knowledge about how to accelerate student learning."[280] These tools allow educators to closely track student progress and make test results, along with attendance and other student-specific data, available to parents via an online portal.[281]

Broadband also allows for more widespread use of cloud computing services that streamline various information technology processes. Cloud computing has been defined as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."[282] These tools help institutions save money by allowing them to pay on an as-needed basis for software, platforms, and infrastructure delivered as services over the Internet.[283] By one measure, these products can cost 10 to 13 percent less than licensed commercial products with equivalent capabilities when

considering the total cost of ownership.[284] Services provided via the "cloud" can include e-mail, data set storage, course management systems, help-desk, and licensed software distribution.[285]

The use of these types of resources is increasing in American universities, as nearly 60 percent of campus IT officials believe that they will play an increasingly critical role in future plans.[286] Further, 40 percent claim that their campus is currently testing such tools for use in central IT services[287] and the majority of these institutions reported utilizing Google and Microsoft for student e-mail.[288] Other large corporations, like IBM, are also aggressively pursuing large universities as potential customers of their suite of open source and cloud computing services.[289] Such uses have two core impacts on education administration.

First, broadband-enabled administrative tools provide schools an array of lower-cost options for pursuing certain IT projects. The recent economic downturn will play a significant role in determining future developments for educational technology. Budgets have already been cut back significantly, likely impacting future IT funding streams and projects for years to come.[290] As a result, plans for IT investment have been reconsidered and redrawn to focus on opportunities with assured outcomes of increased efficiency and lower costs.[291] Consequently, the near future is likely to witness increased growth in administrative IT, open source efforts, cloud computing, and online learning opportunities to efficiently and cost-effectively improve the delivery of education.

Second, utilizing broadband facilitates administrative and operational efficiencies. As IT projects are being reevaluated, new, more focused projects are being put forward to create efficiencies in specific administrative and operational processes. For example, the reporting capabilities of student tracking systems are being improved upon, data warehouses are being utilized to streamline reporting, and standard imaging solutions are being installed to facilitate office workflows.[292] Such solutions are being deployed in order to "produce cost savings or help units increase productivity to cope with the layoffs that have already occurred."[293] Many organizations are likely to begin sourcing such activities externally in open-source collaborations.[294] Collaboration among educational institutions and IT providers to streamline the provision of administrative services "is both an economic necessity and a driver for real innovation."[295]

Through the use of cloud computing, for example, "[e]fficiencies may be realized in aggregating personnel, expertise, licensing, business continuity, and other benefits far beyond the simply joining of computer hardware."[296] The aggregation of services such as server hosting, technical support, data storage, and e-mail to achieve economies of scale will provide significant cost benefits as multiple organizations leverage their resources to provide and share IT resources.[297] Efficiencies will also be enabled through the on-demand or as-needed provision of IT services through the cloud.[298]

3.2.5 Broadband and Adult Education

Adult professionals and corporations use broadband in a number of ways in an effort to enhance the number and diversity of available learning opportunities and to bolster outcomes. Snapshot #6 provides an overview of these uses and impacts.

SNAPSHOT #6
Uses & Impacts of Broadband for Adult Education

Uses	Impacts
▪ Continuing education for adults	▪ Anytime, anywhere learning
▪ Corporate training	▪ Cost savings
▪ Collaboration regardless of geography	

Older learners utilize broadband to enable a variety of continuing education and job training opportunities. For example, online learning programs offer opportunities for professionals to further their education – whether for job training or continuing education – in a flexible, self-paced format that can be easily incorporated into their lifestyles. According to the National Center for Education Statistics, 39 percent of college students are adults over the age of 25.[299] As online degrees have become more commonplace, many employers now view such opportunities as a viable alternative to traditional education. Indeed, *"85 percent of employers representing a variety of industries across the U.S. feel that online degrees are more acceptable today than they were five years ago."*[300]

The proliferation of high-speed broadband networks has also enabled significant developments in online learning for use by corporations over the past several years. Indeed, a survey of several large corporations and organizations found that "technology was used to deliver 37 percent of formal training in 2005, up from 24 percent in 2003."[301] Another report estimated that "e-learning made up [nearly one-third] of all learning hours in the private sector in 2007."[302] IBM, for example, provides instructor-led online training through its IBM Training program. More specifically, the program offers "a comprehensive portfolio of technical training and education services designed for individuals, companies, and public organizations to acquire, maintain, and optimize their IT skills."[303]

Online learning reduces the costs to corporations and individuals, improves the effectiveness of training, and increases access to adult education. Indeed, Blackboard claims that "[b]roadband and high-speed internet access are critical elements in making online education accessible and affordable for learners. Online education, training, certification and re-skilling are more affordable than traditional education and impacts income."[304] *IBM found that its e-learning program "enables managers to learn five times as much material at one-third the cost of a classroom-only approach."*[305] *Through online learning, IBM claims to have saved $579 million in two years.*[306]

The cost savings realized from online training programs have helped some companies offset spending decreases on traditional professional development program. Indeed, while spending on corporate learning initiatives has decreased significantly, the number of online programs has increased.[307] As a result, a growing number of corporations are leveraging the popularity of social networking tools and using them as in-house research, collaboration, and learning tools for employees across the world.[308]

3.3 Conclusions

The preceding analysis supports a number of conclusions regarding how broadband is being used by and impacting students, educators, and administrators across the continuum. These include:

- Students, particularly younger ones, are avid technology users and are embracing broadband-enabled technologies to enhance their in-classroom education via online tutors, games, research, etc.
- A growing number of educators are using broadband-enabled tools to enhance their curricula, to augment classroom instruction, to engage students in learning outside of the classroom, and to participate in a variety of online professional development opportunities.
- A number of barriers exist to more robust adoption and utilization of broadband by educators and schools. These include a lack of technical training and support for incorporating these tools into curricula, negative perceptions regarding the value of using broadband in the classroom, and a variety of cost issues associated with purchasing the necessary equipment and bandwidth necessary to provide a full broadband experience.
- Higher education institutions have proven adept at leveraging high-speed broadband networks to provide coursework and resources and to manage classes through online learning environments.

- Online learning is a significant trend in K-12 schools, higher education, and private-sector professional development. Online learning decreases the costs of education, increases access to such opportunities regardless of geographic location, and enhances the effectiveness of instruction.
- An emerging trend in both K-12 and higher education involves the use of mobile devices to deliver educational content and participate in learning environments. Such tools erase the traditional borders of the classroom and facilitate more engaging interactions with learning material from any location at any time.
- Broadband-enabled tools are increasingly being used to create efficiencies and cost-savings in the administration of education across all levels.

4. The Role of Broadband in U.S. Education: A Survey of Recent Approaches

Broadband enables a multitude of applications and educational tools that are helping to reshape the education paradigm in the United States. Students are being more fully engaged in the classroom and at home via laptop initiatives, broadband connections, and new content. Broadband-enabled teaching and learning is occurring in a variety of contexts and is improving learning outcomes.[309] However, the many benefits and positive impacts of using digital technologies and broadband for educational purposes will not be fully realized without widespread adoption of broadband and computers – especially at home – and the effective integration of these tools into classrooms and other learning environments.

For those schools, teachers, and parents that remain wary or uncertain of the true value of using broadband to deliver and enhance education, numerous efforts are currently underway at every level of education to demonstrate the myriad benefits of using broadband-enabled education technologies. This section provides an overview of innovative public and private sector efforts focused on using broadband to enhance education for:

- Pre-K to 12th grade students, parents, and educators;
- Post-secondary students and educators; and
- Adult learners.

4.1 Approaches in Pre-K to High School

This section highlights an array of unique approaches at the local, state, and national level for integrating broadband into schools and using broadband-enabled tools to engage students and parents and to enhance teaching skills.

4.1.1 State & Local "Macro" Approaches to Increasing Broadband Utilization in Public Schools

To enable the far-reaching and myriad impacts of broadband in educational settings from pre-K to 12th grade, many state and local governments are working with schools and private organizations to provide access to, and necessary equipment for using, broadband and broadband-enabled technologies. These efforts often leverage statewide broadband networks and other such resources for use by individual schools.

A number of states operate large broadband networks that support a variety of educational and public institutions. For example, the Alabama Research & Education Network provides Internet access to K-12 schools, libraries, and post-secondary schools.[310] Many participating institutions receive free broadband access because of a special "legislative appropriations from the Alabama Education Trust Fund."[311] Similarly, a coalition of K-12 schools, state and local governments, the legislature, local businesses, and universities in Arizona have joined together under the auspices of the Arizona State Public Information Network (ASPIN) to ensure access to computers and the Internet.[312] Among other things, the program provides funding and information for educational programs that promote utilization of computers and broadband. One recent project of ASPIN, called Wireless Connectivity in Mohave County, provided one year of partial support to establish wireless connections in four K-12 schools in a rural Arizona community.[313]

Another program, based in California, has also partnered with stakeholders in the private-sector to promote broadband usage in schools. The Corporation for Educational Network Initiatives in California (CENIC) "designs, implements, and operates the California Research and Education Network (CalREN), a high-bandwidth, high-capacity network designed to meet the needs of California education and research communities at [K-12 and higher] educational institutions."[314] CENIC and CalREN were at the center of recent proposals by the California Broadband Task Force to leverage existing infrastructure and expertise to bring connectivity to as many schools as possible across the state.[315] Similar programs are currently in operation across the nation. They represent a critical source of funding and support for broadband access in schools.[316]

Through such networks, comprehensive online learning communities are being created and made available for use in both primary and secondary schools. Such communities include full online course programs as well as tutoring and other resources. OneCommunity's OneClassroom program, which is based in Ohio, provides an example of a comprehensive online education program serving K-12 students. According to OneCommunity, the program "is a secure, Web-based learning environment serving Northeast Ohio Counties, which delivers educational programs, technologies, and distance learning to Pre-K-12 schools to motivate students, improve educational outcomes, and increase the adoption of technology while reducing its overall cost of ownership."[317] Among other things, OneCommunity provides users with access to a "Digital Resource Library that allows students and teachers to quickly find and view state-approved content, including educational videos and other rich digital media from local and national providers."[318]

Similarly, Arizona-based IDEAL (www.ideal.azed.gov) is a comprehensive e-learning platform managed by the Arizona Department of Education and Arizona State University. Like OneClassroom, IDEAL provides educational resources for students across the state. A wide array of Web-based resources is available to help students complete homework assignments, learn new information, and prepare for their future. In addition, parental involvement is encouraged through IDEAL: Home Edition, which provides parents with information, resources, tips, and support strategies.[319] Finally, substantial content on IDEAL, however, is geared toward providing educators with resources and information regarding "professional development, standards-based curriculum resources, collaborative tools, and school improvement resources."[320]

While such efforts are focused on enhancing student achievement, teacher performance, and parental oversight via increased broadband use across entire states and across pre-K through high school, many programs are being developed at a more targeted level. The following sections explore specific efforts in a variety of contexts, including: pre-K through elementary school; middle school and high school; professional development for educators; and resources that encourage increased parental involvement in their children's education.

4.1.2 Pre-K and Elementary School

It is axiomatic that educational skills garnered at an early age are a key indicator of future academic success for students.[321] The incorporation of digital technologies into educational models for pre-K to fifth grade students is thus critical to ensuring the mastery of traditional content, as well as nurturing the development of 21st century skills. Educators, policymakers, and innovators in the private sector are deploying targeted content, tools, and approaches that use broadband to offer educational activities, information, and games to young children from preschool through fifth grade. In addition, stakeholders are increasingly integrating digital literacy requirements into

school standards in order to ensure that the next generation of workers is able to compete in a rapidly globalizing knowledge-based economy.[322] This section provides an overview of some of the tools and approaches currently in use.

- **Online Content for Young Learners**

Many Web sites provide educational information and activities for younger students, such as those created by the Sesame Workshop. For example, Sesame's Panwapa (www.panwapa.com) offers a virtual community that fosters global citizenship and a broader international perspective among young students. The Web site allows children to "travel" safely around the world, learn cultural and geographical highlights about the places visited, watch interactive movies, and learn words in other languages.[323] The site has gained international recognition and, as of December 2010, had drawn over 314,000 young users to the site.[324] In addition, Sesame Workshop recently introduced free podcasts that feature Muppet characters teaching language and reading skills to young children.[325] These tools provide "anywhere, anytime learning" for young children.[326]

Children's books are also available online. For example, the International Children's Digital Library (http://en.childrenslibrary.org) "holds the world's largest and most diverse collection of digitized children's books freely available online."[327] The library includes thousands of stories from 60 different countries that can be read in either the story's native language or in English. Moreover, the entire collection is available on iPhones and iPods through a free app available at Apple's App Store.[328] Newer devices like the iPad are spurring the digitization and creation of a wider variety of children's books. Custom-made stories and books for smaller devices like the iPhone are being bolstered for use on larger-format devices (e.g., the iPad), allowing for more interaction and engagement by younger readers.[329]

Video-sharing Web sites are also increasingly popular among children. Indeed, Kaiser's recent study of media consumption habits of children aged 8 to 18 concluded that the "story of media in young people's lives today is primarily a story of technology facilitating increased consumption. The mobile and online media revolutions have arrived in the lives – and the pockets – of American youth."[330] A variety of video providers are adapting to these new consumption patterns. For example, PorchLight Entertainment recently introduced Kid Videos, a YouTube-inspired Web site that allows children to upload and view videos, send them to friends, and comment on them.[331]

- **Leveraging Mobile Devices**

In this increasingly mobile world, integrating broadband-enabled mobile devices into the educational context is critical in order to leverage the ubiquity and popularity of these technologies among both students and parents. To this end, a number of pilot programs

have been launched to evaluate the efficacy and value of using mobile devices in the education of young students. The GeoHistorian Project, for example, is investigating "mobile phones as educational tools inside and outside the classroom" in order to "reduce barriers between schools and community resources such as zoos and museums, and above all, [provide] students the opportunity to create digital resources for their community."[332] In other words, broadband-enabled mobile technologies with built-in GPS, wireless Internet access, and Internet-based media-sharing sites are being used to connect classrooms with local historical landmarks in order to encourage "students to become video historians, creating and sharing a living history of real people and real places."[333] A pilot program in Florida, which provided pre-K through fifth graders with Palm Pilots, found that students successfully utilized the handheld devices to enhance the educational experience by, among other things, accessing the GoKnow Handheld Learning Environment. This allowed students to "use software tools that integrate word processing, concept mapping, drawing, animation, and the downloading of Web pages."[334]

- **Broadband in Pre-Kindergarten**

A variety of schools and private companies are leveraging broadband to enhance early education. IBM's KidSmart Early Learning Program, for example, "integrates new interactive teaching and learning activities using the latest technology into the pre-Kindergarten curricula."[335] Since being launched in 1998, over $106 million has been invested by IBM, building 45,000 KidSmart Early Learning Centers in 60 countries. An evaluation of the program found that participating teachers "grew significantly more adept at integrating technology into their instruction. The evaluation also found that children's comfort levels using computers increased significantly, with 99 percent of the children either comfortable or very comfortable with computers."[336]

Another pre-K-focused effort is the Georgia Pre-K Program, administered by Bright from the Start, which has served over one million students. To manage the development of so many students, Georgia's Pre-K Program uses the Work Sampling System (System), an observational student assessment system developed by Pearson, a global provider of education technology. The System is a "curriculum-embedded, teacher-guided, observational assessment in which multiple sources of documentation are gathered over time. The System involves the child, family, teacher, and program in the ongoing process of assessment and reporting."[337] The System also offers an online version, which helps educators to "efficiently and accurately gather and manage data."[338]

- **Broadband in Elementary School**

Elementary schools across the country are also experimenting with using technology inside and outside of the classroom for an array of purposes. For example, North

Elementary School in Noblesville, Indiana has launched a Virtual Library Media Center.[339] This Web site provides targeted math and literacy resources for students in Kindergarten through fourth grade, along with general resources for art, physical education, and music classes. In addition, the Virtual Library Media Center makes available social media tools like wikis, collaborative planning resources like Moodle, and a variety of databases for use by students, parents, and teachers.

Several schools in New York City are also using broadband and broadband-enabled technologies to enhance the educational experience. See Case Study #4 for an overview of these approaches.[340]

CASE STUDY#4

Innovative Elementary Schools in New York City

The New York City school district is the largest and most diverse in the country. Across more than 1,600 schools, the city's Department of Education oversees 1.1 million students and 80,000 teachers. With an annual budget of over $20 billion and a mayoral mandate supportive of innovation in how education is structured and delivered, New York City is a laboratory for experimenting with using technology to enhance learning outcomes.

Several elementary schools in the city are using broadband-enabled technologies to enhance curricula and further engage students. The Verrazano School (PS 101), located in Brooklyn, has expanded its 1:1 laptop initiative to 13 classrooms (from three) and leverages technology to engage students in maintaining the schools Web site and participating more actively in class by soliciting real-time feedback to guide teachers. According to Principal Gregg Korrol, "we must teach our students what we know they need to learn, in the context of the world in which they live." To do so, teachers administer Web-based literacy and math assessments to determine skill levels; access free online content via Teacher Tube to supplement in-classroom lessons; and reinforce lessons with podcasts and blogs. Parents are also encouraged to stay engaged via email and text messages. These technologies have had discernible impacts on learning outcomes for those students in tech-enhanced classrooms.

At PS 5 in the South Bronx, students use the One Laptop per Child XO computing model to develop 21st century skills. Fourth-grade students, for example, are tasked with writing online memoirs, while some third-graders use blogs to share poetry. Students use specialized literacy software to hone reading and writing skills. Teachers use a variety of online tools to "create individual student learning profiles to help them customize instructional activities." Parents are encouraged to access school-related materials online via a home computer or via the school's computer lab. The impacts of this approach have been similarly positive in terms of student engagement and student achievement.

4.1.3 Middle and High School

Broadband is also being used in a variety of ways to enhance education in middle schools and high schools across the country. This section provides an overview of some of these efforts.

- **Curricular Resources for Educators**

Several noteworthy efforts focused on curriculum enhancement and student tutoring provide enhanced learning opportunities both inside and outside of the classroom. Carnegie Learning (www.carnegielearning.com), for example, provides an array of curriculum resources for high school math teachers and students. Among its many offerings, Carnegie provides Blended Learning Math Curricula, which "integrate interactive software, text, and collaborative classroom activities for core, full-year math instruction."[341] Carnegie also offers a variety of math software solutions and customizable tutoring services. All of the organization's offerings are supported by professional development services in order to ensure that these tools are effectively used. Carnegie Learning has partnered with numerous school systems across the nation to deploy its services. In one instance, the Louisiana Department of Education provided students with access to Carnegie's Algebra Solutions. The participating students had higher performance outcomes than the control group of non-participating students. In another instance, a software pilot program in mathematics, funded by the Kentucky state legislature, found that all 12 participating schools "went from needing improvement to meeting [performance standards]."[342]

- **Digital Textbooks**

Increased access to and ownership of computers, particularly via 1:1 laptop initiatives (see section 2.2.1) and new pilot initiatives (discussed below), could eventually replace hard-copy student textbooks with digital versions that "can be downloaded, projected and printed, and can range from simple text to a Web-based curriculum embedded with multimedia and links to Internet content."[343] Digital versions of existing textbooks are increasingly available for purchase, while a growing number of titles are available free online. Though digital textbooks currently make up just 5 percent of the $7 billion U.S. textbook market,[344] they are gaining in popularity in many schools across the country. Indeed, California has put forward the largest effort in the United States to date through its approval of ten free math and science works for use in high schools. California Governor Arnold Schwarzenegger expects his digital textbook initiative to significantly cut the costs of education in the state and update instructional subject matter.[345] For the 2010-11 school year, California has launched an pilot program that will use iPads to replace algebra textbooks for 400 eighth-grade students.[346] The primary goal behind this initiative is to "prove the advantages of interactive digital technologies over traditional

teaching methods."[347] In general, however, several barriers are impeding more robust growth of this fledgling market (see section 6.7 for further discussion).

▪ Experimenting with Mobile Learning

A number of pilot programs are examining the efficacy of using broadband-enabled mobile devices for middle school and high school education. Project K-Nect, for example, is a pilot program that has partnered with the North Carolina Department of Public Instruction, Digital Millennial Consulting, and a number of other organizations to deliver educational material to ninth-grade students in North Carolina.[348] The program "is designed to address three core needs that include the lack of at-home Internet Access for our country's poorest families, 21st century skills development, and the math and science skills deficit."[349] According to its project director, "75 percent of classes [using these devices] outperformed other cohorts in math subjects in the recently completed first phase of research. Students also displayed "increases in average study time" and "significant gains in parental involvement" were also reported.[350]

In Arizona, a school district is experimenting with making Wi-Fi available on school buses. The "Internet Bus" experiment allows students to access the Internet on their way to school and on their way home.[351] In addition to helping students more efficiently manage their time, this experiment has resulted in a drastic drop in bus-related behavioral problems.[352]

Abilene Christian University (ACU) in Texas has launched an initiative aimed at providing rural teachers with access to new technologies in the hope that these teachers will bring these tools and lessons back to their schools. To this end, ACU has developed a three-week summer session for middle- and high-school teachers that provide educators with an iPad and instruction in how to effectively integrate it into their curricula.[353] In an effort to lure teachers to this program, ACU offers participants the chance to earn professional development credits.[354]

▪ Innovative Middle Schools and High Schools

Middle schools and high schools have emerged as leaders in experimenting with using broadband to deliver unique educational experiences and to empower students by providing more targeted content, tools, and services. For example, the Science Leadership Academy (SLA) in Philadelphia was launched in 2006 to "provide [students with] a rigorous, college-preparatory curriculum with a focus on science, technology, mathematics and entrepreneurship."[355] Students and teachers use a variety of broadband-enabled tools – including laptops via a 1:1 initiative – to complete inquiry-based learning modules and to participate in ongoing projects (e.g., students operate the school's technical help desk).[356] The unique model implemented by SLA has created a

culture of innovation and experimentation among students and teachers, and has resulted in an entirely new approach to high school education.[357]

Similar efforts are underway in schools across the country. See Case Study #5 for three examples from New York City.[358]

CASE STUDY #5
Innovative Middle Schools & High Schools in New York City

In addition to a growing number of innovative elementary schools, New York City is also home to a large number of forward-looking middle schools and high schools. For example, IS 339, a middle school based in the Bronx, has become a model for using laptops, broadband, and an array of broadband-enabled technologies to enhance learning outcomes (it was recently profiled in the PBS documentary *Digital Nation*). IS 339 uses a variety of Google tools to track student information (via Google spreadsheets), facilitate better and more timely communications (via Gmail, Gchat, and Google-enabled blogs), and streamline the submission of assignments (via Google Docs). Teachers are also encouraged to use a variety of Web-based resources to supplement and enhance lesson plans and to tailor certain lessons to individual needs. As a result of these and other tech-based methods, test scores have risen across the school.

At the high school level, leveraging broadband-enabled technologies has been one component of a multi-pronged effort to increase graduation rates, which rose to over 60 percent in 2008 (from 46 percent in 2005). Brooklyn Technical High School, for example, was created by legislative mandate to provide students with an "environment for the research and development of innovative and interdisciplinary approaches in the areas of mathematics, science, engineering, computer science and the liberal arts." Over 4,600 students enrolled in this school have a number of opportunities to use a variety of broadband-enabled technologies and tools. Students are encouraged to pursue college credit by, among other things, participating in a distance learning partnership with the North Carolina School of Science and Mathematics. Teachers and administrators use a variety of broadband-enabled tools to enhance lessons and to closely track student progress and achievement.

New York City's iSchool was launched as a model tech-based high school that "blends innovative technology with project-based curriculum modules." Students participate in one module each semester (modules focus on real-world issues). Most modules incorporate "electronic media, such as podcasts, Web sites, Facebook pages, and videos, often created by the students themselves with the school's digital cameras." Several modules leverage broadband-enabled video conferencing to speak with subject-matter experts relevant to their coursework. Students also have the opportunity to participate in online courses, which allow for more individualized and independent learning experiences.

4.1.4 Professional Development

The willingness of educators to experiment with integrating broadband-enabled educational applications into curricula is essential. However, as discussed in section 3, many educators lack adequate training and access to technical assistance and

professional development services to encourage such experimentation. To address this problem, a variety of innovative approaches have been developed.

Via the Internet, K-12 educators have access to a wealth of information and resources for using new technologies to improve teaching methods. Many Web sites provide curriculum, lesson planning, and social support for teachers of all grade levels. Education World, for example, offers resources for lesson planning, professional development, administration, technology integration, news regarding school issues, as well as an online marketplace.[359] Likewise, Internet4Classrooms provides help for educators on a wide range of subjects, including help for certain grade levels, technology tutorials, assessment assistance, and an online database of links for educators.[360] PBS also offers online resources for pre-K through 12th grade teachers.[361]

A number of Web-based programs also provide professional development and administrative support for educators. eTech Ohio, for example, "serves as a one-stop-shop for providing planning, support and information about grants, subsidies and professional development, as well as teaching, learning and technology integration."[362] The program also supplies resources for administrators and technology support staff.[363] Alabama offers educator support through the Alabama Best Practices Program, which has established a 21st Century Learners Wiki.[364] The wiki is part of a collaborative effort, enabled through funding from Microsoft, which provides access to information resources for educators.[365]

Teach for America (TFA), a national organization that trains and places teachers in schools across the country, uses broadband to provide its recruits with a variety of ongoing professional development resources. For example, TFA has launched an online portal – TFANet – that provides teachers with an interactive forum for exchanging ideas and finding "assessments, lesson plans, tips, and strategies [to ensure that] they're not constantly reinventing the wheel. [This resource] debuted in 2008 with 6,500 materials; [as of 2009], there are more than 20,000."[366] Recent innovations on this portal include the availability of online educational videos for its teachers.[367]

Onsite technical support and professional development resources are a critical component of reassuring and encouraging hesitant teachers to use technology in the classroom. Several approaches have been developed to overcome these barriers. For example, at the Goddard School in New York City, a full-time "technology facilitator" provides teachers with convenient solutions to any technical queries.[368] The school's principal has also developed a number of workshops to supplement these efforts and has outlined a clear agenda for using laptops and other educational technologies in the classroom. MOUSE, a nonprofit organization based in New York City, has developed another unique approach for providing technical support in schools (see Case Study #6).[369]

CASE STUDY #6
MOUSE

MOUSE (www.mouse.org) was launched in 1997 to bring Internet access to public schools across New York City. However, once most schools were wired, a need for technical support quickly emerged. MOUSE leveraged its existing apparatus and developed a training program for students to become onsite IT experts. These groups of students eventually evolved into MOUSE Squads, which were initially deployed in schools across New York City. These Squads represent a "cost-effective solution to the problem of inadequate levels of on-site support in schools and the need to serve the 21st century educational needs of students." Moreover, participation in these groups "broadens the learning and 'life opportunities' of youth by providing authentic hands-on experiences that build skills and the motivation to succeed in school and life."

This program has had discernible impacts on both students and schools. The vast majority of MOUSE Squad members – 89 percent – reported better schools attendance as a result of their participation. Moreover, 92 percent of MOUSE Squad members indicated that they were better prepared for college because of the program. A Fordham University study of MOUSE found that participating students had increased academic performance. A Citibank study found that "schools running the MOUSE program save an estimated $19,000 per year in technology support costs." As a result of its proven effectiveness, the model has been adopted by schools in Chicago and California. There are currently over 340 MOUSE Squads, involving more than 5,700 students.

4.1.5 Parental Engagement

Broadband and broadband-enabled technologies are increasingly being used to engage parents in the education of their children. *Studies have found that "the family and the home are both critical education institutions where children begin learning long before they start school, and where they spend much of their time after they start school."*[370] Indeed, literacy development begins and is sustained at home, and skills and lessons learned in school are reinforced by parents at home.[371] As such, ensuring that parents are actively engaged in their child's education is crucial to ensuring that knowledge is retained and that skills are further developed.

Comprehensive programs, such as Arizona's IDEAL (discussed above in section 4.1.1), provide a wide range of information for parents to foster understanding and oversight of their child's education. More focused efforts include coalitions of concerned parents and school-specific student monitoring systems. The Wisconsin Coalition of Virtual School Families, for example, "provides information and support for families who are interested in having their children educated in virtual schools and advocates for the interests of those families."[372] In addition, Edline is an online platform used by many schools to enhance course organization as well as parent-teacher communication.[373]

Through the service, parents are able to monitor student grades, school news, class news, assignments, attendance and calendars, and other relevant information.[374] This is similar to the ARIS program that New York City recently deployed (discussed above in section 3).

A variety of informational resources targeted at parents have also been developed in recent years. Many of the organizations that supply this information seek to help parents understand how their children might be using new technologies and provide interested parents with ratings and other materials to help guide them through the nearly infinite universe of online content. One of the leading organizations in this field is Common Sense Media (CSM) (www.commonsensemedia.org). CSM educates parents about how their children are using certain types of digital media (e.g., social networking sites) and how some of these tools may be impacting them. For example, CSM has developed targeted resources regarding sexting, cyberbullying, and Facebook etiquette for parents and their children.[375] In addition, CSM partners with schools to provide onsite parent-student workshops and other targeted resources.[376]

However, not all homes and parents are the same. Indeed, the percentage of two-parent households has decreased sharply over the last several decades. As a result, overburdened single parents are often left with little time to focus on their child's education.[377] Several other factors, including income disparities and lack of quality daycare programs, have resulted in many children being unprepared for school and many parents being disengaged from their child's educational development. In an effort to bridge these gaps and to engage both parents and students in an array of online learning activities, several unique approaches have been deployed to push computers, broadband, and learning into the home. Examples include Technology Goes Home (discussed in section 5.3) and Computers for Youth (see Case Study #7).[378] Several programs that received federal stimulus funding have used these approaches as models (these are discussed in more detail in sections 5 & 6).

CASE STUDY #7

Pushing Learning into the Home: Computers for Youth

Computers for Youth (CFY) (www.cfy.org), which was launched in 1998, focuses exclusively on bolstering the in-home learning environment of low-income middle school students. Via its Take IT Home program, CFY provides students and parents with hardware (i.e., a computer), pre-installed educational software, and, in some cases, subsidized broadband connections to create a home learning center that seeks to improve student learning outcomes, increase parental involvement in their child's education, and extend the reach of teachers into the home.

In order to sustain this program, CFY offers two unique services to parents and students. First, CFY regularly hosts Family Learning Workshops. Every participating family is required to attend a half-day workshop that provides a tutorial on the home learning center that they will take home with them at the end of the day. Additional programs are held on a regular basis. Second, CFY provides 24/7 bilingual technical support to answer any questions that participating families might have.

CFY works directly with educators and other personnel at partner schools to ensure that they are adequately trained to leverage these tools. To this end, CFY provides a number of professional development resources that help train teachers and parents to use technology to enhance the student learning experience.

Computers for Youth currently serve over 4,000 families each year in cities across the country. The impacts of this program have been impressive. Several analyses conducted by CFY have found that participating students report increased effort in class, more academic curiosity, and better performance. Nearly all participating parents – 90 percent – "felt more confident in helping their children learn as a result of CFY's program."

4.2 Approaches in Higher Education

Higher education institutions are incorporating broadband-enabled technologies into educational endeavors in innovative ways. Such efforts have led to the incorporation of a wide array of digital tools within the physical classroom to engage students and enhance instruction. Educational content is increasingly being provided online to increase access to high-quality instruction. Broadband-supported administrative tools are also frequently used in higher education settings to create efficiencies in the provision of educational services.

A number of online tools are available to assist in the integration of technology in postsecondary instruction. PLATO, for example, is an innovative educational technology company that provides "personalized instruction, technology-based teaching tools, and standards-driven assessment and data management."[379] A similar provider of higher education instructional tools is the Center for Computer-Assisted Legal Instruction (CALI), a non-profit consortium of law schools. CALI "researches and develops computer-mediated legal instruction and supports institutions and individuals using technology and distance learning in legal education."[380] Interactive

lessons and educational materials on numerous law school subject areas are offered through the Web site in an interactive, question and answer format.[381]

More targeted efforts are being deployed in higher education classrooms to provide innovative educational experiences. For instance, a professor at the Indiana University School of Social Work has implemented a program through which virtual seminars are held with students in Second Life, a virtual world.[382] Students create avatars and interact with other students and the professor online. Another professor at Northeastern University in Boston lectures his students through streaming videos that remote students are able to view online.[383]

Twitter is also being applied as an educational tool by some professors. Live discussion threads are implemented during class lectures, which provide for the real-time sharing of feedback and information, as well as the gathering of useful data.[384] This type of tool also allows professors to acquire some additional insight into how students are reacting to course material during the lecture.[385] Students may also be more motivated and able to participate in class discussions, as participation is no longer dependent on speaking out in front of the class and discussions can be extended beyond class-time.[386]

Broadband is also being used by educators to collaborate with colleagues and to share best practices. To this end, the Carnegie Foundation for the Advancement of Teaching recently launched an open version of its learning environment – the Teaching and Learning Commons – to facilitate the sharing of case studies regarding teaching and learning projects and to provide access to a number of Web-based tools used to create the case studies. The Commons allows educators at all levels and all locations to share experiences and participate in conversations regarding teaching practices.[387]

4.3 Adult Education

In addition to its impacts on students from pre-K through 12th grade and higher education, broadband is being used to enhance adult education and corporate professional development. To this end, numerous companies are using broadband to expand their corporate training services. In addition, as a result of increasing utilization of Web-based tools and services by corporations, several organizations are now specializing in the delivery of these tools. As such, a large number of companies are devoted to delivering employee training services over the Internet. Though there has been a decrease in overall spending on professional online learning programs over the last few years, broadband continues to facilitate efficiencies, cost savings, and increased access to corporate professional development programs.

A leading company in the delivery of such content is Enspire Learning. Enspire "creates learning experiences that address strategic business and training challenges."[388] It

provides custom e-learning development applications that drive employee retention and change behavior, as well as simulations and game-based learning, and custom learning solutions that address business issues in areas such as finance, leadership development and business process improvement.[389]

Such professional development tools are being used to increase the accessibility and efficiency of employee training. Quiznos, for example, trains its employees via its Corporate University, which consists of a nine-month blended learning curriculum. The University offers a number of educational materials via an online platform, including required lessons and tutorials as well as online operations manuals.[390] The program also utilizes the Quiznos Sub Commander Game, which remotely trains its many franchise members to, among other things, make sandwiches.[391]

Similar approaches to online training are also being developed and adopted abroad. The Kenya Nurse Upgrading Program, for example, uses e-learning to educate and train Kenyan nurses. In 2005, the program began "with a pilot of four schools and 145 students and aims to upgrade 22,000 Enrolled Community Health Nurses from 'enrolled' to 'registered' within 5 years."[392] This program utilizes e-learning to deliver the training "due to its interactivity, cost effectiveness, ease of revision and ability to achieve the goal in less time and at a lower cost than the residential" program.[393] To date, this program has increased the number of registered nurses in Kenya.[394]

4.4 Conclusions

The many innovative efforts being implemented across the continuum of education – from preschool through high school and college and into the corporate world – has spurred a vibrantly innovative educational technology industry. Moreover, educators and parents are increasingly aware of the fact that, with their students and children spending more time online, the best and more effective ways of engaging and stimulating them exist in those virtual spaces. As a result, an increasing amount of educational content is migrating online, and new technologies are being deployed to facilitate access and the delivery of these tools and applications. Broadband is thus an essential and versatile vehicle that provides many of these tools with a reliable and fast medium through which they can be made widely available to students across the nation and around the world. As discussed in the next section, broadband will continue to play a major role in shifting the education paradigm and transforming the ways in which education is delivered and consumed.

5. THE IMPACT OF GREATER BROADBAND AVAILABILITY & TECHNOLOGICAL ADVANCES ON EDUCATION

Greater broadband availability and continued technological innovation at the network level and across the education sector will impact students, parents, and educators in profound ways in both the near-term and long-term. This section provides an overview of innovations at the broadband network level and assesses how innovators, educators, parents, students, and other stakeholders will leverage these advanced networks to deploy cutting-edge educational content.

5.1 Innovation at the Broadband Network Level

Many of the innovations in educational technology described in previous sections rely on advanced broadband networks to deliver content, tools, and services. Future advances in the transmission of educational content will, in both the near- and long-terms, increasingly depend on more robust broadband connections to assure timely and reliable delivery of time-sensitive data and content to educators, parents, and students. As such, innovation at the network level will ensure that educational technologies are widely available and reliably delivered.

Despite the recent economic downturn, broadband network owners continue to invest billions of dollars each year to bolster their infrastructure and to reach new customers. Indeed, network owners invested some $30 billion in broadband networks in 2009, representing about half of their capital expenditures.[395] Many expect that, in the absence regulatory uncertainty, service providers will continue to invest similarly large sums of money in their networks over the next several years.[396]

However, as discussed in section 3.1.1, pockets of the country remain unserved. In order to reach these areas, the federal government has funded two grant programs dedicated to spurring broadband availability in unserved and under-served regions of the country. The goal of these programs – the Broadband Technology Opportunities Program (BTOP), administered by the National Telecommunications & Information Administration at the U.S. Department of Commerce,[397] and the Broadband Initiative Program, administered by the Rural Utilities Service at the U.S. Department of Agriculture[398] – is to fund broadband infrastructure deployments to unserved parts of the country and to support programs that seek to sustain broadband adoption and make computers more widely available.[399]

In addition to these targeted efforts, network owners continue to deploy new infrastructure and update existing networks.[400] For example, companies like AT&T[401] and Verizon[402] are bolstering their networks by deploying wide-scale fiber-optic lines to

increase the speed of data transmissions. In addition, cable companies are deploying a new network standard – DOCSIS 3.0 – that will enhance transmission speeds over existing infrastructure.[403] Comcast and other cable companies have already deployed this new standard in many areas across the country and expect to make higher network speeds available to all customers in the near future.[404]

Wireless broadband is poised to become a critical platform for enabling a variety of innovations in the education arena and many other sectors.[405] By 2010, 82 percent of American adults owned a cellphone.[406] According to the FCC, by mid-2009, "35 million mobile wireless service subscribers had mobile devices (such as laptops and smartphones) with data plans for full Internet access, as compared to 25 million six months earlier."[407] Most importantly in the educational context, the number of children with basic cellphones and advanced smartphones is rapidly increasing. Indeed, Kaiser has found that cellphone ownership rates among children between the ages of 8 and 18 increased from 30 percent in 2004 to 66 percent in 2009.[408] Among teens, three-quarters owned a cellphone in 2009.[409] Texting remains the most popular cellphone-based activity among this group by far (66 percent of teens with cellphones report sending and receiving texts), but using handsets to access the Internet is growing in popularity (over a quarter of teens with cellphones use them to go online).[410]

As a result of an overall shift towards a preference for more robust mobile content in the education sector and beyond, carriers are investing heavily in the deployment of advanced networks. In the near term, third- and fourth-generation (3G and 4G) networks will continue to be deployed by wireless carriers. While 3G networks are already available to a significant portion of the population,[411] 4G networks will be deployed by wireless carriers in the near future to provide faster and more reliable service.[412] Since more robust connectivity – via advanced networks and cutting-edge devices – will beget more demand for mobile data services, widely deployed and carefully managed wireless networks are essential to supporting the growing number of mobile devices that are being used for educational purposes.[413]

5.2 Near-Term Outlook

As a result of increased availability and utilization of broadband and broadband-enabled educational technologies, the traditional education paradigm is undergoing a significant shift. As discussed above in sections 3 and 4, broadband-enabled tools are transforming traditional approaches to teaching and redefining educational institutions across the continuum. In the near-term, several important trends are evident.

First, access to and adoption of broadband and other technologies will increase as a result of a renewed focus on educational reform and innovation at the federal and state level. Several federal and state-led programs are providing critical funding and support for the development of innovative educational technology programs in schools across the

nation. Moreover, private-sector efforts and public-private partnerships are playing an integral role in expanding access to technology and facilitating skill development for all students, particularly those from low-income homes. These programs provide funding and necessary support for accessing these tools and will also facilitate the integration of broadband and broadband-enabled technologies into a variety of learning environments.

The federal Race to the Top program is a leading example of an innovative approach to spurring technology integration in the near-term. This program, which is administered by the U.S. Department of Education, allocated $4 billion in 2010 to spur reform in schools across the country.[414] In particular, this program rewarded and supported states that implemented forward-looking reforms "by using college- and career-ready standards and assessments, building a workforce of highly effective educators, creating educational data systems to support student achievement, and turning around their lowest-performing schools."[415] Ultimately, Race to the Top rewarded those states with the most innovative approaches to reform. A key aspect of reform, especially as it pertains to developing 21st century skills, is technology integration, specifically broadband utilization inside and outside of the classroom. While Race to the Top is not focused exclusively on technology or broadband, some commentators have noted that the program could indirectly spur technology use.[416]

A key impact of the Race for the Top program has been the high number of states that have made commitments to wide-scale, comprehensive reform.[417] Indeed, nearly every state in the country "joined a nationwide partnership to develop a common set of rigorous, career-ready standards in reading and math."[418] For example, numerous states, including Illinois, Louisiana, New York, Tennessee, and California enacted laws or policies allowing the expansion of charter schools.[419] Many other states implemented changes to how they monitor and reward teacher performance.[420] Such efforts are likely to have significant indirect impacts on the number of innovative technology programs in operation across the nation.

In addition, magnet and charter schools will likely be key laboratories for experimentation and innovation in how technology is used to enhance the educational experience. Several studies have found that charter schools "are more likely than public schools to adopt promising practices such as use of technology in the classroom, new staff development programs, involvement of teachers in policymaking, pre-K programs, and parent contracts designed to boost parental involvement."[421] Moreover magnet schools, which provide specialized curricula on discrete topics, are also fostering innovation and developing best practices that could be exported to other public schools. For example, Florida's Lee County School District operates the Academy for Technology Excellence, a technology-focused magnet school that seeks to "prepare high school students to excel in a society built on information and technology."[422] The program was developed in 2005 by educators searching for more innovative methods to prepare students for a technology-

based society.[423] The program has witnessed overwhelming success as test scores have risen above state and district averages, and graduation rates also increased.[424] As a result of these successes, Lee County is now considering expansion of the program to other district middle and high schools.[425]

Other innovative approaches are seeking to not only develop school technology programs, but to *incorporate technology into the daily lives of students and their families.* Many such programs focus on bridging the digital divide between low-income students and their peers to adequately prepare them for 21st century careers. The Boston Digital Bridge Foundation, for example, operates the Technology Goes Home (TGH) program, which trains underprivileged families to effectively use technology.[426] Through the Boston Public School system, TGH brings together students, parents, and teachers in order to educate them on the use of technology and foster parental involvement.[427] The program has enjoyed support from teachers and administrators as it "improves student academic performance, changes the dynamic between parents and teachers, and it improves parental involvement with their children and the schools."[428] In particular, TGH engages parents and students in research projects, which are used as a way to teach and hone critical literacy skills for children and workforce skills for adults.[429]

A similar approach that seeks to foster parental involvement and technology integration in the home is a proposed pilot program by the National Cable and Telecommunications Association. Its Adoption Plus (A+) program is a two-year, public-private partnership seeking to support sustainable broadband adoption and impact educational outcomes by providing discounted home computers and broadband connections for up to 3.5 million low-income middle school-aged students in school districts across the United States. [430] In addition, the program would provide digital literacy training through school districts for both students and their parents, thereby addressing the multifaceted barriers to student broadband adoption.[431] Program partners would include federal and state governments, non-profit corporations supporting digital literacy, hardware and software manufacturers, and broadband service providers (see section 6 for additional discussion). [432]

These and many other innovative programs are being supported in various ways by both public and private stakeholders. If continued, this rate of investment and collaboration could lead to significant increases in student access to and utilization of broadband and broadband-enabled technologies and improved learning outcomes in the years to come.

The second trend evident in the near-term is that increased use of online learning will have wide and profound impacts on students, parents, and educators. As discussed above, online learning is expected to grow significantly over the next few years, impacting not only the availability of educational content but also the quality of education. *While over 2 million students in pre-K-12 are currently learning online, this number is expected to jump to*

over 10 million students by 2014.[433] According to Ambient Insight, "the number of students taking all of their courses in physical classrooms will drop to 40.5 million, while 3.8 million will take all of their classes online, and 6.7 million will take some of their classes online."[434] Growth is also expected in online certifications in the near-term.[435]

The recession has not hindered the demand for online learning and course management products, and may actually have increased the need for such time- and cost-saving tools.[436] Indeed, utilization of technologies such as course management systems, video streaming, online testing, and exam tools, as well as online learning libraries, are expected to increase over the next several years. Course management systems, in particular, are likely to play a critical role and evolve into interactive learning environments, rather than simply providing "management" support.[437] Research also predicts a rise of blended learning instruction in coming years, which combines online instruction with face-to-face offerings.[438]

As online learning becomes more widely utilized and accepted, the quality of online education and learning outcomes are also expected to improve and may even surpass that of traditional instruction by as early as 2013.[439] Such tools are expected to enable a shift toward more learner-centered teaching techniques, utilizing collaborative, problem-based learning tools, rather than traditional lecturing.[440] As a result of this shift, students will likely be better equipped for competing in a 21st century workforce.

The third trend evident in the near-term is that the rise in social learning, currently evident in higher education, will begin to trickle down and be used more ubiquitously across many grade levels. Experimentation with Web 2.0 tools such as blogs, wikis, videoconferencing, and podcasting is on the rise in higher education institutions and in many K-12 schools.[441] These tools hold enormous potential for dramatically reshaping the traditional educational paradigm.[442] However, outdated policies have slowed the utilization of these tools for educational uses, particularly in the K-12 schools.[443] In the near-term, as student use of these tools increases outside of school (e.g., at home or on handheld devices), schools will likely begin to revise their policies to reflect student usage patterns and support the development of social learning opportunities.

Web 2.0 tools are being integrated and used in educational settings by innovative programs in higher education and are poised to deliver significant impacts on traditional approaches to instruction. Indeed, some commentators claim that "[t]he most profound impact of the Internet, an impact that has yet to be fully realized, is its ability to support and expand the various aspects of social learning."[444] Social learning, enabled through Web 2.0 tools like blogs and wikis, allows students of all ages to garner understanding through conversations and interactions with other individuals and with the material being studied.[445] Indeed, CoSN has found that "Web 2.0 tools can provide highly interactive and participatory environments that establish communities, open a

myriad of communication channels, and ensure each individual and group a voice. In fact, there is a growing body of evidence that the collaboration inherent in the participatory nature of Web 2.0 tools can be leveraged to deepen student learning through authentic, real-world learning."[446] Moreover, a report issued by the MacArthur Foundation in 2008 observed that, through broadband networking and online relationships, "youth engaged in peer-based, self-directed learning online" and that youth are often "more motivated to learn from peers than from adults."[447] In addition, the report claims that, "to stay relevant in the 21st century, education institutions need to keep pace with the rapid changes introduced by digital media."[448]

To this end, Web 2.0 tools are currently being used in higher education settings and are "empowering learning in ways that hadn't been possible before."[449] Electronic portfolios, wikis, podcasts, and collaboration tools are being employed by educators to give students a more active role in the learning process. As previously discussed, professors are using Twitter to enhance instruction,[450] while students use Twitter for group projects and to communicate with one another and with the professor to discuss various issues.[451] In addition, virtual worlds are being used by many higher education institutions to offer interactive, engaging and alternative learning environments. As utilization of these types of tools increases, they will likely begin to be used more often in K-12 settings as well.[452]

However, even though educators appreciate and largely understand the value of social learning tools, administrators and educators at the K-12 level have been slow to adopt these tools.[453] Indeed, the majority of district administrators, superintendents and curriculum directors report that Web 2.0 tools have yet to be incorporated into teaching and learning in their districts.[454] This low level of adoption is due partly to outdated policies and practices regarding new technologies. Educators are working to balance the need for safety and protection from inappropriate material with the many benefits that are likely to be realized from using these tools.[455] To this end, one recent survey found that over 53 percent of district administrators believe that Web 2.0 "has caused [their] district policymakers to become nervous about allowing student access to it."[456] In addition, another recent survey found that more than one in five students between the ages of 10 and 18 reported being cyberbullied at least once in their life.[457]

New policies are evolving to facilitate increased use of these tools in K-12 settings. Many current policies are restrictive of certain Web 2.0 applications and have failed to address the new opportunities that such tools have made available. For example, most districts allow prescribed educational use of Web 2.0 technologies, though social networking and chat room participation are banned in the vast majority of school districts.[458] In addition, over 94 percent of technology directors require students and/or parents to sign an acceptable use policy before using the Internet at school, though 51 percent of district administrators claim that their policies have not been updated to address the use of Web 2.0.[459]

Internet filtering systems also impede the use of some Web 2.0 tools in many schools. Twenty-one percent of curriculum and technology directors reported that educators ask that ports be opened to allow the use of educational sites "fairly often" and 62 percent report that such requests are made "occasionally."[460] In addition, schools that receive funding from the federal E-rate program are subject to the Internet filtering requirements set forth in the Children's Internet Protection Act of 2000.[461] Discussions are currently underway in the majority of school districts to address the potential use and misuse of Web 2.0 tools.[462] Moreover, district administrators have expressed support for the use of such technologies in the future, as 61 percent of district administrators believe that access to approved educational sites should be allowed in school.[463] In the near term, addressing these types of novel policy issues will likely become inevitable as student use of social media and as educator support for them continue to grow. As policies adapt to the unique situations and issues raised by such technologies, social media is likely to be widely incorporated into K-12 educational settings over the next few years.

5.3 Long-Term Outlook

Enhanced connectivity to and utilization of broadband and broadband-enabled education technologies in the near-term will facilitate a number of fundamental shifts in the educational paradigm in the long term.

First, wireless broadband will become a key medium for the delivery of targeted educational content. Wireless broadband is already prevalent on college campuses and a number of K-12 schools. One survey from 2009 found that 88 percent of school districts and 96 percent of higher education institutions currently offer wireless networks, and 65 percent of schools without a wireless network are considering installation within the next few years.[464] To take advantage of developments in wireless networking, laptops and other mobile computing devices are becoming more mainstream in higher education and are increasingly being used in K-12 settings as well. According to one report, about 79 percent of college freshmen own a laptop computer that is relatively new and about 51 percent of all college undergraduates own an Internet-capable handheld device.[465] Moreover, 44 percent of undergraduate respondents expect to use their mobile devices for many activities they currently perform on a laptop or desktop computer, and about 74 percent of those who use the Internet from their handheld device expect their usage to increase in the next few years.[466] Kaiser has found that laptop ownership rates from children aged 8 to 18 more than doubled over the last few years, increasing from 12 percent in 2004 to 29 percent in 2009.[467]

Competition in the wireless and laptop markets are driving prices down and providing a wide array of innovative new products. Indeed, even though cellphones have traditionally been much cheaper than laptops, the new generation of more advanced smartphones and smaller, more portable laptops – also called netbooks – has brought

the price points of each technology more in line. The popularity of each type of device has exploded in recent years and offer intriguing new mediums for engaging students.[468] Moreover, the Apple iPad represents the next iteration in the rapid innovation currently evident in the portable computing device market. The iPad supports 3G network access and could eventually be used as platform for delivering an array of educational content[469] and for facilitating a variety of activities.[470] Competition across the many segments of the wireless ecosystem – which includes wireless service, hardware, software and "apps" – will continue to drive costs down and spur use of these tools in an array of educational settings.

The major impact of more robust adoption and utilization of mobile broadband devices will be a major shift toward "anytime, anywhere" learning. This trend is increasingly evident in higher education and may trickle down to K-12 environments in the long-term. Moreover, the "potential of mobile computing is being demonstrated in hundreds of projects at higher education institutions."[471] For example, the University of Washington provides free Wi-Fi on campus, which is accessed by over 15,000 handheld devices in a typical month. The university "maximizes learning on the go with its iTunes U site and custom app – m.UW – [which is] available for free in the App Store. The m.UW app gives iPhone users a searchable directory, course information, campus news and events, and more than a thousand video lectures."[472] These types of programs will likely produce best practices that will be imported for use in an increasing number of K-12 settings in the longer term.

Second, as technology adoption and digital literacy skills diffuse across greater percentages of the population, there will be greater opportunities for more individualized learning experiences. Technology-enabled personalized learning holds significant implications for the future of education. Indeed, the Department of Education, in 2008, noted that "[p]ersonalized instructional delivery through the strategic use of technology is a key part of [educational] transformation."[473] By utilizing technology to adapt instruction to the needs of individual students, educators are better able to engage students, foster motivation, and enhance productivity.[474]

Educators have begun to apply technology to personalize learning in pre-K-12 and higher education settings, and will likely do so on a larger scale in the long-term. To this end, the federal Race to the Top program has called for the widespread adoption of data systems in school systems across the nation to manage student performance.[475] These systems track student achievement and preparedness for college[476] and "offer instructors the ability to view and interpret data on learner traits such as prior experience, knowledge, and learner style, and use that data to customize student experiences and their own instructional approaches."[477] In addition, learning management systems can work with data systems to automatically deliver personalized content.[478]

Other methods of personalization are also being used. For example, Advanced Academics provides "customizable online learning solutions that include Web-based curriculum, highly qualified teachers, a 24/7 support environment, and a proprietary technology platform specifically designed for middle and high school education."[479] Similarly, iClass is a new "intelligent cognitive-based open learning system and environment" being developed by 17 partners in the EU, Turkey, and Israel.[480] The project is based on the concept of self-regulated personalized learning and will give students an active role in the learning process. Moreover, "the Web-based iClass platform is well placed to link seamlessly the formal and informal learning environment."[481] It is designed to provide pupils with ubiquitous access in an effort to encourage them to maximize formal and informal learning opportunities.[482]

Third, higher education institutions will be redefined. As a result of the many advances and innovations described above, higher education has entered a time of uncertainty as traditional roles and identities are being reestablished for a technology-dependent future.[483] More specifically, the future is likely to bring the unbundling of higher education services and a greater focus on meeting the demands and needs of individual students.[484] Universities are currently unbundling some coursework and making it available in an array of forms via a number of outlets (e.g., podcasts, streaming video, open courseware, etc.). This wider offering of coursework increases the accessibility and affordability of such materials for students and allows institutions to reach a wider audience of students.[485] The long-term impacts of these trends will likely be greater demand for more flexibility in higher education as students increasingly desire to "determine for themselves which products, services, and information they are interested in using."[486] In the future, higher education curriculum and infrastructures may be designed to satisfy these diverse demands, thus undermining the historical role of higher education institutions.[487]

5.4 Conclusions

Ongoing innovations in educational technology, along with key innovations at the broadband network level, will have profound impacts on the traditional education paradigm. In the near future, public and private efforts will likely spur access to broadband and educational technologies and stir demand for online learning programs. Moreover, social learning will likely continue to become more prevalent in K-12 settings, enabling new, more engaging methods of instruction in most grade levels. In the long term, wireless broadband and advanced mobile devices will likely serve as primary vehicles for the delivery of educational content. This will expand access to "anywhere, anytime" learning. Moreover, these and other approaches will shift the education paradigm toward more personalized learning. Coupled with the migration and unbundling of vast amounts of educational content online, this shift will redefine

the roles of education institutions across the continuum. As a result, students of all ages will become increasingly equipped to compete in the global economy.

6. Government, Education & Broadband: Recommendations for Meaningful Policymaking

In order to realize the full potential of broadband in education, policymakers must address a number of key issues. Recommendations for meaningful policymaking include:

1. Address cost issues related to adoption and usage of broadband for educational purposes through a combination of public-private partnerships, targeted funding, and reform of the federal E-rate program.
    - 1.1 Continue supporting public-private attempts that seek to address cost issues associated with adopting and promoting broadband use in school and at home.
    - 1.2 Improve the targeting of federal funding aimed at spurring broadband adoption in all of the nation's schools.
    - 1.3 Modernize the federal E-rate program.
2. Address the lack of computers in schools through support of public-private partnerships and other unique collaborations.
3. Develop and implement a multifaceted strategy for supporting the development and honing of 21st century digital literacy skills across the continuum of education.
4. Provide adequate professional development resources and support for educators in order to facilitate greater integration of technology into curricula.
5. Support efforts to identify and promulgate proven outcomes and best practices associated with using broadband-enabled technologies in schools in order to spur additional adoption in schools and at home.
6. Encourage ongoing collaborations among stakeholders that seek to spur adoption and utilization of broadband and broadband-enabled technologies for educational purposes.
7. Pursue a multifaceted approach to enhance online educational content.

8. Support the nation's pro-investment policy framework for broadband in order to encourage continued innovation at the network level and across the educational technology sector.

* * * * *

6.1 RECOMMENDATION #1

Address cost issues related to adoption and usage of broadband for educational purposes through a combination of public-private partnerships, targeted funding, and reform of the federal E-rate program.

Despite the many efforts currently underway to increase broadband and technology utilization in education, cost issues have prevented many schools from adopting many of these services.[488] As a result, broadband adoption rates in schools and classrooms, on a national level, remain fragmented – and average per-student bandwidth remains low.[489] Compounding this, the recent economic downturn has forced many schools to delay or cancel education technology-related projects.[490] As IT budgets continue to be cut, schools must either find alternative means of funding projects, which can run as high as several hundreds of thousands of dollars, depending on the school's location,[491] or forgo projects.

In addition to the institutional costs of deploying broadband-enabled education technology systems, students and their families also face significant financial constraints that are impeding more robust home adoption and usage of broadband for educational purposes.[492] Many online educational programs require a broadband connection, a computer, and other enabling technologies in order to complete Internet-based assignments. Though home broadband adoption has grown significantly in recent years, the adoption rate among low-income households and certain demographic groups still lag behind the general population.[493] Many low-income families are unable to afford a monthly broadband subscription, particularly when combined with the costs of purchasing a home computer and any additional educational software.

A number of negative impacts result from a lack of proper investment in school broadband connections. For example, schools with low per-student bandwidth rates are often forced to impose strict usage policies on students and educators alike. Indeed, one recent survey found that 67 percent of schools use a restriction policy that bars students and teachers from using certain online applications (e.g., streaming video) to conserve bandwidth.[494] Moreover, when broadband-enabled resources become limited or difficult to use, many teachers respond by reducing the amount of technology they

incorporate into their lessons.[495] At home, students without a computer or an Internet connection are at risk of falling behind other students

Policymakers should address these various cost issues in three interrelated ways.

6.1.1 Continue supporting public-private attempts that seek to address cost issues associated with adopting and promoting broadband use in school and at home.

While federal funding support of state and local educational initiatives remains critical (see below), public-private partnerships offer a variety of advantages to more precisely target broadband adoption in schools and at home. These types of collaborations have succeeded in a number of other broadband contexts and efficiently pair public funding with private-sector expertise in developing and implementing innovative solutions.[496] Policymakers can leverage these approaches by providing ongoing support of innovative and forward-looking proposals.

To date, many public-private partnerships focused on spurring adoption and use of broadband in schools have succeeded because of some level of government involvement (several examples were discussed above in section 4.1.1). A unique illustration of the beneficial interplay of public and private sector resources is the South Carolina K-12 Technology Initiative, which is a partnership of the South Carolina Department of Education, South Carolina Educational Television, South Carolina Budget and Control Board, the South Carolina State Library, and AT&T. This partnership "guides the distribution of funds appropriated by the Governor and General Assembly that collectively meet the state's needs for software, hardware, connectivity, digital content, instructional technologies and professional development."[497] In the 1990s, South Carolina became one of the first states in the nation to wire all schools for the Internet and to adopt teacher and student technology curriculum standards.[498] However, the program is highly dependent upon state funding to cover the cost of maintaining school Internet connectivity, and recent decreases in funding have prevented schools from leveraging "critical programs that have proven value to learning and digital equity."[499] Additional federal funding could expand this pioneering approach to bringing technology to schools.

The initiative announced by the National Cable & Telecommunications Association in December 2009 – the A+ Program – is an example of a large-scale public-private initiative that could serve as a model for efforts going forward. The A+ Program aims to increase in-home broadband access and usage for low-income, middle school-age students.[500] The initiative is a proposed two-year, public-private partnership between participating school districts, federal and state government, nonprofit corporations focused on digital literacy, computer manufacturers, and broadband service providers. Federal funding and matching contributions by private-sector donors would be used to

pursue a multifaceted approach, which includes "(1) digital media literacy education, including online safety training; (2) discounted desktop, laptop, or netbook computers that can access the Internet; and (3) discounted home broadband service to households that do not currently receive a broadband service."[501] A crucial aspect of this program is that it will draw up to $572 million from the cable industry,[502] in addition to federal, state, and school-based support. This represents one of the most comprehensive proposals for broadband stimulation to date and potentially one of the largest private allocations of funding for these purposes.

Some of these programs have received funding as part of federal broadband stimulus grant programs.[503] However, significantly more funding is needed to support additional and more expansive programs. Indeed, some have suggested that it would take approximately $10 billion in funding to ensure that all schools are "technology rich."[504] Thus, a more long-term and sustainable funding approach must also be considered in order to ensure that innovative approaches continue to be developed and deployed.

6.1.2 Improve the targeting of federal funding aimed at spurring broadband adoption in all of the nation's schools.

A number of federal funding resources are available to schools. Examples include:

- The EETT Program administered via Title II of the No Child Left Behind Act (discussed in section 3.1.2);
- Stimulus funding allocated via the U.S Department of Education and the Commerce Department's BTOP program (discussed in section 5.2);
- The Department of Education's Race to the Top program (discussed in section 5.2); and
- Federal E-rate program (discussed below).

Despite this seeming surfeit of funding, allocations are often imprecise and made in overlapping and redundant ways. For example, the $650 million allocated by the U.S. Department of Education for education technology can be used by states to "pay for things such as professional development to help teachers learn how technology can improve their lessons, software programs to enhance lesson plans, and computer labs."[505] However, federal stimulus funding will also be used to support computer labs.[506] In addition, some have argued that general stimulus disbursements for educational purposes might serve to prop up failing schools rather than create incentives to change by, among other things, effectively incorporating technologies (e.g., computers and the Internet) into the curriculum.[507] Such overlap and imprecision could result in waste and deter efforts to integrate broadband-enabled educational technologies into schools. This lack of coordination at the federal level suggests a lack of a comprehensive framework guiding these efforts.

Policymakers can address shortcomings in a number of ways. Government allocations should, for example, be more precisely targeted and less open-ended. The FCC acknowledged these issues in its *National Broadband Plan* and outlined several recommendations for reorienting the E-rate program.[508] In 2010, the Commission adopted several orders focused on modernizing and streamlining the program (these efforts are discussed in the next section). Moreover, the U.S. Department of Education, via its Race to the Top program, has doled out funding as a reward to states for implementing innovative changes to curricula and other efforts aimed at enhancing student performance by, among other things, effectively incorporating technology into curricula (see section 5.2 for further discussion).

In addition, the U.S. Department of Education, via its *National Educational Technology Plan*, has outlined a "vision for how information and communication technologies can help transform American education."[509] The plan focuses on using technology to enhance productivity, teaching, learning, and assessments. This Plan, which "provides a set of concrete goals that can inform state and local educational technology plans as well as inspire research, development, and innovation,"[510] is a promising step in the right direction and could serve as a jumping off point for additional discussions regarding how to more efficiently target funding to support the country's vision for a more innovative and effective education sector.

Another related consideration is ensuring that funding allocations are not unduly influenced by considerations other than actual need. For example, some have argued that current allocation mechanisms discriminate between geographic areas by prioritizing funding for rural areas.[511] Legislation introduced in 2009 – the Achievement Through Technology and Innovation (ATTAIN) Act – seeks to "ensure that every student is technologically literate by graduation, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability."[512] The Act has been endorsed by a number of stakeholders who view it as an opportunity to "focus… resources on those practices known to best leverage technology for educational improvement."[513] Similar targeted funding efforts that provide support for school broadband and educational technology, regardless of geographic location or other ancillary considerations, should be encouraged at the federal level.

6.1.3 Modernize the federal E-rate program.

The E-rate program, administered by the Universal Service Administrative Company under the direction of the FCC, provides critical support to schools and libraries for telecommunications and Internet access.[514] Both public and private institutions are provided discounts of between 20 and 90 percent toward telecommunications services, Internet access, internal connections, and basic maintenance of those connections.[515] The program structure provides a funding priority for schools with high poverty levels and/or rural residence.[516] Over the past ten years, the program has provided over $22

billion to help schools and libraries pay telephone and Internet bills and install network wiring and components.[517] As a result of such largesse, "schools and districts have come to rely heavily on telecommunications networks to deliver educational content and to administer student achievement tests."[518] However, despite some success over the past decade, concerns abound regarding E-rate's funding structure, rural preference, and application process, all of which may limit its ability to meet the technology needs of educators. In order to ensure that this critical program is adequately structured for the broadband era, policymakers should consider a number of modifications.

First, the total amount of E-rate funding should be increased. Lack of adequate funding via E-rate is a much-cited barrier to further adoption and utilization of broadband in everyday education.[519] One major reason for this has been an inability to adjust E-rate funding levels for inflation or changes in demand over the past decade.[520] Indeed, funding levels have been capped at $2.25 billion[521] even though the amount of requested funding has consistently exceeded the allotted amount from 1998 to 2007.[522] In 2008, for example, nearly 40,000 applicants requested a total of $4.3 billion from E-rate.[523] The FCC, as part of its commitment to modernizing the overall Universal Service Fund (USF) and the E-rate component of it, has outlined a framework for adjusting the amount for inflation.[524] However, the total amount available to schools for broadband connectivity will remain essentially unchanged in the near-term.[525] Several other recent actions by the FCC could ensure that these limited funds have more impact,[526] but a limited pool of funding could thwart more sweeping changes necessary to bolster broadband in education. However, additional funding for broadband in schools and in homes with school-age children could be sourced from a reoriented USF, which the FCC hopes to transition to supporting broadband service, rather than traditional telephone service, over the next few years.[527]

Second, funding should be allocated to schools regardless of location. As currently structured, the E-rate program provides smaller awards to low-income schools not located in a rural area. Indeed, the discount rate is ten percentage points higher for rural schools than for urban schools with one percent to 49 percent of students eligible for the National School Lunch Program.[528] By limiting the priority given to rural schools, the E-Rate program can encourage low-income urban schools to apply for the funding they need. In its *National Broadband Plan,* the FCC outlined several recommendations for ensuring that funding is prioritized based on need and not on location.[529]

Third, the E-rate application and approval processes need to be streamlined. The complex application process for the E-rate program may serve to decrease the applicant pool.[530] Just 63 percent of the 150,000 eligible schools in the United States are currently taking part in the program, with 13 percent of eligible private schools applying for funding.[531] Nonparticipants state that the complexity of program requirements is a key barrier, though the process is becoming easier.[532] Between 35 to 50 percent of applicants are typically new to the E-rate process, and must devote large amounts of time and

resources to receive funding.[533] Furthermore, funding has been denied to some participants in the past due to mistakes in the application process.[534]

In order to address these concerns, attempts have been made to make the application process more user-friendly.[535] A new format has been developed, which focuses on educating new applicants on the complex program procedures.[536] The FCC, in September 2010, adopted a series of new rules to simplify the current application process by, among other things, eliminating certain redundant requirements (e.g., technology plans) and providing more clarity regarding bidding criteria for applicants.[537] By simplifying and streamlining the E-rate application and approval processes, schools will be better able to "focus resources on providing funding for high-speed broadband connectivity [rather than] bureaucratic processes."[538]

6.2 RECOMMENDATION #2

Address the lack of computers in schools through support of public-private partnerships and other unique collaborations.

Although computer availability and ownership rates have steadily increased over the past decade, a significant number of students and schools remain without sufficient computer resources.[539] Indeed, a 2008 study found that over 50 percent of public school teachers reported having just two computers or less in the classroom or primary work area for students.[540] A number of viable approaches have been implemented in schools across the country to address this gap in computer access. Policymakers should support these and other innovative approaches to spurring computer access in schools.

One-to-one laptop programs, for example, should be encouraged. As discussed in section 2.2.1, many schools are working with private providers to deliver laptops to students for use during the school day and often to take home as well.[541] The impacts of these programs have been largely positive, so long as they are carefully designed and effectively implemented. However, despite the promise of 1:1 initiatives, they are often very expensive to launch and sustain. For example, in South Carolina, the legislature has set aside $5 million toward the iAm Laptop Pilot Program, which will provide ninth-graders in six public schools with laptop computers to keep for four years.[542] Moreover, a number of BTOP grant recipients include large-scale 1:1 laptop initiatives, including one by the New York City Department of Education for $28 million. This effort will provide low-income sixth graders in 100 schools across the city with laptops and subsidized broadband connections in order to "link…the classroom and the home to simultaneously support the achievement of disadvantaged students, while spurring broadband adoption."[543] Such programs are valuable because they have been shown to improve student performance. Additional federal mechanisms and other incentives

should be developed to encourage continued collaborations focused on increasing computer access in both the near-term and long-term.

Other innovative approaches could also be held up as models for other schools and states to follow. For example, both Computers for Youth and Tech Goes Home (discussed above) provide valuable best practices that could be exported to schools across the country. Indeed, Computers for Youth has created a nationwide network of affiliates that "provides members with the products and services to more efficiently implement their programs while increasing the depth of services offered to their constituencies."[544] The network is currently comprised of 21 members in 16 states. A more systematic framework for leveraging effective approaches (e.g., by collecting and promulgating best practices), in addition to providing additional funding, could further spur computer access for students, parents, and educators across the country.

6.3 RECOMMENDATION #3

Develop and implement a multifaceted strategy for supporting the development of 21st century digital literacy skills across the continuum of education.

Educators, scholars, and policymakers agree that students must be equipped with digital literacy skills to succeed in a world dominated by digital media and information.[545] Indeed, as early as 1996, the U.S. Department of Education recognized that technology literacy "ha[d] become as fundamental to a person's ability to navigate through society as traditional skills like reading, writing, and arithmetic."[546] Over the last decade, as technology facilitated the development of a more globalized marketplace, the need for an appropriately skilled workforce has become more immediate. As discussed above in Snapshot #2, many new jobs "involve higher levels of knowledge and applied skills like expert thinking and complex communicating," along with the ability to effectively use broadband and broadband-enabled technologies.[547] Indeed, as the FCC has observed, "the demands of the new information-based economy require substantial chances to the existing [educational] system" in order to ensure that the United States is well positioned for continued economic prosperity.[548]

However, many stakeholders agree that a significant number of U.S. students do not possess these skills and are thus ill-equipped to compete in the global marketplace.[549] Moreover, there is some disagreement as to what 21st century digital literacy skills should encompass.[550] A 2009 report by the New Media Consortium found that "[i]ssues of assessment and integration of new literacies across the curriculum and of teacher training are complicated by the overarching need for a fuller understanding of what constitutes new literacy skills."[551] In addition, recent attempts to spur skill development on a national scale have mostly floundered. For example, the NCLB calls for all students

to be technology literate by the end of the eighth grade, but provides no requirements or accountability measures to ensure literacy levels.[552] Even attempts by individual states have produced mixed results. While 48 states currently offer technology standards for students, only four states actually test the technology literacy skills of students.[553] The low level of technology literacy tests is due largely to the lack of widely accepted and measurable standards.[554] In light of the current status of 21st century skill development in the United States, policymakers should address these failings in a number of ways.

First, federal and state government should work together to establish digital literacy as a national priority by setting measurable standards. Although major curriculum changes typically flow from individual states,[555] benchmarks could be set through traditional methods of assessing student progress. The National Assessment of Educational Progress (NAEP) program, for example, is "the only nationally representative and continuing assessment of what America's students know and can do in various subject areas."[556] The NAEP criterion could be expanded to include measurable standards of technology literacy.

In the alternative, performance benchmarks tied to federal education funding could be revised to include technology requirements.[557] The NCLB IID competitive grants, for example, have called for "systematic changes in policies, practices, and professional learning that increase or enhance a school's ability to use technology effectively in teaching and learning."[558] Although some stakeholders warn against the implementation of formal requirements and standards, others argue that a piecemeal, state-by-state, and possibly district-by-district, approach might further delay integration of technology into school curricula.[559] One model could be the set of model educational standards released by state governors and educational officials in early 2010. These standards attempted to capture and formalize the range of skills every student in the United States ought to possess after completion of each grade.[560] Benchmarks for ensuring technology literacy were included in these standards.

Second, funding should be targeted at expanding programs and identifying best practices that have successfully promoted digital literacy. Innovative and successful approaches should serve as models for future programs aimed at enhancing digital literacy. For example, the University of South Carolina has developed the GameDesk pilot program, which "challenges 15- to 17-year-old pupils to create their own computer games using game tools, such as GameMaker, to build educational and entertainment video games from scratch."[561] Three high-priority high schools are participating in the study, and, through the program, students are expected to garner skills in math, science, and technology.[562] According to a 2009 report by New Media Consortium, such collaborative efforts between universities and K-12 teachers and students are invaluable and will likely become more popular so long as they are adequately funded.[563]

Another innovative approach has been deployed by One Economy, a national nonprofit organization, in partnership with Comcast. Their Digital Connectors program represents a unique approach to diffusing digital literacy skills across diverse populations by empowering capable and interested students with these skills. In particular, this program "identifies talented young people, immerses them in technology training, and helps them build their leadership and workplace skills to enter the 21st century economy."[564] By the end of 2011, the program is expected to reach some 1,500 students in 50 markets across the country.[565] These efforts will be further bolstered over the next few years by a federal BTOP grant[566] and have been used as a model for the FCC's proposed National Digital Literacy Corps.[567] This approach, which is similar to the model developed by MOUSE (discussed in Case Study #6), provides students with a vehicle for not only learning and applying digital literacy skills, but also with a viable post-graduation career path.

In sum, when devising a strategy for enhancing 21st century skill development in the United States, policymakers should be more comprehensive in their approach and should seek to engage innovators that are successfully training students to use new broadband-enabled technologies and tools.

6.4 RECOMMENDATION #4

Provide adequate professional development resources and support for educators in order to facilitate greater integration of technology into curricula.

As discussed in section 3, many educators have yet to integrate technology into their curricula. The reasons for this vary. Some educators are both unwilling and unable to incorporate technology into classroom curricula, even when adequate access is provided.[568] In addition, some are unaware of the many benefits of using technology to enhance learning inside and outside of the classroom, while others feel that technology will disturb the conventional roles of instruction.[569] Indeed, a significant number of teachers fear that traditional roles will be reversed if students have more familiarity with technology than their educators do.[570] Moreover, many educators that adhere to established teaching methods are "accustomed to teaching within the traditional education model and are [thus] simply satisfied with the status quo."[571] In addition, new tools like Web 2.0 services often befuddle educators and administrators, many of whom are unwilling or unable to rationalize the potentially negative aspects of these tools (e.g., cyberbullying) with the overwhelmingly positive impacts that these tools, properly leveraged, can have on learning.

Compounding these attitudinal barriers is a general lack of access to adequate professional development, technical support, and other resources that could assuage fears and encourage

educators to experiment with using new technologies in their teaching. However, just making these resources available is not a panacea. In 34 percent of schools offering professional development courses, less than 25 percent of teachers attended the professional development courses within the previous year, according to one study.[572] Moreover, a 2008 report found that much of the technology training available to educators is geared toward administrative tasks, rather than preparing teachers for instructional use.[573] Throughout the education industry as a whole, "little effort has been invested to promote the maturity of educational software products, especially software designed to fulfill the instructional requirements of teachers."[574]

In order to overcome these barriers, policymakers and education administrators have a number of options available to them for enhancing the resources available to reluctant educators and for creating incentives for integrating broadband-enabled technologies into their curricula. For example, policymakers could create mechanisms that leverage existing approaches to providing teacher technology training and technical support. Examples of these efforts were described in section 4.1.4. These types of approaches rely on local resources and have proven to be successful in helping educators recognize the many benefits associated with using new educational technologies in their classrooms.

In addition, funding could be strategically allocated to encourage experimentation with supportive technologies in addition to, or perhaps in lieu of, more traditional onsite technical assistance. A growing number of supportive software tools are being developed to help teachers transition to the digital classroom. For example, the Adobe Digital School Collection "provides affordable multimedia software and resources for teaching and learning 21st century literacy, problem solving, and communication skills across the curriculum."[575] These tools help educators to edit documents, manage portfolios, edit video and audio content, as well as publish Web content. Moreover, the Collection includes a Teacher Resource DVD that provides lesson plans, tutorials, and educator tips.[576] A large number of other such tools and Web sites – e.g., Ning (www.ning.com), a customizable social networking site, Moodle (http://moodle.org), which helps teachers develop online courses, and an array of technology-specific blogs – are also available to educators as a kind of informal resource exchange. As previously mentioned, several large organizations, like Teach for America, have launched either proprietary or publicly-available resources for use by educators. These tools help educators learn and manage various educational applications and support technology integration on a wider scale. Some of these are free, but others require paid subscriptions or the purchase of proprietary software. The FCC has called upon the U.S. Department of Education to "provide additional grant funding to help schools train teachers in digital literacy."[577] This is a step in the right direction, but policymakers must do more in order to encourage wide-scale experimentation with using new technologies to enhance the educational experience across the continuum.[578]

6.5 RECOMMENDATION #5

Support efforts to identify and promulgate proven outcomes and best practices associated with using broadband-enabled technologies in schools in order to spur additional adoption in schools and at home.

A critical component of spurring adoption of broadband-enabled technologies for educational purposes is identifying and promulgating proven outcomes, benefits, and best practices associated with using these tools. Providing this information in a comprehensive yet user-friendly way could engage larger swaths of schools and parents and encourage them to experiment with new methods and applications.

However, the amount of information available to educators, parents, and students – from data on how certain technologies impact learning outcomes to statistics about technology usage to a vast array of studies examining digital literacy, social learning, etc. – *is intimidating and may be dissuading genuinely interested stakeholders from pursuing certain technology solutions.* Moreover, this information overload can result in uncertainty regarding the true impacts and effectiveness of using broadband-enabled technologies and tools.[579] Further, the seemingly constant emergence of new e-learning technologies and methods creates confusion for educators trying to determine which tools are best for their classrooms or schools.[580] Similar perceptional problems pester parents. For example, a study released by the Joan Ganz Cooney Center in 2008 found that a majority of parents do not think the Web helps their children learn how to communicate or work with others, or to be responsible in their communities.[581] Moreover, 59 percent of educators stated that parents underestimate the value of digital media.[582] These negative attitudes contradict research that consistently finds positive learning outcomes associated with educational technology[583] and blended learning approaches.[584]

In order to overcome this formidable barrier, policymakers and other stakeholders could pursue a number of approaches. *First and foremost is devising a systematic way of processing, cataloguing and highlighting important data sets, observations, and conclusions embedded in the vast array of studies, reports, white papers, etc. that are released each year by the U.S. Department of Education, its partners, third-party groups, and other interested stakeholders.* A more comprehensive approach to managing existing data and collecting more targeted information regarding student performance could help to rationalize some of the information overload.[585]

Second, state and federal government could sponsor more targeted research on discrete issues. For example, one issue that continues to puzzle educators and parents is the true value of using social media for educational purposes. A number of studies by an array of organizations have already been released on this subject, but very few are seen as truly

authoritative (or as bearing the imprimatur of the U.S. Department of Education). Local, state, and federal government, either directly or through other entities, could sponsor official studies that either conduct original research or that compile a meta-analysis of existing studies.[586] There is a demand for these studies, the results of which could be widely disseminated and used as a basis for identifying best practices.[587]

One potential model for this type of undertaking could be an effort recently undertaken by the European Commission (EC). The EC called for a comprehensive analysis of approaches to teaching digital literacy as part of its i2010 strategy to foster greater inclusion and utility of information and communications technologies. The project and subsequent report, titled *Supporting Digital Literacy: Public Policies and Stakeholders' Initiatives*, examined 450 digital literacy initiatives in Europe, and highlighted 30 projects as best practices.[588] Among the many valuable lessons garnered from the analysis, the EC found that "it will be necessary to develop adequate criteria, evaluation methodologies and benchmarks that can be used effectively to target resources to those areas of need and to measure impact and value for money."[589]

The U.S. Department of Education has outlined a similar proposal for supporting and scaling, as appropriate, the development of new approaches focused on further integrating education technologies like broadband into the classroom.[590] In particular, this plan calls for a comprehensive aggregation and analysis of best practices for using new technologies not only in the educational context but also in the consumer and business contexts as well. Moreover, the Department of Education will spearhead higher-risk research and development projects in order to ensure that students and teachers have access to the widest possible range of new techniques for using these tools to enhance the learning experience.[591] If fully implemented, this plan could bolster the use of broadband-enabled technologies inside and outside of the classroom and thus ensure that students of all ages are properly equipped to compete in the global economy.

6.6 RECOMMENDATION #6

Encourage ongoing collaborations among stakeholders that seek to spur adoption and utilization of broadband and broadband-enabled technologies for educational purposes.

Recent efforts centered on increasing broadband adoption generally and broadband-enabled educational technologies specifically should be supported and encouraged to continue into the future. These efforts have included the U.S. Department of Education's various stimulus-funded grant programs (e.g., Race to the Top), which have been conducted in a relatively open and transparent manner, and the collaborative approach it implemented during the drafting and review of its *National Education*

Technology Plan, which actively solicited input from the community of educators, parents, and other interested stakeholders.[592] The FCC also employed an interactive approach during the development of its *National Broadband Plan*. For example, through its Broadband.gov Web site, the agency facilitated real-time communication and stakeholder involvement via, among other resources, a blog dedicated to the Plan.[593] In addition, the FCC hosted several collaborative workshops, the proceedings of which are archived online.[594] Through these efforts, the FCC "promote[d] open dialogue between the FCC and key constituents on matters important to the national broadband plan."[595] Policymakers and other stakeholders could leverage government interest in facilitating collaboration to launch a wider-scale initiative focused on spurring adoption and use of broadband in education.

In structuring a collaborative initiative, policymakers could set clear policy objectives and then defer to stakeholders to engage in solution-focused dialogues as to how to meet those goals. Such an approach, driven initially by a government entity, could nudge the diverse array of stakeholders in the education space towards more unified action on issues of overriding interest. *By encouraging conversations between policymakers, educators, parents, and even students, innovative solutions can be addressed and resources can be pulled to create the necessary change.*[596]

Once established, these types of collaborative efforts could partner with other programs and organizations that seek to raise public awareness of technology generally and broadband specifically. These organizations might include CoSN, MOUSE, Computers for Youth, and One Economy's Digital Connectors program. CoSN works to empower "K-12 school district technology leaders to use technology strategically to improve teaching and learning" and provides "the leadership, community and advocacy tools essential for the success of these leaders."[597] Similarly, One Economy's Digital Connectors program, MOUSE, and Computers for Youth could each provide a unique platform for engaging a wider array of stakeholders. These and other vehicles could be leveraged to support ongoing, wide-scale collaborations among stakeholders in the public and private sectors.

6.7 RECOMMENDATION #7

Pursue a multifaceted approach to enhance online educational content.

Despite the proliferation of online educational content over the past decade, many teachers and parents lack access to high quality educational information resources.[598] This is largely due to the difficulties associated with adapting or digitizing curriculum content for delivery via broadband, as well as the large up-front costs required to produce high-quality digital versions of existing educational content (e.g., textbooks).[599]

As such, policymakers and other stakeholders should pursue a multifaceted and comprehensive approach to enhancing the quality of online educational content.

For example, an output of the wide-scale collaborations discussed in section 6.6 could be a digital information clearinghouse that provides "ready-to-use and customizable [broadband]-based resources."[600] Such an effort could evaluate the quality and safety of educational content to encourage utilization of appropriate and effective the material in classrooms.[601] This approach could make it easier for educators to sift through the vast array of information online and more easily identify high-quality content. In doing so, collaborators could leverage the expertise of existing organizations in order to provide this information in more expeditiously. Organizations like Common Sense Media could be a partner in these efforts. Potential partners focused on offering relevant information about quality online content currently exist. The Federal Resources for Educational Excellence, for example, is an online database that provides teaching and learning resources from over thirty federal agencies.[602] The U.S. Department of Education also maintains an online library of education research and information through the Education Resources Information Center.[603] The FCC has also called upon several parts of the federal government to pursue new policies in order to "expand digital content and online learning systems."[604] *Coordinating these many efforts could yield a comprehensive clearinghouse that identifies useful resources from an array of public and private sources.*

In addition, quality online educational content could flow from a wider embrace of open course materials currently available on the Web. As previously discussed, numerous organizations and universities are now providing schools, educators, and individuals with free and open access to educational resources (e.g., MIT's Open Courseware). However, making available a comprehensive library of digital textbooks remains one of the primary goals of forward-looking educators.[605]

To date, the print textbook industry has begun to offer free versions of some materials online.[606] California became a leading state in the effort to push more textbook online when it announced its digital textbook initiative will not only reduce textbook costs, but will also provide for more current and relevant educational content.[607] New devices – like Apple's iPad or dedicated e-readers like Amazon's Kindle – could spur more rapid digitization of textbooks and could eventually create a new distribution model for the industry.[608] Indeed, several studies have argued that the unbundling of traditional education content could drive down costs for students and educators and provide access to only the content that these stakeholders need.[609] Distributing unbundled content is made much easier online and, in the textbook context, could be enhanced via the implementation of an iTunes model, whereby consumers would be able to download and use individual chapters rather than whole books. Having access to individual bits of textbooks online could cut costs on the demand-side and could encourage innovation in curriculum development across the continuum.[610] *Policymakers could consider devising incentives to nudge textbook producers in this direction.*[611]

6.8 RECOMMENDATION #8

Support the nation's pro-investment policy framework for broadband in order to encourage continued innovation at the network level and across the educational technology sector.

As discussed throughout this report, broadband has emerged as a vital medium for the delivery of a growing universe of educational content. Even though pockets of unserved areas remain, broadband is widely available and is being increasingly adopted in schools and homes across the country. The current regulatory approach to broadband and the ecosystem of services and applications that it has nurtured has been decidedly pro-investment and pro-competition in nature.[612] This approach has resulted in an enormous amount of innovation that is impacting education at all levels. But for robust broadband networks, cutting-edge educational tools and applications may not have been developed. Going forward, stakeholders across the education sector – including innovators of educational technology, educators, parents, and students – will increasingly rely on the wide availability of advanced broadband network infrastructure as the primary means of reliably delivering and consuming advanced content and services aimed at enhancing the learning experience.

Efforts to tinker with or perhaps radically alter this dynamic could disrupt the many organic gains realized across the ecosystem. As such, the FCC and other regulatory entities should continue to play constructive roles in the oversight of the broadband sector going forward. As previously discussed, the FCC has already adopted much-needed changes in an effort to modernize the E-rate program and has released a comprehensive strategy for enhancing an already vibrant broadband market. However, at this point in the evolution of the broadband sector, when this technology is just beginning to be integrated into segments like the education space, adopting new rules that might impede or halt these organic gains should be resisted. Moreover, rather than imposing a series of new regulations on this dynamic technology, policymakers and regulators should take a holistic, forward-looking approach to broadband in an effort to allow it to continue embedding itself in sectors that are greatly benefitting from this unique technology. Otherwise, premature action could result in a series of unforeseen consequences that might slow or halt the many innovative successes described throughout this report.[613]

In order to preserve competition and innovation in the educational technology and advanced communication sectors, the current regulatory approach to broadband should not be altered at this point in time. Maintaining this approach is in the best interests of students, educators, and the entire nation.

7. Conclusion

Education in the United States is at a critical turning point. Educators are under significant pressure to enhance learning outcomes for a diverse and increasingly large number of students. Moreover, students are not being adequately prepared for the 21st century job market, which requires a unique set of critical thinking and technology skills that are not being taught in a coordinated or comprehensive manner. On a more fundamental level, traditional methods of education are being questioned as significant numbers of students drop out of school and as overall student achievement flags. At this critical juncture, broadband-enabled educational technologies are poised to radically transform an antiquated paradigm, improve the quality of education outcomes, and equip student with the skills needed to succeed in the global marketplace.

Broadband is driving innovation across the education sector. Broadband-enabled tools are allowing teachers to develop new methods of instruction that reach and engage students in the increasing number of places where learning occurs – in school, at the library, at home, on their cellphone, and in many other venues. Traditional approaches to preparing and disseminating content are being upended by blogs, wikis, social networks, and other such resources. These and other tools are enabling cost savings, enhancing collection and analysis of student data, and otherwise increasing accountability across the continuum. In the long-term, broadband will enable more individualized learning experiences for students, enabling them to learn at their own pace by using targeted content delivered to their computing device via a high-speed Internet connection.

A robust, efficiently managed broadband infrastructure will allow these and many more impacts to accrue in the near future. All stakeholders – schools, educators, parents, and students – face a number of barriers to further adoption and utilization of these technologies. However, organic efforts that have been nurtured and encouraged by carefully calibrated government support have begun to show that these obstacles can be overcome. As discussed throughout this report, these efforts have demonstrated success in raising the awareness of the benefits of technological tools, providing training, and encouraging collaboration to find targeted solutions aimed at overcoming various impediments. In light of these promising trends, policymakers should continue to finely attune their involvement and focus first and foremost on implementing mechanisms to spur further adoption and utilization of broadband across the education continuum.

ENDNOTES

[1] *See A Nation at Risk*: *The Imperative for Educational Reform*, at p. 7, A Report to the Nation and to the Secretary of Education by the National Commission on Excellence in Education (April 1983), *available at* http://www.ed.gov/pubs/NatAtRisk/index.html.

[2] According to the most recent assessment by the U.S. Department of Education, long term trend data indicate that reading and math test scores have increased across all age groups and ethnicities since the 1970s. *See The Nation's Report Card: Long Term Trend 2008*, at p. 4, National Assessment of Educational Progress Trends in Academic Progress, U.S. Dept. of Education (April 2009), *available at* http://nces.ed.gov/nationsreportcard/pdf/main2008/2009479.pdf.

[3] *See A Nation Accountable: Twenty-five Years after A Nation at Risk*, at p. 1, U.S. Dept. of Education (April 2008), *available at* www.ed.gov/rschstat/research/pubs/accountable/accountable.pdf.

[4] *See* The Official Website of the White House, Issues: Education, http://www.whitehouse.gov/issues/education/.

[5] *Id.*

[6] *See The Condition of Education 2010,* Indicator 1, U.S. Department of Education, National Center for Education Statistics, *available at* http://nces.ed.gov/programs/coe/2010/section1/indicator01.asp (data as of 2008).

[7] These programs include English as a Second Language, adult basic education classes, GED classes, college/university/vocational training, apprenticeships, and courses taken for work or personal interest. *See Issue Brief: Recent Participation in Formal Learning Among Working-Age Adults with Different Levels of Education*, U.S. Department of Education, National Center for Education Statistics 2008-041 (Jan. 2008), *available at* http://nces.ed.gov/pubs2008/2008041.pdf (data collected between 2000 and 2005).

[8] *See* Thomas D. Snyder and Sally A. Dillow, *Digest of Education Statistics 2009,* at p.1, National Center for Education Statistics, U.S. Department of Education (April 2010), *available at* http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2010013 ("*Education Statistics 2009*").

[9] *Id.*

[10] *Id.* at Table 3.

[11] *Id.*

[12] *See The Condition of Education 2010,* Indicator 4, U.S. Department of Education, National Center for Education Statistics, *available at* http://nces.ed.gov/programs/coe/2010/section1/indicator04.asp.

[13] *See The Condition of Education 2010,* Indicator 6, U.S. Department of Education, National Center for Education Statistics, *available at* http://nces.ed.gov/programs/coe/2010/section1/indicator06.asp.

[14] *See Press Release: High School Graduation Rate Improves Over Past Decade; Recent Declines Threaten Progress,* at p. 1, June 9, 2009, Education Week, http://www.edweek.org/media/ew/dc/2009/DC09_PressPackage_FINAL.pdf (*"Education Week 2009"*).

[15] *See* Carly Shuler, *Pockets of Potential,* at p. 2, Joan Ganz Cooney Center at Sesame Workshop (2009), *available at* http://www.joanganzcooneycenter.org/pdf/pockets_of_potential.pdf (*"Pockets of Potential"*).

[16] A 2007 study by the U.S. Department of Education found that "the average income of persons ages 18 through 65 who had not completed high school was roughly $20,100 in 2005. By comparison, the average income of persons ages 18 through 65 who completed their education with a high school credential, including a General Educational Development (GED) certificate, was nearly $29,700." The study also observed that Dropouts are also less likely to be in the labor force than those with a high school credential or higher and are more likely to be unemployed if they are in the labor force." *See* Jennifer Laird et al.,

Dropout Rates in the United States: 2005, Compendium Report, at p. 1, U.S. Dept. of Education, National Center for Education Statistics, NCES 2007-059 (June 2007), *available at* http://nces.ed.gov/pubs2007/2007059.pdf.

[17] *Education Week 2009* at p. 4.

[18] *See The Economic Impact of the Achievement Gap in America's Schools,* at p. 9, McKinsey & Company (2009), *available at* http://www.mckinsey.com/App_Media/Images/Page_Images/Offices/SocialSector/PDF/achievement_gap_report.pdf (*"Achievement Gap"*).

[19] *Id.* at p. 12.

[20] *See* Meris Stansbury, *Ten Ways to Boost Learning With Technology,* November 18, 2008, eSchool News, *available at* http://www.eschoolnews.com/news/top-news/index.cfm?i=56081 (*"Learning with Technology"*). A study from 2007 found that "Sixty-five percent of college professors do not believe high school standards prepare students for college, perhaps because they believe standards cover too many topics without targeting the essential knowledge and skills required for college readiness." *See High School Teaching for the Twenty-First Century: Preparing Students for College*, at p. 2, Alliance for Excellent Education, Issue Brief: Sept. 2007, *available at* www.all4ed.org/files/archive/publications/HSTeach21st.pdf.

[21] *See* TONY WAGNER, THE GLOBAL ACHIEVEMENT GAP: WHY EVEN OUR BEST SCHOOLS DON'T TEACH THE NEW SURVIVAL SKILLS OUR CHILDREN NEED – AND WHAT WE CAN DO ABOUT IT xix(Basic Books 2008) (citing a2008 study released by the Bill & Melinda Gates Foundation) ("GLOBAL ACHIEVEMENT GAP").

[22] For an overview of recent studies regarding international student comparisons, *see Facts for Education Advocates: International Comparisons*, Alliance for Excellent Education (Jan. 2009), *available at* http://www.all4ed.org/files/Facts_For_Education_Adv_Jan2009.pdf.

[23] *See, e.g.,* Kenneth Chang, *White House Pushes Science and Math Education*, Nov. 22, 2009, N.Y. Times (reporting on the launch of a White House initiative – Educate to Innovate – that seeks to "enlist companies and nonprofit groups to spend money, time and volunteer effort to encourage students, especially in middle and high school, to pursue science, technology, engineering and math."

[24] *Achievement Gap* at p. 8, Exhibit 2.

[25] *Pockets of Potential* at p. 2; GLOBAL ACHIEVEMENT GAP xix-xx (comparing high school and college graduation statistics from a number of sources, including the OECD).

[26] *See Are They Ready to Work?* at p. 9, Joint Report of The Conference Board, Corporate Voices for Working Families, the Partnership for 21st Century Skills, and the Society for Human Resource Management (2006), *available at* http://www.21stcenturyskills.org/documents/FINAL_REPORT_PDF09-29-06.pdf.

[27] *See generally* ERIC HANUSHEK & ALFRED LINDSETH, SCHOOLHOUSES, COURTHOUSES, AND STATEHOUSES: SOLVING THE FUNDING-ACHIEVEMENT PUZZLE'S IN AMERICA'S PUBLIC SCHOOLS (Princeton 2009) (providing a comprehensive overview of the many arguments surround the school funding issue and outlining an alternative framework for performance-based funding system),

[28] *See* Eric Hanushek & Alfred Lindseth, *Performance-Based Funding*, Defining Ideas (2009), *available at* http://www.hoover.org/publications/definingideas/62923792.html.

[29] *See* John Paul Gee, *Getting Over the Slump: Innovative Strategies to Promote Children's Learning,* at p. 4, Joan Ganz Cooney Center at Sesame Workshop (June 2008), *available at* http://www.joanganzcooneycenter.org/pdf/Cooney_policy_FINAL.pdf (*"Getting Over the Slump"*).

[30] *Connecting America: The National Broadband Plan*, at p. 225, FCC (rel. March 2010) ("*National Broadband Plan*").

[31] For example, the 2010 Lemelson-MIT Invention Index found that one of the most effective ways of increasing teens' interest and performance in STEM subjects is through hands-on learning outside of the classroom. As discussed *infra*, broadband is increasingly being used to provide students with these types of interactive and experimental educational experiences. *See* Press Release, *2010 Lemelson-MIT Invention Index Reveals Ways to Enhance Teens' Interest in Science, Technology, Engineering, and Mathematics in the Classroom and Beyond*, Jan. 28, 2010, MIT, *available at* http://web.mit.edu/invent/n-pressreleases/n-press-10index.html.

[32] *See, e.g., National Broadband Plan* at p. 226.

[33] *See* Charles M. Davidson & Michael J. Santorelli, *Barriers to Broadband Adoption*, at p. 68-83, A Report to the Federal Communications Commission, New York Law School (Oct. 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/ACLP%20Report%20to%20the%20FCC%20-%20Barriers%20to%20BB%20Adoption.pdf (highlighting 10 policy and non-policy barriers to further adoption of broadband in the education sector) ("*Barriers to Broadband Adoption*").

[34] In his comprehensive historical overview of American educational technology, Paul Saettler provides a thorough discussion of the many connotations that have been associated with the phrase "educational technology" over the last few centuries. *See generally* PAUL SAETTLER, THE EVOLUTION OF AMERICAN EDUCATIONAL TECHNOLOGY (2000) ("AMERICAN EDUCATIONAL TECHNOLOGY").

[35] *See* Alena R. Treat et al., *Major Developments in Instructional Technology: During the 20th Century,* IDT Record, Department of Instructional Systems Technology, Indiana University (Sept. 2006), *available at* http://www.indiana.edu/~idt/shortpapers/documents/ITduring20.html ("*20th Century Developments*").

[36] *See What is the History of the Field?* Association for Educational Communications and Technology, *available at* http://www.aect.org/standards/history.html ("*AECT History*").

[37] *Id.*

[38] As a result, the FCC set aside 242 television frequencies for noncommercial educational purposes in 1953. *See* Robert A. Levin and Laurie Moses Hines, *Educational Television, Fred Rogers, and the History of Education*, History of Education Quarterly, Vol. 43, No. 2 (Summer 2003), pp. 262-275.

[39] AMERICAN EDUCATIONAL TECHNOLOGY at p. 96.

[40] *Id* at p. 201-202.

[41] One early study, for example, found that media technologies were effective educational tools, due largely to their enhanced level of realism. *20th Century Developments* (citing Edgar Dale's *Cone of Experience*).

[42] *Id.* (citing the Dalton and Winnetka Plans developed by Frederic Burk's staff in the 1920s).

[43] AMERICAN EDUCATIONAL TECHNOLOGY at p. 201-203.

[44] *See* Joan Ganz Cooney, *The Potential Uses of Television in Preschool Education*, Carnegie Corporation (1966), *available at* www.joanganzcooneycenter.org/pdf/jgc-1966-report.pdf ("*Potential Uses of TV for Preschool Education*"). For a more detailed overview of how this report spurred the development of *Sesame Street*, *see* MICHAEL DAVIS, STREET GANG: THE COMPLETE HISTORY OF SESAME STREET (2008).

[45] *Potential Uses of TV for Preschool Education* at p. 7.

[46] For example, some thought these types of shows would help in sharpening "visual discrimination." Visual discrimination refers to the ability of child to discern the differences between different objects, e.g., picking out the duck from among a group of three cats and a duck. *Id*. at p. 31.

[47] *See, e.g.,* Lisa Guernsey, *Sesame Street: The Show that Counts*, June 1, 2009, Newsweek, *available at* http://www.newsweek.com/id/199141 (providing an overview of studies that have found positive impacts on student performance); *cf.* Kay S. Hymowitz, *On Sesame Street, It's All Show*, City Journal (Autumn 1995), *available at* http://www.city-journal.org/printable.php?id=116 (observing that "Stripped of all the noise and color, the fun and the speed, the sophisticated design-school aesthetic and the unfailing wittiness, it is nothing more than a disjointed series of animated flash cards [about 40 per one-hour show], whose inherent blandness and triviality the producers spend millions trying to disguise.").

[48] Larry Cuban notes that television was already being widely used in classrooms in the 1950s. A key enabler of this proliferation was the Ford Foundation, which, through its "Fund for the Advancement of Education underwrote the initial use of [television] in schools and colleges, especially as a tool for relieving the crushing shortage of teachers that resulted from ballooning enrollments. Without [this] sponsorship, classroom video probably would have remained chic gimmickry not unlike the 'talking typewriters' of a few decades earlier." *See* LARRY CUBAN, TEACHERS AND MACHINES: THE CLASSROOM USE OF TECHNOLOGY SINCE 1920 28 (Teacher's College Press 1986) ("TEACHERS AND MACHINES").

[49] *See* Eleanor Cornthwaite et al., "Sesame Street" and "The Electric Company": What Is Their Impact on Teaching Methods? Education Resources Information Center, U.S. Dept. of Education (1974), *available at* http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED126863.

[50] *Id*. at p. 27-31.

[51] *See, e.g.,* Charles Kenny, *Revolution in a Box*, Foreign Policy (Nov./Dec. 2009), *available at* http://www.foreignpolicy.com/articles/2009/10/19/revolution_in_a_box?page=full.

[52] *See, e.g.,* MIZUKO ITO, ENGINEERING PLAY: A CULTURAL HISTORY OF CHILDREN'S SOFTWARE (MIT 2009) ("ENGINEERING PLAY").

[53] For an overview of the modern marketplace, *see* Carly Shuler, *D is for Digital: An Analysis of the Children's Interactive Media Environment With a Focus on Mass Marketed Products that Promote Learning*, Joan Ganz Cooney Center, Sesame Workshop (Dec. 2007), *available at* http://www.joanganzcooneycenter.org/pdf/DisforDigital.pdf ("*D is for Digital*").

[54] *20th Century Developments.*

[55] In 1963, only one percent of secondary schools used computers for instructional purposes, whereas in 1974 over two million students had begun using computers in their classes. By 1975, 55 percent of schools had computer access. *See* Andrew Molnar, *Computers in Education: A Brief History*, at p. 2-3, The Journal, June 1, 1997, *available at* http://thejournal.com/Articles/1997/06/01/Computers-in-Education-A-Brief-History.aspx?Page=1 ("*Computers in Education*").

[56] *Id.* at p. 2 (citing ROGER LEVIEN, THE EMERGING TECHNOLOGY: INSTRUCTIONAL USES OF THE COMPUTER IN HIGHER EDUCATION (1972)).

[57] *Id* at p. 3; *see also 20th Century Developments.*

[58] *Computers in Education* at p. 4 (citing James Kulik et al., *Effectiveness of Computer-based Instruction: An Updated Analysis*, Computers in Human Behavior, 7(1-2), 75-04, (1991)).

[59] *Id* at p. 5.

[60] *See Using Technology to Support Education Reform,* (September 1993), U.S. Department of Education, *available at* http://www2.ed.gov/pubs/EdReformStudies/TechReforms/chap2g.html (*"Education Reform"*).

[61] *Id.*

[62] *Id.* (citing the Office of Technology Assessment 1988).

[63] *20th Century Developments* (citing R.A. Reiser, *A history of instructional design and technology*, in TRENDS AND ISSUES IN INSTRUCTIONAL DESIGN AND TECHNOLOGY 26-53 (R.A. Reiser & J.V. Dempsey, eds.) (Prentice Hall 2002) ("*Reiser 2002*")).

[64] *Education Reform.*

[65] *20th Century Developments* (citing *Reiser 2002).*

[66] *Id.*

[67] *Id*.

[68] *See* MARK WARSCHAUER, LAPTOPS AND LITERACY: LEARNING IN THE WIRELESS CLASSROOM 23 (Teacher College Press 2006).

[69] *Id.* at p. 24.

[70] *See Access, Adequacy, and Equity in Education Technology,* at p. 10, National Education Association (May 2008), *available at* http://www.edutopia.org/files/existing/pdfs/NEA-Access,Adequacy,andEquityinEdTech.pdf ("*NEA 2008*").

[71] *See The 21st-Century Campus: Are We There Yet?* at p. 17, Oct. 13, 2008, CDWG *available at* http://webobjects.cdw.com/webobjects/media/pdf/newsroom/CDWG-21st-Century-Campus-1008.pdf ("*CDWG 2008*").

[72] Resources used for this case study include: Maine Learning Technology Initiative, Home, http://www.maine.gov/mlti/index.shtml; Maine Learning Technology Initiative, History, http://maine.gov/mlti/about/history.shtml; Maine Learning Technology Initiative, About, http://maine.gov/mlti/about/index.shtml; Sec. II-1. 5 MRSA §12004-I, sub-§18-C (legislation enacting the creation of the Technology Endowment), *available at* http://maine.gov/mlti/resources/history/statute.pdf; *Teaching and Learning for Tomorrow: A Learning Technology Plan for Maine's Future,* Final Report of the Task Force on the Maine Learning Technology Endowment (Jan. 2001), *available at* http://maine.gov/mlti/resources/history/mlterpt.pdf; David L. Silvernail & Dawn M. M. Lane, *The Impact of Maine's One-to-One Laptop Program on Middle School Teachers and Students, Phase One Summary Evidence, Research Report #1*, at p. iii, Maine Education Policy Research Institute, University of Southern Maine Office (Feb. 2004), *available at* http://www.bryan.k12.oh.us/Forms/MLTIPhaseOne.pdf; Alexis M. Berry & Sarah E. Wintle, *Using Laptops to Facilitate Middle School Science Learning: The Results of Hard Fun*, Center for Education Policy, Applied Research, and Evaluation, University of Southern Maine in collaboration with Bristol Consolidated School (Feb. 2009), *available at* http://usm.maine.edu/cepare/pdf/Bristol_Final_Copy_cover.pdf; David L. Silvernail & Pamela J. Buffington, *Improving Mathematics Performance Using Laptop Technology: The Importance of Professional Development for Success*, Maine Education Policy Research Institute in collaboration with the Maine International Center for Digital Learning, University of Southern Maine (Feb. 2009), *available at* http://usm.maine.edu/cepare/pdf/Mathematics_Final_cover.pdf; and Michael Trucano, *The Maine Thing About 1:1 Computing*, Nov. 13, 2009, EduTech Blog, The World Bank, *available at* http://blogs.worldbank.org/edutech/checking-in-with-the-MLTI.

[73] Two of the most vociferous critics have been Larry Cuban and Todd Oppenheimer. *See, e.g.,* Larry Cuban, TEACHERS AND MACHINES; OVERSOLD AND UNDERUSED: COMPUTERS IN THE CLASSROOM (Harvard 2001); *cf. Confessions from a Skeptic on Computers in School*, Jan. 31, 2010, Larry Cuban on School Reform and Classroom Practice Blog, *available at* http://larrycuban.wordpress.com/2010/01/31/confessions-from-a-skeptic-on-computers-in-school/ (noting that some of his previous skepticism has not been borne out but also observing that classroom use of educational technology is still far from universal). *Also see*

generally TODD OPPENHEIMER, THE FLICKERING MIND: SAVING EDUCATION FROM THE FALSE PROMISE OF TECHNOLOGY (2003) ("THE FLICKERING MIND").

[74] *See* J. James Cengiz Gulek and Hakan Demirtas, *Learning with technology: The impact of laptop use on student achievement*, at p. 29, Journal of Technology, Learning, and Assessment, vol. 3, no. 2 (2005), *available at* http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1052&context=jtla.

[75] *See generally* Michael Russell et al., *Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent One-to-One laptops*, Technology and Assessment Collaborative Study, Boston College (Feb. 2004), *available at* http://www.bc.edu/research/intasc/PDF/Andover1to1.pdf.

[76] *Id.*

[77] *See* William R. Penuel, *Implementation and Effects of One-to-One Computing Iniatives: A Research Synthesis,* at p. 336-337, Journal of Research on Technology in Education (2006), *available at* http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/2a/5b/5b.pdf

[78] These studies, which were published in a special edition of the *Journal of Technology, Learning and Assessment* (Vol. 9: Educational Outcomes and Research from 1:1 Computing Settings), are *available at* http://escholarship.bc.edu/jtla/.

[79] *See* Damian Bebell & Laura M. O'Dwyer, *Educational Outcomes and Research from 1:1 Computing Settings*, at p. 12, Journal of Technology, Learning and Assessment, Vol. 9, No. 1, *available at* http://escholarship.bc.edu/jtla/vol9/1/.

[80] *See* John Timmer, *Despite Problems, Laptops Boost Student Test Scores*, Jan. 25, 2010, Ars Technica, *available at* http://arstechnica.com/tech-policy/news/2010/01/evidence-that-laptop-education-programs-boost-test-scores.ars.

[81] *See, e.g.,* MICHAEL BELFIORE, THE DEPARTMENT OF MAD SCIENTISTS: HOW DARPA IS REMAKING OUR WORLD, FROM THE INTERNET TO ARTIFICIAL LIMBS 63 (2009) ("DEPARTMENT OF MAD SCIENTISTS").

[82] See Richard N. Katz, *The Tower and the Cloud*, *Higher Education in the Age of Cloud Computing,* at p. 9, EDUCAUSE, *available at* http://www.educause.edu/Resources/TheTowerandtheCloudHigherEduca/163293 (*"Tower and the Cloud"*).

[83] *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* p. 14, The National Center for Education Statistics (November 2006), *available at* http://nces.ed.gov/pubs2007/2007020.pdf.

[84] *Id.*

[85] *Id* at p. 4.

[86] *Id* at p. 7; *see also 20th Century Developments*.

[87] *Tower and the Cloud* at p. 9.

[88] *Computers in Education* at p. 9.

[89] *Id.*

[90] *Id.*

[91] *Id.*

[92] *20th Century Developments* (Citing *Reiser 2002).*

[93] *Id.*

[94] *Id*.

[95] TEACHERS AND MACHINES at p. 9 (quoting Edison in 1922).

[96] THE FLICKERING MIND at p. 10 (quoting Frederic Golden, *Here Come the Microkids*, May 3, 1982, Time).

[97] *See* Press Release, *U.S. Department of Education Study Finds that Good Teaching can be Enhanced with New Technology; Analysis of Controlled Studies Shows Online Learning Enhances Classroom Instruction*, June 26, 2009, U.S. Department of Education, *available at* http://www.ed.gov/news/pressreleases/2009/06/06262009.html.

[98] *See Transforming American Education: Learning Powered by Technology*, at p. 9-12, U.S. Dept. of Education (Nov. 2010), *available at* http://www.ed.gov/sites/default/files/netp2010.pdf ("*National Ed Tech Plan*").

[99] *National Broadband Plan* at p. 226.

[100] *See* Steve Midgeley, *Gaps in Broadband for Education,* Nov. 25, 2009, FCC Blogband, *available at* http://blog.broadband.gov/?entryId=16369.

[101] *National Broadband Plan* at p. 37-42 (finding that only 5 percent of census tracts in the U.S. are without a wireline broadband providers and that less than 2 percent are without a 3G mobile provider); *The Broadband Availability Gap*, at p. 17, FCC (July 2010) (finding that about 7 million out of 130 million housing units – or a little more than five percent of all housing units – in the U.S. lack access to broadband service that meets the Commission's more rigorous upload/download speed standard for broadband), available at http://download.broadband.gov/plan/the-broadband-availability-gap-obi-technical-paper-no-1.pdf ("*Broadband Availability Gap*")

[102] *See* John Horrigan, *Broadband Adoption and Use in America,* at p. 5, OBI Working Paper No. 1, FCC (Feb. 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296442A1.pdf ("*Broadband Adoption and Use in America*"); *Exploring the Digital Nation: Home Broadband Internet Adoption in the United States*, at p. 17, Economic & Statistics Administration and NTIA (Nov 2010), *available at* http://www.ntia.doc.gov/reports/2010/ESA_NTIA_US_Broadband_Adoption_Report_11082010.pdf ("*NTIA Broadband Adoption Report 2010*").

[103] It is estimated that companies invested approximately $30 billion in broadband infrastructure in 2009. *See, e.g.,* Robert W. Crandall & Hal J. Singer, *The Economic Impact of Broadband Investment*, at p. 12, 38-43 (Feb. 2010) (observing that between 2003 and 2009, communication service providers invested over $190 billion in last-mile broadband technologies and estimating the service providers will likely invest an average of $30 billion in broadband networks between 2010 and 2015) ("*Economic Impact of Broadband Investment*").

[104] *Broadband Availability Gap* at p. 19-20 (noting that "Due to higher network costs per home passed, most of the unserved are located in less dense and/or rural areas.").

[105] *National Broadband Plan* at p. 236.

[106] The 2009 American Recovery and Reinvestment Act (ARRA) created a Broadband Technology Opportunities Program within the National Telecommunications and Information Administration (NTIA) of the Department of Commerce. The grant program distributed $4.7 billion to fund the deployment of broadband infrastructure in unserved and underserved areas in the country, and to help facilitate broadband use and adoption. An additional $2.5 billion in loans and grants were administered by the Rural Utilities Service. *See Bill Summary: Energy and Commerce Provisions on Healthcare, Broadband and Energy,* U.S. House of Representatives Committee on Commerce, Feb. 12, 2009, *available at* http://energycommerce.house.gov/Press_111/20090212/economiceecoverysummary.pdf ("*ARRA Summary*").

[107] *See generally* Michael J. Copps, *Bringing Broadband to Rural America: Report on a Rural Broadband Strategy*, FCC (rel. May 22, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291012A1.pdf ("Bringing ubiquitous and affordable broadband services to rural America will improve the quality of education, healthcare, and public safety in rural America, among other benefits," at para. 15; "Broadband build-out to rural America also can enhance educational opportunities and the likelihood of academic achievement. Students without access to broadband cannot do the same type of homework as their counterparts who enjoy access to broadband, and students in certain rural areas are often many miles away from advanced educational institutions, such as colleges and universities. Broadband can significantly improve the quality of education by providing students in rural America with the ability to do online research, interact with their teachers and schools from home, and obtain college credit and college degrees, even though they are not physically on campus," at para. 19).

[108] *Id.* at n. 118 ("The Distance Learning and Telemedicine programs provide a combination of loans and grants to improve educational and health care opportunities. The grant program focuses primarily on connecting students and teachers or medical providers and patients at separate locations, while the loan and combination loan/grant program seeks to fund additional resources to improve medical care and education. Funds generally are used to finance broadband infrastructure, purchase land and buildings, acquire end-user and other equipment, and provide technical assistance and instruction." (citations omitted)). Additional information can be found *at* USDA, Distance Learning and Telemedicine Program, http://www.usda.gov/rus/telecom/dlt/dlt.htm.

[109] *NEA 2008* at p. 1.

[110] *Id.* at p. 2. *See also Barriers to Broadband Adoption* at p. 78-80; *National Broadband Plan* at p. 233 (noting that "while teacher use of technology continues to grow, most teachers still do not use technology in their classrooms for many key activities." (citations omitted)).

[111] *Barriers to Broadband Adoption* at p. 72-73.

[112] *National Broadband Plan* at p. 236 (citing a 2006 study released by the U.S. Department of Education's National Center for Education Statistics).

[113] According to the U.S. Department of Education, "an estimated 100 percent of public schools had one or more instructional computers with Internet access" at the beginning of the 2008-2009 school year. *See Educational Technology in U.S. Public Schools: Fall 2008*, at p. 2, National Center for Education Statistics, U.S. Dept. of Education (April 2010), *available at* http://nces.ed.gov/pubs2010/2010034.pdf ("*Ed Tech: Fall 2008*").

[114] *See* U.S. Department of Education, National Center for Education Statistics, Question: How many schools have access to the Internet?, http://nces.ed.gov/fastfacts/display.asp?id=46. The FCC has observed that individual schools and school districts across the country use a wide array of broadband connection technologies to get online. These include direct fiber, T-1 lines, and wireless connections. *National Broadband Plan* at p. 236.

[115] *See High-Speed Broadband Access for All Kids: Breaking Through the Barriers*, at p. 6, State Educational Directors Association (June 2008), available at http://www.setda.org/web/guest/2020/broadband.

[116] The FCC revised its definition of broadband in 2008, increasing the minimum speed necessary to qualify as a broadband connection from 200 kb/s to 786 kb/s. *See, e.g.,* Anne Broache, *FCC Approves New Methods for Tracking Broadband's Reach*, March 19, 2008, CNET News.com, *available at* http://news.cnet.com/8301-10784_3-9898118-7.html.

[117] *See* Tom Rolfes and Tammy Stephens, *21st Century Networks for 21st Century Schools: Making the Case for Broadband*, at p. 3, CoSN ("*21st Century Networks*").

[118] *Breaking Through the Barriers* at p. 4; *National Broadband Plan* at p. 236.

[119] *Ed Tech: Fall 2008* at Table 1 (this figure excludes laptops on carts).

[120] *Id.*

[121] *Id.*

[122] *NEA 2008* at p. 9.

[123] *Broadband Adoption and Use in America* at p. 7. However, the broadband adoption rate in single-parent households remains below the overall national average. *NTIA Broadband Adoption Report 2010* at p. 8.

[124] *See* Aaron Smith, *Home Broadband Adoption 2010*, at p. 7-8, Pew Internet & American Life Project (Aug. 2010), *available at* http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx ("*Home Broadband Adoption 2010*") . In its study, measuring adoption rates through the end of 2009, NTIA found that 49 percent of African-Americans and 36 percent of households earning less than $25,000 per year had adopted broadband. *NTIA Broadband Adoption Report 2010* at p. 8.

[125] A 2003 survey found that just 41 percent of students in the eighth grade who take part in the free and reduced lunch program had home Internet access in 2003, compared to 72 percent for those not participating. *See* Karen Kaminski, Pete Seel, and Kevin Cullen, *Technology Literate Students? Results from a Survey,* at p. 34, Educause Quarterly (2003), *available at* http://net.educause.edu/ir/library/pdf/eqm0336.pdf ("*Technology Literate Students*").

[126] *See Connected to the Future,* at p. 6, Corporation for Public Broadcasting, http://www.cpb.org/stations/reports/connected/connected_report.pdf (*"Connected to the Future"*).

[127] *Id*. According to U.S. Census data from 2005, less than half – 45 percent – of blacks used a computer at home, compared to over 60 percent for both Whites and Asians. *See Computer and Internet Use in the United States: October 2007*, Table 4 - Reported Computer and Internet Access for Individuals 15 Years and Older, by Selected Characteristics: 2005, U.S. Census Bureau, *available at* http://www.census.gov/population/socdemo/computer/2007/tab04.xls.

[128] *See A Resource Guide Identifying Technology Tools for Schools*, at p. 7, The state Educational Technology Directors Association (SETDA) and the National Association of State Title I Directors (NASTID), September 2009, *available at* http://www.setda.org/c/document_library/get_file?folderId=295&name=DLFE-490.pdf.

[129] *Id*.

[130] *Id*.

[131] *See* Elaine Allen and Jeff Seaman, *Online Nation*: *Five Years of Growth in Online Learning,* at p. 3, The Sloan Consortium (October 2007) ("Higher costs for online development and delivery are seen as barriers among those who are planning online offerings, but not among those who have online offerings."); *see also Barriers to Broadband Adoption* at p. 73.

[132] *See* Katie Ash, *Mobile Learning Costs Add Up,* March 18, 2010, Education Week, *available at* http://www.edweek.org/ew/articles/2010/03/18/26cost.h29.html.

[133] *Id.*

[134] *Id.*

[135] *See, e.g.,* CURTIS J. BONK, THE WORLD IS OPEN: HOW WEB TECHNOLOGY IS REVOLUTIONIZING EDUCATION 91-137 (2009) (describing a variety of examples of how the Internet is being used to supplement traditional classroom learning) ("THE WORLD IS OPEN"). Additional examples are provided throughout the remainder of this paper.

[136] *See* Diana G. Oblinger and James L. Oblinger, *Educating the Net Generation,* at p. 2.3, Educause (2005) ("*Educating the Net Generation*").

[137] *Id*.

[138] *See* Victoria J. Rideout et al., *Generation M2: Media in the Lives of 8- to 18-year Olds*, at p. 2, Kaiser Family Foundation (Jan. 2010), *available at* http://www.kff.org/entmedia/upload/8010.pdf ("*Generation M2*") ("Over the past five years, young people have increased the amount of time they spend consuming media by an hour and seventeen minutes daily, from 6:21 to 7:38 – almost the amount of time most adults spend at work each day, except that young people use media seven days a week instead of five.").

[139] *See* Elizabeth A. Vandewater et al., *Digital Childhood: Electronic Media and Technology Use Among Infants, Toddlers, and Preschoolers*, at p. 1010, Pediatrics, Vol. 119 No. (May 2007), *available at* http://pediatrics.aappublications.org/cgi/reprint/119/5/e1006.pdf.

[140] *Educating the Net Generation.*

[141] *Id.*

[142] *See* Sydney Jones and Susannah Fox, *Generations Online in 2009* at p. 2, Pew Internet & American Life Project, *available at* http://www.pewinternet.org/Reports/2009/Generations-Online-in-2009.aspx (observing that "93 percent of teenagers age 12-17 went online in 2008, compared to 85 percent of adults age 25-29 and 78 percent of those ages 50-54").

[143] *See* Amanda Lenhart et al., *Social Media & Mobile Internet Use Among Teens and Young Adults*, at p. 7, Pew Internet & American Life Project (Feb. 2010), *available at* http://www.pewinternet.org/~/media//Files/Reports/2010/PIP_Social_Media_and_Young_Adults_Report.pdf ("*Social Media Use Among Teens – 2010*").

[144] *See* Amanda Lenhart, *Presentation: Teens and Social Media – An Overview*, Slide 5, April 10, 2009, Pew Internet & American Life Project, *available at* http://www.pewinternet.org/Presentations/2009/17-Teens-and-Social-Media-An-Overview.aspx ("*Teens and Social Media*").

[145] *See Teens Do Not Consider a lot of Their Electronic Texts as Writing,* April 24, 2008, Pew Trusts, *available at* http://www.pewtrusts.org/news_room_detail.aspx?id=38268 ("*Teens and Writing*).

[146] *Id.*

[147] *Id.*

[148] *See* Donna St. George, *Parents Use 'Digital' Grounding as a 21st Century Grounding Tool*, Sept. 5, 2010, Wash. Post., *available at* http://www.washingtonpost.com/wp-dyn/content/story/2010/09/05/ST2010090503851.html.

[149] *Social Media Use Among Teens – 2010* at p. 22.

[150] Twitter users tend to be in their late twenties and early thirties. *Id.* at p. 3.

[151] *Id.* at 2.

[152] *See* John Palfrey and Urs Gasser, BORN DIGITAL: UNDERSTANDING THE FIRST GENERATION OF DIGITAL NATIVES 4 (2008). This generation is the subject of a wide range of scholarship. Other important recent works on the subject of how technology impacts and shapes the lives of "natives" include: DON TAPSCOTT, GROWN UP DIGITAL (2008); MIZUKO ITO ET AL., HANGING OUT, MESSING AROUND, AND GEEKING OUT: KIDS LIVIGING AND LEARNING WITH NEW MEDIA (MIT 2009).

[153] *See* Jeanne Wellings and Michael H. Levine, *The Digital Promise: Transforming Learning with Innovative Uses of Technology,* at p. 10, Joan Ganz Cooney Center at Sesame Workshop (October 2009), *available at*

http://www.joanganzcooneycenter.org/pdf/Cooney%20Apple_Whitepaper_jp10-23-09.pdf ("*Digital Promise*").

[154] *Id.*; *see also* ENGINEERING PLAY at p. 82-84 (discussing the impacts of video games on how children learn and participate in education).

[155] *Digital Promise* at p. 10.

[156] *D is for* at p. 17 (citing a study by Cable in the Classroom, 2007).

[157] *See Ready to Learn Initiative Summative Evaluation,* October 14, 2009, Center for Children & Technology, *available at* http://cct.edc.org/ready_to_learn.asp.

[158] *See* Sharon Collins, *Virtual Worlds in Education,* EDUCAUSE Evolving Technologies Committee (December 2008), *available at* http://net.educause.edu/ir/library/pdf/DEC0801.pdf.

[159] A more detailed listing of virtual worlds targeted at young children can be found at, Common Sense Media, Reviews: Virtual Worlds, http://www.commonsensemedia.org/website-reviews/all-ages/virtual+worlds?action=new-releases.

[160] *See Evaluation of Evidence-Based Practices in Online Learning,* at p. xi, U.S. Department of Education, Center for Technology in Learning (2009), *available at* http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf ("*Evaluation of Online Learning*").

[161] THE WORLD IS OPEN at p. 98 (citing a study by Project Tomorrow, *Learning in the 21st Century: A National Report on Online Learning* (2008), *available at* http://www.blackboard.com/Solutions-by-Market/K-12/Learn-for-K12/Leadership-Views/Education-in-the-21st-Century.aspx).

[162] *See* Clayton M. Christensen and Michael B. Horn, *How Do We Transform Our Schools?* Education Next, Vol. 8, No. 3 (Summer 2008), at http://educationnext.org/how-do-we-transform-our-schools.

[163] For an overview of blended learning, *see* Charles Dziuban et al., *Research Bulletin: Blended Learning*, Educause (March 2004), *available at* http://www.educause.edu/ir/library/pdf/ERB0407.pdf.

[164] *See* Cheryl Lemke and Ed Coughlin, *Leadership for Web 2.0 in Education: Promise and Reality,* at p. 7, Metiri Group, Commissioned by CoSN through support from the John D. and Catherine T. MacArthur Foundation (May 2009), *available at* http://www.cosn.org/Portals/7/docs/Web%202.0/CoSN%20Report%20042809Final%20w-cover.pdf (detailing the results of a survey that found that an increasing number of educators and administrators are beginning to integrate Web 2.0 tools into curricula) ("*CoSN Web 2.0 Study*").

[165] *See* Lauren Barack, *Twittering Dante,* April 1, 2009, School Library Journal, *available at* http://www.schoollibraryjournal.com/index.asp?layout=talkbackCommentsFull&talk_back_header_id=6594667&articleid=ca6647718.

[166] *Pockets of Potential* at p. 14 (citing a 2008 NPD Group study that found "[m]obile device ownership among children ages 4-14…experienced double-digit growth since 2005"); *see also* Amanda Lenhart et al., *Teens and Mobile Phones*, at p. 15. Pew Internet & American Life Project (April 2010), *available at* http://www.pewinternet.org/~/media//Files/Reports/2010/PIP-Teens-and-Mobile-2010-with-topline.pdf (finding that cell phone ownership rates have increased steadily among teenagers of all ages over the last several years); *Generation M2* at p. 18.

[167] *Generation M2* at p. 18.

[168] *Id.*

[169] *Pockets of Potential* at p. 17-21.

[170] *See* Patricia Sobrero, *Social Learning Through Virtual Teams and Communities,* Journal of Extension, vol.46, no.3 (June 2008), *available at* http://www.joe.org/joe/2008june/a1.php (*"Virtual Teams and Communities"*); *CoSN Web 2.0 Study;* S. CRAIG WATKINS, THE YOUNG AND HE DIGITAL: WHAT THE MIGRATION TO SOCIAL-NETWORK SITES, FAMES, AND ANYTIME, ANYWHERE MEDIA MEANS FOR OUR FUTURE 19-46 (Beacon Press 2009).

[171] *Virtual Teams and Communities.*

[172] Information included in this Case Study is primarily derived from various pages on the program's website, Virtual Hall of Science, http://www.nysci.org/learn/research/vhos.

[173] *See, e.g.,* Julius Genachowski, FCC Chairman, *Broadband: Our Enduring Engine for Prosperity and Opportunity*, at p. 4, Remarks before NARUC, Feb. 16, 2010, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296262A1.pdf (noting the vast potential of broadband-enabled online learning: "Imagine a connected America where kids in poor neighborhoods, living in rural towns or city apartments, can have access in their classrooms to the best teachers in the world, and access in their homes to up-to-date e-textbooks and high-quality tutoring from energized college and grad students around America.") (*"Prosperity and Opportunity"*).

[174] *National Broadband Plan* at p. 231 (citing a 2009 studying released by the Center for American Progress).

[175] *Prosperity and Opportunity* at p. 3.

[176] *See* U.S. Dept. of Education: National Center for Education Statistics, Question: How many students with disabilities receive services? http://nces.ed.gov/fastfacts/display.asp?id=64.

[177] *See 2008 Disability Status Report – United States*, at p. 46-51, Rehabilitation Research and Training Center on Disability Demographics and Statistics, Cornell University, *available at* http://www.ilr.cornell.edu/edi/DisabilityStatistics/statusreports/2008-pdf/2008-StatusReport_US.pdf.

[178] *Id.* at p. 38.

[179] *See* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on People with Disabilities*, at p. 26-27, A Report to the U.S. Chamber of Commerce (Dec. 2009), *available at* http://www.uschamber.com/NR/rdonlyres/eg527llrwtht77nu6ifxqxyfyam3pbbdizzwuwwu3kuomn37hitdicjmnox7onfsc3ad4iwevg4babodfjivqtctiad/U%2eS%2eChamberPaperonBroadbandandPeoplewithDisabilities.pdf ("*The Impact of Broadband on People with Disabilities*").

[180] *The Digital Promise* at p. 11.

[181] *Educating the Net Generation,* at p. 2.13.

[182] *Id.*

[183] *Id.*

[184] *Id* at p. 2.12.

[185] *Getting Over the Slump* at p. 13-14.

[186] *See* Clayton M. Christensen and Michael B. Horn, *How Do We Transform Our Schools?* EducationNext, Summer 2008, Vol. 8 No. 3 *available at* http://educationnext.org/how-do-we-transform-our-schools/ ("*EducationNext 2008"*).

[187] *Digital Promise* at p. 3 (citing a study by Apple, 2009).

[188] *See, e.g., National Broadband Plan* at p. 228-231.

[189] *Connected to the Future* at p. 8.

[190] *Id.*

[191] *See Evaluation of Evidence-Based Practices in Online Learning,* at p. ix, U.S. Department of Education, Center for Technology in Learning (2009), *available at* http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf ("*Evaluation of Online Learning*").

[192] *Digital Promise* at p. 3 (citing the International Society for Technology in Education, 2008).

[193] *See* Linda A. Jackson et al., *Does Home Internet Use Influence the Academic Performance of Low-Income Children?* Developmental Psychology, Vol. 42, No. 3 (2006).

[194] *See* Kallen Tsikalas et al., *Home Computing, School Engagement and Academic Achievement of Low-Income Adolescents: Findings from Year One of a Three Year Study of the CFY Intervention*, at p. 5, Computers for Youth Foundation in collaboration with the Educational Testing Service (2007).

[195] *National Broadband Plan* at p. 227.

[196] *Id.* at p. 228.

[197] Resources used for this Case Study include: Partnership for 21st Century Skills, Framework for 21st Century Learning, http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120; *P21 Framework Definitions*, Partnership for 21st Century Skills, *available at* http://www.21stcenturyskills.org/documents/P21_Framework_Definitions.pdf; ThinkFinity, 21st Century Skills, http://www.thinkfinity.org/21stCenturyHome.aspx; Jay Mathews, *The Latest Doomed Pedagogical Fad: 21st Century Skills*, Jan. 5, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/01/04/AR2009010401532.html; *enGauge 21st Century Skills*, Metiri Group Report commissioned by the North Central Regional Educational Laboratory (2003), *available at* http://www.metiri.com/21/21%20Century%20Skills%20Final.doc; Metiri Group, Features, http://www.metiri.com/features.html.

[198] *National Broadband Plan* at p. 174.

[199] *Getting Over the Slump* at p. 13-14.

[200] *See* ThinkFinity, 21st Century skills, http://www.thinkfinity.org/21stCenturyHome.aspx.

[201] *See* Global Kids, Online Leadership Program, http://www.globalkids.org/?id=5.

[202] *Id.*

[203] *See Education World, available at* http://www.education-world.com/.

[204] *See Distance Education,* Indiana University School of Education, *available at* http://site.educ.indiana.edu/Default.aspx?alias=site.educ.indiana.edu/disted.

[205] *NEA 2008* at p. 19.

[206] *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* at p. 10, National Center for Education Statistics, *available at*- http://nces.ed.gov/pubs2007/2007020.pdf ("*Public Schools*").

[207] *NEA 2008* at p. 20.

[208] *Id.*

[209] *Id.*

[210] *Id.*

[211] *CoSN Web 2.0 Study* at p. 7.

[212] *Id.* at p. 7-8.

[213] *See CDW-G 21st Century Campus Study,* at p. 21, CDW-G (Jan. 2009) ("*21st Century Campus*").

[214] *Id*. at p. 4.

[215] *Public Schools* at p. 9.

[216] *Id.*

[217] *NEA 2008* at p. 3.

[218] *Id.* at p. 14.

[219] *Id.* at p. 15.

[220] *See* J.H. Sandholtz & B. Reilly, *Teachers, not technicians: Rethinking technical expectations for teachers*, 106 Teachers College Record 487-512 (2004).

[221] *See* Yao-Ting Sung & Alan Lesgold, *Software Infrastructure for Teachers: A Missing Link in Integrating Technology with Instruction*, Teachers College Record (2007), *available at* http://www.tcrecord.org/Content.asp?ContentID=14536 (quoting M. Guzdial et al., *Beyond adoption to invention: Teacher created collaborative activities in higher education*, 10 J. of the Learning Sciences 265-279 (2001)) (*"SIT 2007"*).

[222] *Id.*

[223] *NEA 2008* at p. 16.

[224] *See, e.g., Barriers to Broadband Adoption* at p. 81-82.

[225] *SIT 2007.*

[226] *21st Century Campus*.

[227] *SIT 2007.*

[228] *21st Century Campus* at p. 6.

[229] *See New Poll: Parents Conflicted About Role of Digital Media in Kids' Lives,* Press Release, May 8, 2008, Joan Ganz Cooney Center, *available at* http://www.joanganzcooneycenter.org/pressroom/press-announcement-poll.html (citing a poll from Common Sense Media and the Joan Ganz Cooney Center). ("*Parents Conflicted*").

[230] *See Informing Communities,* at p. 53, The Knight Commission on the Information Needs of Communities (2009), *available at* https://secure.nmmstream.net/anon.newmediamill/aspen/kcfinalenglishbookweb.pdf.

[231] *The Digital Promise* at p. 8-9.

[232] *National Broadband Plan* at p. 228.

[233] *Id*.

[234] *The Digital Promise* at p. 8-9.

[235] *Id.*

[236] *CoSN Web 2.0 Study* at p. 11.

[237] *See* Kyong-Jee Kim and Curtis J. Bonk, *The Future of Online Teaching and Learning in Higher Education: The Survey Says…*, Educause (2006), *available at* http://www.educause.edu/library/eqm0644 ("*Future of Online Teaching and Learning*").

[238] *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Telemedicine*, at p. 7, A Report to the U.S. Chamber of Commerce (April 2009), *available at* http://www.uschamber.com/NR/rdonlyres/ec5epgwk7vyanosellij36hyzht3udur5ceemxscfgfayigcrkyfuntto6adiwt7s2rw2g73epqddifjvykf7n6pj6h/BroadbandandTelemedicineApril2009.pdf.

[239] DEPARTMENT OF MAD SCIENTISTS.

[240] *See* Shannon D. Smith, et. al, *Key Findings, The ECAR Study of Undergraduate Students and Information Technology,* at p. 3, Educause (October 2009), *available at* http://net.educause.edu/ir/library/pdf/EKF/EKF0906.pdf ("*ECAR Study*").

[241] *Id.* at p. 4.

[242] *Id.*

[243] *Id.*

[244] *Id* at p. 6.

[245] *See Background Information About LMS Deployment from the 2008 Campus Computing Survey,* at p. 1, The Campus Computing Project, *available at* http://net.educause.edu/ir/library/pdf/LIVE0914ccp.pdf ("*LMS Deployment*")

[246] *See Blackboard Learn,* Blackboard, *available at* http://www.blackboard.com/Teaching-Learning/Learn-Platform.aspx.

[247] *See Mobile Platform,* Blackboard, *available at* http://www.blackboard.com/Mobile/Mobile-Platform.aspx.

[248] *See* MIT, OpenCourseWare, About, http://ocw.mit.edu/OcwWeb/web/about/about/index.htm.

[249] *See 2009 Program Evaluation Findings – Summary,* MIT, OpenCourseWare, *available at* http://ocw.mit.edu/ans7870/global/09_Eval_Summary.pdf.

[250] *See* MIT, OpenCourseWare, Site Statistics, http://ocw.mit.edu/about/site-statistics.

[251] *See* Katie Hafner, *An Open Mind,* April 8, 2010, The New York Times, *available at* http://www.nytimes.com/2010/04/18/education/edlife/18open-t.html?pagewanted=1&ref=education ("*Open Mind*").

[252] *See* John Seely Brown and Richard P. Adler, *Minds on Fire: Open Education, the Long Tail, and Learning 2.0,* EDUCAUSE Review, vol. 43, no.1 (January/February 2008): 16-32, *available at* http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume43/MindsonFireOpenEducationtheLon/162420 ("*Minds on Fire*").

[253] *See Open Yale Courses, About*, http://oyc.yale.edu/about.

[254] *Open Mind.*

[255] *National Broadband Plan* at p. 227.

[256] *See* Apple.com, iTunes U: About, http://www.apple.com/education/itunes-u/.

[257] *See* Press Release, *iTunes U Downloads Top 300 Million*, Aug. 24, 2010, Apple.com, *available at* http://www.apple.com/pr/library/2010/08/24itunes.html.

[258] *See* I. Elaine Allen & Jeff Seaman, *Learning on Demand: Online Education in the United States 2009*, at p. 1, Sloan Consortium (Jan. 2010), *available at* http://sloanconsortium.org/publications/survey/pdf/learningondemand.pdf.

[259] *See* B. Parsad and L. Lewis. *Distance Education at Degree-Granting Postsecondary Institutions: 2006–07,*

NCES 2009–044, National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education (2008).

[260] *Id.*

[261] *See Distance Education: Online Courses at Harvard,* Harvard University Extension School, *available at* http://www.extension.harvard.edu/DistanceEd/.

[262] Resources for Case Study 4 were derived from New York Law School, Mental Disability Clinic, http://www.nyls.edu/academics/graduate_and_certificate_programs/mental_disability_law_masters/mental_disability_law_masters.

[263] *ECAR Study* at p. 10-11.

[264] *Id.*

[265] *Pockets of Potential* at p. 13-14.

[266] *See* Brian X. Chen, *How the iPhone Could Reboot Education,* December 8, 2009, Wired.com, *available at* http://www.wired.com/gadgetlab/2009/12/iphone-university-abilene/.

[267] *Id.*

[268] *Id.*

[269] *See, e.g.,* Chris Foresman, *iPad Goes Under the Gauntlet at Universities this Fall*, July 21, 2010, Ars Technica, *available at* http://arstechnica.com/apple/news/2010/07/ipad-goes-under-the-gauntlet-at-universities-this-fall.ars.

[270] *Id.*

[271] *See* Brad Stone, *The Argument for Free Classes via iTunes,* November 17, 2009, The New York Times, *available at* http://bits.blogs.nytimes.com/2009/11/17/the-argument-for-free-classes-via-itunes/ (quoting Martin Bean, former general manager of Microsoft's education products group) ("*The Argument for Free Classes via iTunes*").

[272] *Tower and the Cloud* at p. 3-4.

[273] *Id.* at p. 4 (noting that "Even campuses in virtual worlds such as *Second Life* and elsewhere draw inspiration from the medieval idea of a city of intellect featuring sacred gardens and other spaces to be secured by walls, gates, and towers.").

[274] *Id.* at p. 20-21.

[275] *See* The University of Phoenix, About, History, http://www.phoenix.edu/about_us/about_university_of_phoenix/history.html.

[276] *See, e.g.,* Zephyr Teachout, *A Virtual Revolution is Brewing for Colleges,* Sept. 13, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/09/11/AR2009091104312.html.

[277] *The Digital Promise* at p. 7.

[278] *See* Paul Basken, *States Embrace Student-Data Tracking, With Prodding From White House,* Jan. 3, 2010, The Chronicle, *available at* http://chronicle.com/article/States-Embrace-Student-Data/63376/ (citing a Nov. 2009 survey by the Data Quality Campaign). Many of these changes have been made in response to the U.S. Department of Education's Race to the Top competition. *See, e.g.,* Jennifer Medina, *New York Wins Nearly $700 Million for Education*, Aug. 24, 2010, N.Y. Times (discussing a variety of other changes made by states). The Race to the Top program is discussed in more detail, *infra,* in section 6.

[279] *The Digital Promise* at p. 7.

[280] *See* New York City Department of Education, ARIS, http://schools.nyc.gov/Accountability/SchoolReports/ARIS/default.htm.

[281] *See* Javier C. Hernandez, *Parents will Get Access to Student-Tracking Site*, May 28, 2009, N.Y. Times (noting that "On the site, parents will be able to view overall course grades and scores on state tests, but not individual scores on class assignments. They will also be able to see attendance histories and look at the probability of a student passing state math and English exams, based on how they have scored on periodic city tests. It will also show how their child is doing compared with children at schools serving similar student populations.").

[282] *See NIST Definition of Cloud Computing, v. 15,* Oct. 7, 2009, NIST Computer Security Div., *available at* http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-def-v15.doc.

[283] *See* Brad Wheeler and Shelton Waggener, *Provisioning Above-Campus IT Services: Supply and Demand,* EDUCAUSE Review, vol. 444, no. 6, (November/December 2009), *available at* http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume44/ProvisioningAboveCampusITServi/185223 (*"Above-Campus IT Services"*).

[284] *National Broadband Plan* at p. 232 (citing a 2006 study by CoSN).

[285] *Above-Campus IT Services*.

[286] *See Background Information About LMS Deployment form the 2008 Campus Computing Survey,* at p. 2-3, The Campus Computing Project, *available at* http://net.educause.edu/ir/library/pdf/LIVE0914ccp.pdf ("*Campus Computing Survey*").

[287] *Id.*

[288] *Id.* at p. 3.

[289] *See, e.g.,* Agam Shah, *IBM Pushes Cloud Computing to Universities,* March 26, 2008, Info World, *available at* http://www.infoworld.com/d/virtualization/ibm-pushes-cloud-computing-universities-576.

[290] *See* Philip J. Goldstein, *Managing the Funding Gap: How Today's Economic Downturn Is Impacting IT Leaders and Their Organizations,* at p. 3-5, EDUCAUSE (Jan. 2009), *available at* http://www.educause.edu/Resources/ManagingtheFundingGapHowTodays/163639 (*"Funding Gap"*).

[291] *Id* at p. 6-7.

[292] *Id.* at p. 6.

[293] *Id.*

[294] *Id.*

[295] *See* Brad Wheeler and Shelton Waggener, *Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education,* EDUCAUSE Review, vol, 44, no.6 (Nov./Dec. 2009): 52-67, *available at* http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume44/AboveCampusServicesShapingtheP/185222 (*"Cloud Computing for Higher Education*).

[296] *Id*.

[297] *See* Brad Wheeler and Shelton Waggener, *Provisioning Above-Campus IT Services: Supply and Demand,* EDUCAUSE Review, vol. 44, no.6 (Nov./Dec. 2009), *available at* http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume44/ProvisioningAboveCampusITServi/185223.

[298] *Id*.

[299] *See* Tim Hill, *FCC Workshop: Broadband, Online Learning & Job Creation,* at Slide 9, Aug. 26, 2009, Blackboard, *available at* http://www.broadband.gov/docs/ws_job_training/ws_job_training_hill.pdf (citing U.S. Department of Education, NCES, *2004 Digest of Educaiton Statistics*, at Table 173) (*"Blackboard 2009"*).

[300] *See* eLearners.com, Facts and Figures from the Online Education Research, http://www.elearners.com/guide-to-online-education/online-education-research.asp (citing a Vault.com study).

[301] *Digital Quality of Life* at p. 18.

[302] *See* Kermit Kaleba, *Expanded Access to Online Job Training: Opportunities and Limitations,* at Slide 2, August 26, 2009, Presentation before the FCC Broadband Initiative Workshop, The Workforce Alliance, *available at* http://www.broadband.gov/docs/ws_job_training/ws_job_training_kaleba.pdf (*"Workforce Alliance 2009"*).

[303] *See IBM Training, available at* http://www-304.ibm.com/jct03001c/services/learning/ites.wss/zz/en?pageType=page&c=a0011023.

[304] *Blackboard 2009* at Slide 9.

[305] *See* Joe Mullich, *A Second Act for E-Learning*, Workforce.com (Feb. 2004), *available at* http://www.workforce.com/section/11/feature/23/62/89/index.html.

[306] IBM Corp, Learning Transformation Story (June 2004), *available at* http://www.tzanis.org/Courses/ClassBlog/archives/files/learning_transformation.pdf.

[307] *See* Press Release, *Bersin & Associates Study Shows Significant Drop in Employee Learning and Development Spending for Second Consecutive Year*, Jan. 13, 2010, Bersin & Associates, *available at* http://www.bersin.com/News/Content.aspx?id=11925 (reporting that spending on corporate learning and development decreased by 11 percent in 2009 and 22 percent over the last two years).

[308] *See Yammering away at the office*, Jan. 30, 2010, The Economist (describing how some firms are designing proprietary social networking tools for use in-house by employees).

[309] *Getting Over the Slump* at p. 15.

[310] *See State Broadband Initiatives,* at p. 5, Alliance for Public Technology and the Communications Workers of America (June 2009), *available at* http://www.apt.org/publications/reports-studies/state_broadband_initiatives.pdf (*"State Broadband Initiatives"*).

[311] *See* Alabama Supercomputer Authority, Alabama Research & Education Network, http://www.asc.edu/network/.

[312] *See ASPIN, available at* http://aspin.asu.edu/index.html.

[313] *See Past Projects,* ASPIN, *available at* http://aspin.asu.edu/projects/.

[314] *State Broadband Initiatives* at p. 10.

[315] *See The State of Connectivity: Building Innovation through Broadband*, at p. 74, Final Report of the California Broadband Task Force (Jan. 2008), *available at* http://www.calink.ca.gov/pdf/CBTF_FINAL_Report.pdf.

[316] *State Broadband Initiatives* includes a wealth of additional information regarding some of these initiatives.

[317] *See* OneCommunity, Frequently Asked Questions, http://www.onecommunity.org/Common.aspx?id=332.

[318] *See* OneCommunity, Programs: Education, http://www.onecommunity.org/programs/programs.aspx?id=38.

[319] *See* IDEAL, Home Edition, https://www.ideal.azed.gov/p/home-edition-students.

[320] *See* IDEAL, Home, https://www.ideal.azed.gov/p/.

[321] *Pocket of Potential* at p. 2.

[322] In 2010, state education leaders and policymakers negotiated a draft set of national education standards for K-12 students. *See, e.g.,* Sam Dillon, *States Receive a Reading List: New Standards for Education,* June 2, 2010, N.T. Times ("*States Receive a Reading List*"). Starting as early as the second grade, these standards call on educators to ensure that students are able to "use technology, including the Internet, to produce, publish, and interact with others about writing." *See Enhancing Digital Literacy: National Technology Standards for Students?* March 22, 2010, BroadbandExpanded.com, *available at* http://www.broadbandexpanded.com/2010/03/22/enhancing-digital-literacy-national-technology-standards-for-students/.

[323] *See Six New Characters Foster Global Citizenship From A Floating Island,* Sesame Workshop, *available at* http://www.sesameworkshop.org/initiatives/respect/panwapa.

[324] The Panwapa site – www.panwapa.com – provides a running count of the number of "Panwapa kids."

[325] *Pockets of Potential* at p. 20.

[326] *Id.* at p. 44.

[327] *Id.* at p. 27.

[328] *Id.* at p. 42.

[329] For examples, *see* Rick Broida, *5 Amazing iPad e-Books for Kids*, April 14, 2010, CNET, *available at* http://reviews.cnet.com/8301-31747_7-20002462-243.html.

[330] *Generation M2* at p. 2.

[331] *See* PorchLight Entertainment, Kids, http://www.porchlight.com/kids.asp.

[332] *Id.* at p. 41.

[333] *Id.*

[334] *See* Gina Adams Palmer, *Education In Hand: Spreading Succes Using Palm Handhelds at Florida Pre-K-5,* June 2006, District Administration, *available at* http://www.districtadministration.com/viewarticle.aspx?articleid=699&p=1#0.

[335] *See IBM KidSmart Early Learning Program,* IBM, *available at* http://www.ibm.com/ibm/ibmgives/grant/education/programs/kidsmart.shtml.

[336] *Id.*

[337] *See Pearson Applauds Georgia's Pre-K Program for Serving One Millionth Child,* Nov. 23, 2009, Earth Times, *available at* http://www.earthtimes.org/articles/show/pearson-applauds-georgias-pre-k-program-for-serving-one-millionth-child,1058881.shtml.

[338] *Id.*

[339] *See* North Elementary School, Virtual Library Media Center, http://www.nobl.k12.in.us/North/NorthMedia/index.htm,

[340] Information for this case study was drawn from New York City Department of Schools, Department of Instructional & Information Technology: Model Technology Schools,

http://schools.nyc.gov/Offices/EnterpriseOperations/DIIT/ModelTechSchools.htm; New York City Department of Education, About Us, http://schools.nyc.gov/AboutUs/default.htm.

[341] *See* Carnegie Learning, Home, http://www.carnegielearning.com/.

[342] *See* Carnegie Learning, Secondary and Post-Secondary Math Curricula Solutions, http://www.carnegielearning.com/products.cfm.

[343] *See* Ashley Surdin, *In Some Classrooms, Books are a Thing of the Past,* Oct. 19, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/10/18/AR2009101802360.html.

[344] *Id.* ("[A]ccording to analyst Kathy Mickey of Simba Information, a market research group".)

[345] *Id.* ("Given that the average textbook costs $100, he argued, the state could save $400 million if its 2 million high school students used digital math and science texts. The initiative also aims to replace aging hardbound books that don't teach students about the Iraq war, the country's first black president or the Human Genome Project.")

[346] *See* Gautham Nagesh, *California Testing iPads as Algebra Textbooks*, Sept. 8, 2010, The Hill's Hillicon Valley Blog, *available at* http://thehill.com/blogs/hillicon-valley/technology/117625-california-testing-ipads-as-algebra-textbooks.

[347] *Id.*

[348] *Pockets of Potential* at p. 43.

[349] *See Needs Assessment,* Project-K-Nect, *available at* http://www.projectknect.org/Project%20K-Nect/K-Nect%20Summary%20.html.

[350] *Pockets of Potential* at p. 14.

[351] *See* Sam Dillon, *Wi-Fi Turns Rowdy Bus Into Rolling Study Hall*, Feb. 12, 2010, N.Y. Times.

[352] *Id.*

[353] *See ACU brings iPad, Mobile Learning to West Texas Middle and High School Teachers*, June 17, 2010, ACU News, *available at* http://www.acu.edu/news/2010/100617_iPadRuralTeac.html.

[354] *Id.*

[355] *See* Science Leadership Academy, About, http://www.scienceleadership.org/drupaled/about.

[356] *See Science Leadership Academy: A New Model for Schools*, Feb. 9, 2010, Technically Philly blog, *available at* http://technicallyphilly.com/2010/02/09/science-leadership-academy-a-new-model-for-schools.

[357] *See* Fran Smith, *My School, Meet MySpace: Social Networking at School*, Edutopia (April 2007), *available at* http://www.edutopia.org/my-school-meet-myspace.

[358] Information for this case study was drawn from: New York City Department of Schools, Department of Instructional & Information Technology: Model Technology Schools, http://schools.nyc.gov/Offices/EnterpriseOperations/DIIT/ModelTechSchools.htm; Brooklyn Technical High School, About Us, http://www.bths.edu/about/mission_statement.jsp?rn=8614294; Meris Stansbury, *iSchools Lift Hopes in NYC*, May 15, 2009, eSchool News, *available at* http://www.eschoolnews.com/2009/05/15/ischools-lift-hopes-in-nyc/; Gene Longo, *NYC iSchool: Rethinking School for the 21st Century*, May 15, 2009, Cisco, *available at* http://blogs.cisco.com/news/comments/nyc_ischool_rethinking_school_for_the_21st_century; Press Release, *High School Graduation Rate Rises Above 60 Percent, Marking the Seventh Consecutive Year of Gains*, June 22, 2009, NY City Dept. of Education, *available at* http://schools.nyc.gov/Offices/mediarelations/NewsandSpeeches/2008-2009/20090622_grad_rates.htm.

[359] *See* Education World, Home, http://www.education-world.com/.

[360] *See* Internet4Classrooms, Home, http://www.internet4classrooms.com/index.htm.

[361] *See* PBS Teachers, Home, http://www.pbs.org/teachers/.

[362] *See* eTech Ohio, Home http://www.etech.ohio.gov/.

[363] *Id.*

[364] *See* ABPC, Home, http://abpc.wikispaces.com/.

[365] *Id.*

[366] *See* Steven Sawchuk, *Growth Model*, Sept. 16, 2009, Education Week, *available at* http://www.teachforamerica.org/assets/documents/091609_Education.Week_Growth.Plan.pdf.

[367] *Id.*

[368] *See* New York City Department of Education, Model Tech Schools: The Goddard School, http://schools.nyc.gov/NR/rdonlyres/CFBC06AD-C55C-4019-8421-07E50437F052/0/Goddardfinalv3.pdf.

[369] Resources used for this Case Study include: MOUSE, Home, www.mouse.org; MOUSE, About, http://www.mouse.org/about-mouse; MOUSE, Why MOUSE Squad? http://www.mouse.org/programs/mouse-squad/why-mouse-squad; MOUSE, MouseTech Source, http://www.mouse.org/programs/mouse-techsource; MOUSE, Impact, http://www.mouse.org/about-mouse/impact; 2005-2008 study by Fordham University's National Center for Schools regarding the MOUSE model, a summary of which is *available at* http://www.mouse.org/sites/default/files/Fordham%20Summary%20for%20Website.pdf.

[370] *See* Paul E. Barton et al., *The Family: America's Smallest School*, at p. 3, Educational Testing Service (2007), *available at* http://www.ets.org/Media/Education_Topics/pdf/5678_PERCReport_School.pdf ("*The Family: America's Smallest School*").

[371] *Id.*

[372] *See* Wisconsin Coalition of Virtual School Families, Home, http://www.wivirtualschoolfamilies.org/home/.

[373] *See* Villanova Preparatory School, About. http://www.villanovaprep.org/about_whatisedline.php.

[374] *Id.*

[375] *See* Common Sense Media, Parent Advice, http://www.commonsensemedia.org/advice-for-parents (registration required).

[376] *See* Common Sense Media, Educators, http://www.commonsensemedia.org/educators (registration required).

[377] *The Family: America's Smallest School* at p. 3.

[378] Resources used in this Case Study include: Computers for Youth, Home, www.cfy.org; Computers for Youth, About Us, http://www.cfy.org/principles.php; Computers for Youth, What we Do, http://www.cfy.org/our-approach.php; Computers for Youth, Professional Development, http://www.cfy.org/teacher-training.php; Computers for Youth, Family Impact, http://www.cfy.org/impact-on-families.php; Timothy Hanrahan, *This Internet Start-up Looks to Conquer an Online Divide*, Jan. 2000, Wall St. J., *available at* http://www.cfy.org/news/01-00_WallStreetJournal.html.

[379] *See* Plato Learning, Home, http://www.plato.com/.

[380] *See* CALI – The Center for Computer-Assisted Legal Instruction, http://www.cali.org/.

[381] *Id.*

[382] A sample syllabus for this course is *available at* home.comcast.net/~dbsocialwork/**secondlife**/SampleMacroSyllabus.doc.

[383] *See* Eve Tahmincioglu, *The Faculty is Remote, but Not Detached,* March 9, 2008, N.Y. Times, *available at* http://www.nytimes.com/2008/03/09/jobs/09starts.html.

[384] *See Tweeting in Class,* Nov. 5, 2009, Inside Higher Ed, *available at* http://www.insidehighered.com/news/2009/11/05/twitter.

[385] *Id.*

[386] *Id.*

[387] *Minds on Fire.*

[388] *See* Enspire Learning, Home http://www.enspire.com/.

[389] *Id.*

[390] *See Quiznos Supports Franchise Owners with Blended Learning,* May 21, 2007, AllBusiness.com, *available at* http://www.allbusiness.com/food-beverage/restaurants-food-service-restaurants-fast/8899336-1.html.

[391] *See Little Planet – Quiznos Sub Commander Game,* OstenInteractive, *available at* http://www.osteninteractive.com/webdesign/quiznos/.

[392] *See AMREF/NCK/Accenture: The Kenya Nurse Upgrading Programme Using eLearning,* AMREF, *available at* http://www.amref.org/info-centre/amref-courses--training-programmes/elearning-programme-/.

[393] *Id.*

[394] *Id.*

[395] *See, e.g.,* Robert Atkinson & Ivy Schultz, *Broadband in America: Where it is and Where it is Going*, at p. 11, Report to the FCC, Columbia University, Institute for Tele-Information (Nov. 2009), *available at* http://www.broadband.gov/docs/Broadband_in_America.pdf ("*Broadband in America*"); *Economic Impact of Broadband Investment*.

[396] *Economic Impact of Broadband Investment* at p. 38-43*; see also* Charles M. Davidson & Bret T. Swanson, *Net Neutrality, Investment & Jobs: Assessing the Potential Impacts of the FCC's Proposed Net Neutrality Rules on the Broadband Ecosystem*, at p. 5-6, New York Law School (June 2010), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Davidson%20&%20Swanson%20-%20NN%20Economic%20Impact%20Paper%20-%20FINAL.pdf ("*Net Neutrality, Investment & Jobs*").

[397] *See* NTIA, BTOP, http://www2.ntia.doc.gov.

[398] *See* RUS, BIP, http://www.broadbandusa.gov/BIPportal/index.htm.

[399] *See, e.g.,* NTIA, BTOP: Grant Awarded, http://www2.ntia.doc.gov/GrantsAwarded (providing an overview of grants awarded to date).

[400] For a comprehensive overview of recent network deployment announcements, *see Broadband in America* at p. A-2-43.

[401] See Press Release, *AT&T to Invest More Than $17 Billion in 2009 to Drive Economic Growth*, March 10, 2009, AT&T, *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26597.

[402] *See Verizon to Discuss Plans to Divest Wireline Businesses in 14 States*, May 13, 2009, Verizon Investor Relations, *available at*, http://newscenter.verizon.com/press-releases/verizon/2009/verizon-to-divest-wireline.html; *Broadband in America: Coming sooner, future,* Oct. 28, 2010, The Economist.

[403] *See* Cable Labs, DOCSIS Primer, http://www.cablelabs.com/cablemodem/primer/.

[404] *See, e.g.,* Sean Michael Kerner, *Comcast: DOCSIS 3.0, WiMAX Coming*, Aug. 7, 2009, InternetNews.com, *available at* http://www.internetnews.com/infra/article.php/3833721/Comcast+DOCSIS+30+WiMAX+Coming.htm.

[405] *Barriers to Broadband Adoption* at p. 3-4

[406] *See* Amanda Lenhart, *Cell Phones and American Adults*, at p. 2, Pew Internet & American Life Project (Sept. 2010), *available at* http://pewinternet.org/~/media//Files/Reports/2010/PIP_Adults_Cellphones_Report_2010.pdf.

[407] *See Internet Access Services: Status as of June 30, 2009*, at p. 4, FCC (Sept. 2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-301294A1.pdf.

[408] *Generation M2* at p. 3.

[409] *Social Media Use Among Teens – 2010* at p. 4.

[410] *Id.* at p. 3, 14.

[411] *National Broadband Plan* at p. 40 (reporting that 98 percent of the U.S. population lives in census tracts with at least one provider of 3G mobile service).

[412] There are two different 4G standards. The first, WiMAX, will be used by Sprint in collaboration with Clearwire, Intel, Google, Comcast, Time Warner Cable, and Bright House Networks. *See* Marguerite Reardon, *Clearwire to Bring WiMax to 10 More Markets*, Aug. 3, 2009, CNET NEWS, *available at* http://news.cnet.com/8301-1035_3-10301928-94.html?part=rss&subj=news&tag=2547-1_3-0-20. The other standard, Long-Term Evolution (LTE), will be used by AT&T, T-Mobile, and Verizon. *See* Marin Perez, *T-Mobiles Lays Out 3G Plans*, Nov. 11, 2009, Information Week, *available at* http://www.informationweek.com/news/mobility/3G/showArticle.jhtml?articleID=221601338.

[413] *See* Charles M. Davidson & Michael J. Santorelli, *Seizing the Mobile Moment: Spectrum Allocation Policy for the Wireless Broadband Century*, 19 CommLaw Conspectus ___ (forthcoming 2010) (draft on file with the authors).

[414] *See* U.S. Department of Education, Race to the Top Fund, http://www2.ed.gov/programs/racetothetop/index.html. An additional $1.35 billion has been set aside in President Obama's 2011 budget to continue the program for another year. *See* Amanda Paulson, *Obama pushes to add $1.35 billion to Race to the Top grants*, Jan. 19, 2010, Christian Science Monitor, *available at* http://www.csmonitor.com/USA/Education/2010/0119/Obama-pushes-to-add-1.35-billion-to-Race-to-the-Top-grants.

[415] *See* Press Release, *U.S. Department of Education Opens Race to the Top Competition,* November 12, 2009, The White House Blog, *available at* http://www2.ed.gov/news/pressreleases/2009/11/11122009.html ("*Race to the Top*").

[416] Indeed, some think that the program will "appeal to students' penchant for technology and desire for real-world skills by teaching them how to use the software that business and creative professionals rely on daily. State and district leaders have been looking at technology rich programs, and in particular career focused programs to bridge the chasm between student interests, the real world and our schools." *See* Bob Regan, *Integrated Technology Curricula Drive Student Retention and Success,* Nov. 17, 2009, Adobe

Education Leaders, *available at* http://blogs.adobe.com/educationleaders/2009/11/integrated_technology_curricul.html ("*Integrated Tech Curricula*").

[417] For a discussion of the federal-state interplay evident in the Race to the Top approach, *see* Michael J. Santorelli, *Regulatory Federalism in the Age of Broadband: A U.S. Perspective*, 2 Policy & Internet 99, 120-121 (2010), *available at* http://www.psocommons.org/policyandinternet/vol2/iss3/art5/.

[418] *See* Jesse Lee, *Speeding Up Race to the Top,* Jan. 19, 2010, The White House Blog, *available at* http://www.whitehouse.gov/blog/2010/01/19/speeding-race-top.

[419] *Id.*

[420] *See, e.g.,* Sam Dillon, *Eastern States Dominate in Winning School Grants*, Aug. 24, 2010, N.Y. Times.

[421] *See* Robin J. Lake, *In the Eye of the Beholder: Charter Schools and Innovation*, at p. 6, J. of School Choice (April 2008), *available at* http://www.crpe.org/cs/crpe/download/csr_files/jrn_ncsrp_innovrsrch_apr08.pdf (citing Paul Teske et al., *Does Charter School Competition Improve Traditional Public Schools?* Manhattan Institute (2000)).

[422] *Integrated Tech Curricula.*

[423] *Id.*

[424] *Id.*

[425] *Id.*

[426] *See* Boston Digital Bridge Foundation, Technology Goes Home, http://www.dbfboston.org/programs.html.

[427] *Id.*

[428] *Id.*

[429] *Id.*

[430] *See Adoption Plus,* at p. 2, National Cable & Telecommunications Association (Dec. 2009), *available at* http://i.ncta.com/ncta_com/PDFs/AdoptionPlus_Overview_12.02.09.pdf ("*Adoption Plus*").

[431] *Id* at p. 3.

[432] *Id*.

[433] *See* David Nagel, *10.5 Million PreK-12 Students Will Attend Classes Online by 2014,* Oct. 28, 2009, The Journal, *available at* http://thejournal.com/Articles/2009/10/28/10.5-Million-PreK-12-Students-Will-Attend-Classes-Online-by-2014.aspx (citing *US Self-Paced eLearning Market*, Ambient Insight, 2009) ("*Online Classes 2009*").

[434] *Id.*

[435] *Future of Online Teaching and Learning* ("[R]espondents predicted that certification and recertification programs would see 10-20 percent growth from present offerings.").

[436] *Online Classes 2009* (according to Ambient Insight Chief Research Officer Sam S. Adkins).

[437] *See* Ali Jafari, Patricia McGee, and Colleen Carmean, *Managing Courses, Defining Learning: What Faculty, Students, and Administrators Want,* EDUCAUSE Review, vol. 41, no.4 (July/August 2006): 50-71, *available at* http://net.educause.edu/ir/library/pdf/ERM0643.pdf.

[438] *Future of Online Teaching and Learning.*

[439] *Id.*

[440] *Id.; see also Tower and the Cloud* at p. 165.

[441] *CoSN Web 2.0 Study* at p. 5 (noting that "The findings [of this study] indicate that, at this point in time, educational mindsets and school cultures do not yet align learning to the realities of the 21st Century. There are, however, also encouraging data which suggest that district administrators do see the educational significance for Web 2.0 and recognize the need for educational innovation.").

[442] *Minds on Fire*.

[443] *CoSN Web 2.0 Study* at p. 5.

[444] *Minds on Fire.*

[445] *Id.*

[446] *CoSN Web 2.0 Study.*

[447] *See* Issue Paper, *Personalized Learning: The Nexus of 21st Century Learning and Educational Technologies,* Pearson, *available at* http://www.pearsoned.com/pr_2009/pearson_personalizedlearning.pdf (citing to the MacArthur study) (*"Personalized Learning"*).

[448] *Id*.

[449] *See* Mary Bart, *Technology Trends in Higher Education: How Web 2.0 Tools are Transforming Learning,* Nov. 17, 2008, Faculty Focus, *available at* http://www.facultyfocus.com/articles/teaching-and-learning/technology-trends-in-higher-education-how-web-20-tools-are-transforming-learning/.

[450] *See Twitter in Higher Education: Usage Habits and Trends of Today's College Faculty,* at p. 2, Faculty Report (Sept. 2009), *available at* http://www.facultyfocus.com/free-report/twitter-in-higher-education-usage-habits-and-trends-of-todays-college-faculty/.

[451] *See* Erica Perez, *Professors Experiment with Twitter as a Teaching Tool,* April 26, 2000, Journal Sentinel, *available at* http://www.jsonline.com/news/education/43747152.html.

[452] *See* Bob Weinstein, *Higher Education Takes Lead in Using Virtual Reality,* June 6, 2009, Troy Media, *available at* http://www.troymedia.com/?p=400

[453] *CoSN Web 2.0 Study* at p. 7.

[454] *Id.* at p. 11.

[455] *Id.* at p. 19.

[456] *Id.* at p. 9.

[457] Cyberbullying Research Center, Research: Cyberbullying Victimization (chart summarizing Feb. 2010 survey findings), http://www.cyberbullying.us/2010_charts/cyberbullying_victim_2010.jpg

[458] *CoSN Web 2.0 Study* at p. 25.

[459] *Id.* at p. 26.

[460] *Id.* at p. 29.

[461] *See, e.g., Internet Safety Policies and CIPA: An E-Rate Primer for Libraries and Schools*, at p. 1, E-Rate Central, *available at* http://www.e-ratecentral.com/CIPA/cipa_policy_primer.pdf.

[462] *CoSN Web 2.0 Study* at p. 23.

[463] *Id.* at p. 22.

[464] *See* Kelly Caraher and Meredith Braselman, *News Release, 2009 School Safety Index Finds Security Improvements Aren't Keeping Pace with Breaches,* May 18, 2009, CDWG, *available at* http://newsroom.cdwg.com/news-releases/news-release-05-18-09.html.

[465] *ECAR Study* at p. 3.

[466] *Id.* at p. 11.

[467] *Generation M2* at p. 3.

[468] *See The Horizon Report 2010 Edition,* at p. 9, The New Media Consortium, EDUCAUSE Learning Initiative, *available at* http://wp.nmc.org/horizon2010/.

[469] *See* David Nagel, *Apple Launches iPad Mobile Tablet,* Jan. 27, 2010, Campus Technology, *available at* http://campustechnology.com/articles/2010/01/27/apple-launches-ipad-mobile-tablet.aspx.

[470] *See* Dian Schaffhauser, *Apple's iPad: The Future of Mobile Computing in Education,* January 27, 2010, Campus Technology, *available at* http://campustechnology.com/Articles/2010/01/27/Apples-iPad-The-Future-of-Mobile-Computing-in-Education.aspx?Page=1.

[471] *2010 Horizon Report* at p. 10.

[472] *See* Apple.com, iPhone in Business: University of Washington, http://www.apple.com/iphone/business/profiles/university-washington ("*University of Washington*").

[473] *Personalized Learning* at p. 2 (citing *Harnessing Innovation to Support Student Success: Using Technology to Personalize Education*, U.S. Department of Education (Oct. 2008)).

[474] *Id.* at p. 8-9.

[475] *Race to the Top.*

[476] *Personalized Learning* at p. 7.

[477] *Id.*

[478] *Id.*

[479] *See* Advanced Academics, About Us, http://www.advancedacademics.com/about.html.

[480] *See Personalized Learning Puts Students In A Class Of Their Own,* November 4, 2008, Science Daily, *available at* http://www.sciencedaily.com/releases/2008/10/081027144645.htm ("*iClass*").

[481] *Id.*

[482] *Id.*

[483] *Tower and the Cloud* at p. 11.

[484] *See* James Hilton, *The Future for Higher Education: Sunrise or Perfect Storm?,* EDUCAUSE Review (March/April 2006): 60, http://net.educause.edu/ir/library/pdf/ERM0623.pdf (*"Future for Higher Education"*).

[485] *Tower and the Cloud* at p. 14-15.

[486] *Future for Higher Education.*

[487] *Id.*

[488] *See, e.g., Barriers to Broadband Adoption* at p. 73-74, 75-78 (identifying several cost-related barriers to more robust adoption of broadband in the education arena); Elaine Allen and Jeff Seaman, *Online Nation: Five Years of Growth in Online Learning,* at p. 3, The Sloan Consortium (Oct. 2007) ("Higher costs for online

development and delivery are seen as barriers among those who are planning online offerings, but not among those who have online offerings.”).

[489] *Breaking Through the Barriers* at p. 6.

[490] *Funding Gap* at p. 3-5.

[491] *See* Tom Rolfes and Tammy Stephens, *21st Century Networks for 21st Century Schools: Making the Case for Broadband*, at p. 4-6, CoSN (2009) (“*21st Century Networks*”).

[492] *See, e.g., Barriers to Broadband Adoption* at p. 74.

[493] *Home Broadband Adoption 2010* at p. 7-8 (reporting on survey results that found that households earning less than $30,000 per year had only a 46 percent home broadband adoption rate and that Blacks had only a 56 percent adoption rate, compared to a national average of 66 percent); *NTIA Broadband Adoption Report 2010* at p. 8.

[494] *21st Century Networks* at p. 3.

[495]*See* Katie Ash, *Schools’ Broadband Needs Grow as Ed-Tech Evolves,* Sept. 30, 2008, Education Week’s Digital Directions, *available at* http://www.edweek.org/dd/articles/2008/09/30/01broadband.h02.html.

[496] These types of efforts have been discussed at length in previous papers in this series. *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Senior Citizens*, p. 31-32, A Report to the U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.uschamber.com/NR/rdonlyres/edp7qgdm6hxo6d7jm365ckwgynjgkihfk27obqr5csczpf3sgmd6vy2xut45vdljkdoz62wa7y55awtolulbkqr57ih/BroadbandandSeniors.pdf; *The Impact of Broadband on People with Disabilities* at p. 43-44; *The Impact of Broadband on Telemedicine* at p. 48-89.

[497] *See* South Carolina K-12 School Technology Initiative, http://www.sck12techinit.org/About.htm.

[498] *Id.*

[499] *Id.*

[500] *Adoption Plus* at p.1.

[501] *Id.* at p. 3.

[502] *Id.* at p. 1.

[503] For information regarding the programs that received federal stimulus funding, *see* NTIA, Broadband USA, Grants Awarded: Sustainable Broadband Adoption, http://www2.ntia.doc.gov/sustainableadoption.

[504] *Stimulus to Impact Education Technology* (quoting an estimate made by Hilary Goldmann, director of government affairs with the International Society for Technology in Education).

[505] *Id.*

[506] *BTOP Overview.*

[507] *See, e.g.,* Clayton M. Christensen and Michael B. Horn, *Commentary: Don’t Prop up Failing Schools*, June 2, 2009, CNN, *available at* http://www.cnn.com/2009/US/06/02/christensen.schools/index.html.

[508] *National Broadband Plan* at p. 233-240.

[509] *See* National Educational Technology Plan, About, https://edtechfuture.org/?page_id=727.

[510] *Id.*

[511] This argument has been made by many stakeholders, including the Schools, Health and Libraries Broadband Coalition, which has expressed that "it is extremely important that the eligibility of [urban and suburban] institutions to receive broadband funding not be dictated by the definitions and geographic boundaries that might apply to households."*See* John Windhausen, Jr., *Before the Federal Communications Commission, Comments of the Schools, Health and Libraries Broadband Coalition,* at p. 4, Sept. 4, 2009, *available at* http://net.educause.edu/ir/library/pdf/CSD5725.pdf.

[512] H.R. 558 – The Achievement Through Technology and Innovation (ATTAIN) Act of 2009 – was introduced in January 2009. This bill would reauthorize Section IID of the NCLB. Full text of the bill is *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-558. In September 2010, the bill was referred to Committee.

[513] *See* State Education Technology Directors Association, 2008 Gateway to Graduation Toolkit: ATTAIN Act, http://www.setda.org/web/toolkit2008/student-engagement/attain.

[514] *See* Universal Service Administrative Company, Overview of the Schools and Libraries Program, http://www.universalservice.org/sl/about/overview-program.aspx.

[515] *Id.*

[516] *Breaking Through the Barriers* at p. 22.

[517] *See Report to Congressional Requesters, Long-Term Strategic Vision Would Help Ensure Targeting of E-rate Funds to Highest-Priority Uses,* at p. 2, United States Government Accountability Office (GAO) (March 2009) (*"GAO Report"*).

[518] *Id.*

[519] *See, e.g.,* Sheryl Abshire, *Presentation at FCC Workshop: Education,* Aug. 20, 2009, FCC, *available at* http://www.broadband.gov/ws_education.html ("The most widely disseminated criticism of the E-Rate program is its lack of funding."); *Barriers to Broadband Adoption* at p. 75-76.

[520] *Breaking Through the Barriers* at p. 23.

[521] *Id*. However, per the FCC, "While the E-rate program is capped by FCC regulation at $2.25 billion annually, unused funds from prior funding years may be rolled over to the future, enabling the FCC to disburse more than the annual cap in a given year. In addition, in a given year, the FCC may disburse more than the cap when invoices for funding commitments from prior years are presented for payment." *National Broadband Plan* at p. 157, note 26.

[522] "Each year from 1998- 2007, the amount of funding applicants requested exceeded the amount available… From 1998 through 2007, applicants requested a total of about $41 billion in E-rate funding—174 percent of the $23.4 billion in program funding." *GAO Report* at p. 13.

[523] *Breaking Through the Barriers* at p. 23.

[524] See *In the Matter of Schools and Libraries Universal Service Support Mechanism*, Sixth Report and Order, para. 34-40, FCC 10-175 (rel. Sept. 28, 2010), *available at* http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db1001/FCC-10-175A1.pdf ("*FCC E-Rate Order - Sept. 2010*").

[525] According to the FCC's September 2010 E-Rate order, the cap for funding year 2010 will be $2.27 billion, up from $2.25 billion. *Id.*

[526] *Id.*

[527] *See, e.g., National Broadband Plan* at p. 145 (outlining a proposal for a new program focused on connecting all Americans to broadband); *In the Matter of Federal-State Joint Board on Universal Service;*

Lifeline and Link up, Recommended Decision, para. 4, FCC 10J-3 (rel. Nov. 4, 2010), *available at* http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db1104/FCC-10J-3A1.pdf.

[528] *See* Universal Service Administrative Company, Step 5: Discount Matrix, http://www.universalservice.org/sl/applicants/step05/discount-matrix.aspx.

[529] *National Broadband Plan* at p. 236-237.

[530] *See, e.g.,* Patricia M. Worthy, *Racial Minorities and the Quest to Narrow the Digital Divide: Redefining the Concept of "Universal Service,"* 26 Hastings Comm. & Ent. L.J. 1, 45 (2003); *Barriers to Broadband Adoption* at p. 76.

[531] *GAO Report* at Highlights.

[532] *Id.*

[533] *See* Laura Devaney, *e-Rate wants to be user friendly*, Sept. 24, 2009, eSchool News, *available at* http://www.eschoolnews.com/news/top-news/index.cfm?i=60880 (*"E-rate User Friendly"*).

[534] *GAO Report* at Highlights.

[535] *E-rate User Friendly*.

[536] *Id*.

[537] *FCC E-Rate Order - Sept. 2010* at para. 51-92.

[538] *Breaking Through the Barriers* at p. 23.

[539] *See* Tamar Lewin, *In a Digital Future, Textbooks are History*, Aug. 8, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/08/09/education/09textbook.html?_r=3&ref=education.

[540] *NEA 2008* at p. 2.

[541] *See* Mark Warschauer, *Information Literacy in the Laptop Classroom,* Teachers College Record (2007), *available at* http://www.tcrecord.org/Content.asp?ContentID=14534 (*"Information Literacy"*).

[542] *See iAm Laptop Pilot Program Announces Recipients,* Customer Services Newsletter, South Carolina Division of the State CIO, State Budget and Control Board, *available at* http://www.state.sc.us/newsletter/ciocs/200782750524490.8125.html.

[543] *See Executive Summary of NYC Connected Learning Proposal*, BTOP, *available at* http://www.ntia.doc.gov/broadbandgrants/applications/summaries/2263.pdf.

[544] *See* Computers for Youth, Affiliate Network, http://www.cfy.org/about-affiliate-network.php.

[545] *See* Jamie L. Carlacio and Lance Heidig, *Technology and Digital Literacy Digitally: A Collaborative Approach,* at p. 2, MIT, *available at* http://web.mit.edu/comm-forum/mit6/papers/Carlacio.pdf (*"Technology and Digital Literacy"*).

[546] *See Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge: A Report to the Nation on Technology and Education,* at p. 1, U.S. Department of Education (1996), *available at* http://www2.ed.gov/about/offices/list/os/technology/plan/national/index.html.

[547] *See* BERNIE TRILLING & CHARLES FADEL, 21ST CENTURY SKILLS: LEARNING FOR LIFE IN OUR TIMES 8 (2009).

[548] *National Broadband Plan* at p. 225.

[549] *See, e.g., Are They Ready to Work?* at p. 9; *National Broadband Plan* at p. 225 (noting educational disparities prevalent among certain minority populations).

[550] *See* Scott J. Cech, *Tests of Tech Literacy Still Not Widespread Despite NCLB Goals*, Jan. 29, 2008, Education

Week.

[551] *See Horizon Report, 2009 K-12 Edition,* at p. 7, New Media Consortium, *available at* http://www.nmc.org/publications/2009-horizon-k12-report (*"K-12 Horizons 2009"*).

[552] *See* Carole Bausell and Elizabeth Klemick, *Tracking U.S. Trends,* March 29, 2007, Education Week.

[553] *Id*.

[554] *See* Scott J. Cech, *Tests of Tech Literacy Still Not Widespread Despite NCLB Goals*, Jan. 29, 2008, Education Week.

[555] *See, e.g.,* ROBERT A. SCHAPIRO, POLYPHONIC FEDERALISM: TOWARD THE PROTECTION OF FUNDAMENTAL RIGHTS 22 (Chicago 2009) (discussing the historical and legal bases for the largely local control of schools) ("POLYPHONIC FEDERALISM").

[556] *See* U.S. Department of Education, National Center for Education Statistics: NAEP Overview, http://nces.ed.gov/nationsreportcard/about/.

[557] POLYPHONIC FEDERALISM at p. 23 (observing that the "NCLB Act institutes massive federal regulation of the administration of elementary and secondary education in the United States. In return for receiving federal education funds, states must accept provisions that regulate the qualifications of teachers, establish student performance goals, and impose detailed reporting requirements. NCLB requires states to establish proficiency goals for the performance of students. Yearly testing monitors the progress in achieving these benchmarks.").

[558] *America's Schools* at p.3.

[559] For an overview of the debate surrounding national standards, *see* Paul E. Barton, *National Education Standards: Getting Beneath the Surface*, Educational Testing Service (2009), *available at* http://www.ets.org/Media/Research/pdf/PICNATEDSTAND.pdf.

[560] *States Receive a Reading List.*

[561] *See* Diane Ainsworth, *Prep Students Get into the GameDesk,* March 20, 2009, USC News, University of South Carolina, *available at* http://uscnews.usc.edu/university/prep_students_get_into_the_gamedesk.html.

[562] *Id.*

[563] *Id.*

[564] *See* One Economy, What we Do: Digital Connectors, http://www.one-economy.com/what-we-do/digital-connectors.

[565] *See* Charisse Lillie, *Comcast Digital Connectors: Year One*, Sept. 20, 2010, Comcast Voices blog, *available at* http://blog.comcast.com/2010/09/comcast-digital-connectors-year-one.html.

[566] *See* NTIA, Broadband Grants Awarded: Sustainable Adoption, One Economy, http://www2.ntia.doc.gov/grantees/OneEconomyCorp.

[567] *National Broadband Plan* at p. 174-176.

[568] *See* R.M. Wallace, *A framework for understanding teaching with the Internet,* 41 American Educational Research Journal 447-488 (2004).

[569] *SIT 2007.*

[570] *See* Catherine Gewertz, *Outside Interests,* March 29, 2007, Education Week.

[571] *21st Century Campus* at p. 6.

[572] *Public Schools* at p. 9.

[573] *NEA 2008* at p. 3.

[574] *SIT 2007.*

[575] *See* Adobe Digital School Collection, K-12, http://www.adobe.com/education/k12/adsc/.

[576] *Id.*

[577] *National Broadband Plan* at p. 233.

[578] The U.S. Department of Education's *National Education Technology Plan* addresses some of these barriers by, among other things, encouraging more experimentation with technology in the classroom and enhancing access to professional development training. *National Ed Tech Plan* at p. 44-50.

[579] *See* Kyong-Jee Kim and Curtis J. Bonk, *The Future of Online Teaching and Learning in Higher Education: The Survey Says,* EDUCAUSE Quarterly, Volume 29, Number 4 (2006), *available at* http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/TheFutureofOnlineTeachingandLe/157426 (*"Future of Online Teaching and Learning"*).

[580] *Id.*

[581] *Parents Conflicted*.

[582] *Id.*

[583] *Evaluation of Online Learning* at p. ix (noting that "On average, students in online learning conditions performed better than those receiving face-to-face instruction.").

[584] *See* David Nagel, *Is Blended Learning Effective?* Sept. 17, 2008, Campus Technology, *available at* http://campustechnology.com/Articles/2008/09/Is-Blended-Learning-Effective.aspx?Page=1.

[585] The FCC has proposed the creation of a national system of electronic education records, which would include "student demographic and academic information as well as course history, student work, attendance and health data." *National Broadband Plan* at p. 234.

[586] The U.S. Department of Education has done this in the past, most recently with its meta-analysis of studies related to e-learning. *See Evaluation of Online Learning.*

[587] *Parents Conflicted.*

[588] *NDLI* at p. 14.

[589] *Id.* at p. 16.

[590] *National Ed Tech Plan* at p. 75-80.

[591] *Id*. at p. 76.

[592] The U.S. Department of Education launched a separate website dedicated to the public discussion and development of the Plan. Stakeholders had an opportunity to participate in a brainstorming event and to submit resources for use by the Department during the preparation of the Plan. Once a draft is produced, the public will have an opportunity to comment on it via the website. For more information, *see* National Educational Technology Plan, Opportunities for Input, https://edtechfuture.org/?page_id=888.

[593] *See* FCC Broadband.gov, Blogband, http://blog.broadband.gov.

[594] *See* FCC Broadband.gov, Workshops, http://www.broadband.gov/workshops.html.

[595] *See* FCC Broadband.gov, http://www.broadband.gov.

[596] *Digital Media* at p. 49.

[597] *See* CoSN, About, http://www.cosn.org/AboutUs/tabid/4214/Default.aspx.

[598] *See* Kathleen Kennedy Manzo, *Hunting the Internet for Quality Content,* March 26, 2009, Education Week http://www.edweek.org/login.html?source=http://www.edweek.org/ew/articles/2009/03/26/26quality.h28.html&destination=http://www.edweek.org/ew/articles/2009/03/26/26quality.h28.html&levelId=2100 ("*Quality Content"*).

[599] *See Knowledge Map: Content and Curriculum Issues,* at p. 41, infoDev (2009), *available at* http://www.infodev.org/en/Publication.161.html (*"Knowledge Map"*).

[600] *Id.* at p. 42.

[601] *Id.*

[602] *See FREE (Federal Resources for Educational Excellence),* Education World (July 2004), *available at* http://www.educationworld.com/awards/2004/r0104-14.shtml. *See also Federal Resources for Educational Excellence,* U.S. Department of Education, *available at* http://free.ed.gov/.

[603] *About the ERIC Program, ERIC, available at* http://www.eric.ed.gov/ERICWebPortal/resources/html/about/about_eric.html.

[604] *National Broadband Plan* at p. 228.

[605] *See, e.g.,* Ashley Surdin, *In Some Classrooms, Books are a Thing of the Past,* October 19, 2009, Washington Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/10/18/AR2009101802360.html

[606] *Id*.

[607] *Id.*

[608] Proposed legislation seeking to update the E-Rate program would provide funding for e-readers. *See* Press Release, *Markey Introduces E-Rate 2.0 Bill to Bring Successful Program into 21st Century*, Fed. 9, 2010, Office of Rep. Ed Markey, *available at* http://markey.house.gov/index.php?option=content&task=view&id=3843&Itemid=125.

[609] For example, a 2004 study by CalPIRG found that "65 percent of faculty 'rarely' or 'never' use the bundled materials in their courses" and that "Online textbooks could significantly lower the retail cost of textbooks." *See Rip-off 101: How The Current Practices Of The Textbook Industry Drive Up The Cost Of College Textbooks*, CalPIRG (April 2004), *available at* http://www.studentpirgs.org/reports/textbooks/affordable-textbooks-reports/rip-off-101-how-the-current-practices-of-the-textbook-industry-drive-up-the-cost-of-college-textbooks. Similarly, a paper submitted to the U.S. Department of Education's ERIC observed that "the unbundling of textbook packages appears to represent a partial solution to rising textbook prices and one that deserves more exploration." *See* James V. Koch, *An Economic Analysis of Textbook Pricing and Textbook Markets*, at p. 11, ACSFA College Textbook Cost Study Plan Proposal (Sept. 2006), *available at* http://www2.ed.gov/about/bdscomm/list/acsfa/kochreport.pdf.

[610] The Higher Education Opportunity Act (HEOA), which was enacted in 2008, requires textbook publishers to "make available the college textbook and each supplemental material as separate and unbundled items, each separately priced." *See* HEOA, H.R. 4137, Section 133 (c)(2), *available at* www.nacua.org/documents/heoa.pdf.

[611] For example, the FCC has recommended that Congress "consider taking legislative action to encourage copyright holders to grant educational rights of use, without prejudicing their other rights." *National Broadband Plan* at p. 230.

[612] *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Network Effects: An Introduction to Broadband Technology & Regulation*, at p. 3-5, A Report to the U.S. Chamber of Commerce (Dec. 2008), *available at*

http://www.uschamber.com/NR/rdonlyres/ew4ahwhwxqx6rxs4vrjebfzdxqt46nw5a67qsor3pa5jcvdgiuw2mwrmns4xe6kua5ce63mhjdk7ykfbx4ioliesrsa/ChamberIntroBroadbandPaperFinal121708.pdf ("*Network Effects*"); *Net Neutrality, Investment & Jobs; Economic Impact of Broadband Investment*.

[613] Sweeping regulations imposed in the modern telecommunications sector have largely failed to produce their intended goals. Perhaps the most notable example of this is the 1996 Telecommunications Act. *See, e.g., Network Effects* at p. 4.

Attachment #7

April 26, 2010

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: *In the Matter of Preserving the Open Internet, GN Docket No. 09-191; Broadband Industry Practices, WC Docket No. 07-52*

Dear Ms. Dortch,

The undersigned parties, representing a diverse *ad hoc* coalition of interested stakeholders, respectfully submit these comments in the dockets cited above.

Overview of Comments

A. Introduction..... 1

B. Broadband is a Transformative Technology that Profoundly Impacts the Lives of Senior Citizens & People with Disabilities, Among Others.....2

C. Broadband is Critical to Many Sectors of the Economy..... 3

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A. Introduction

The current rulemaking proceeding addresses an issue of fundamental importance to key demographics and sectors of the economy: *how best to calibrate Internet-related public policy in a manner that continues to promote innovation and meaningful access to a universe of increasingly vital services and applications that are being delivered via broadband.* Consumers and service providers in a number of key demographics – such as senior citizens and people with disabilities – are utilizing broadband in a manner that is having profound and life-enhancing impacts. Broadband is a transformative tool that is poised to benefit the lives of everyone that uses it.

The impacts of broadband include, among others, *health-related benefits* (e.g., enabling remote, real-time monitoring of vital signs and real-time telemedicine consultations), *essential communications services* (e.g., real-time video relay between people who are hard of hearing or people who are deaf), *mental well-being & social benefits* (e.g., increasing feelings of connectedness amongst senior citizens), and *economic benefits* (e.g., providing people with disabilities an array of educational and employment opportunities that might not otherwise be readily available).

The FCC has outlined a bold vision for broadband in America.[1] If and when that vision is fully realized, a significant portion of daily life, including the delivery of critical services such as real-time healthcare monitoring, telemedicine services, and online educational instruction will be facilitated by broadband. In light of these trends and the myriad positive impacts that broadband is having on users across the United States, it is imperative that policymakers at all levels of government ensure that public policy not inadvertently hinder or disadvantage the very demographics or economic sectors for which broadband may be especially important.

As an overview, the undersigned, via these comments:

- Express support for an open Internet and for the FCC's existing four principles protecting the fundamental rights of Internet users[2];

- Encourage the FCC to reflect in its rulemaking that broadband has unique impacts and importance for key demographics (including senior citizens and people with disabilities) and in discrete sectors of the economy (including the healthcare, education, and energy arenas);

[1] This vision is outlined in the FCC's National Broadband Plan (released March 16, 2010).

[2] These principles protect a user's ability to: (1) access the lawful Internet content of their choice; (2) run applications and use services of their choice (subject to the needs of law enforcement); (3) connect their choice of legal devices that do not harm the network; and (4) be able to choose among competing network providers, application and service providers, and content providers. Per the FCC, each of these principles is subject to reasonable network management.

- Underscore the importance of the myriad applications and services that are enabled by broadband to achieving many of the long-term social and policy goals articulated by the FCC; and

- Urge the Commission to implement a regulatory approach that is sufficiently flexible, adaptable, and accommodating of the many new uses and services that it is championing.

B. Broadband is a Transformative Technology that Profoundly Impacts the Lives of Senior Citizens & People with Disabilities, Among Others

There is wide agreement that broadband is profoundly impacting the way senior citizens and people with disabilities, among others, live their lives. Appreciating the scale and scope of these impacts is critical in public policy discussions, since the populations of senior citizens[3] and people with disabilities[4] are expected to grow significantly over the next few decades. Broadband is poised to serve as a key medium for delivering critical services to and enhancing the lives of these users.

For seniors, broadband represents an interactive outlet to the world that "enhance[s] quality of life,"[5] "reconnect[s] them with distant family members, and provid[es] them with access to an infinite universe of information."[6] Seniors are using broadband to engage in an array of activities, from viewing digital photos of grandchildren to visiting remotely with family and friends via web-cams and low-cost IP-based telephone service.[7] In addition, seniors use their broadband connections to blog, launch small businesses, manage retirement savings, purchase affordable prescription drugs, and engage in a variety of other such activities from the comfort of their home.[8]

Broadband is also "increasingly critical to a healthy and engaged aging population."[9] Numerous studies have found that broadband utilization spurs new brain functions and lessens feelings of depression among older users, both of which can delay the onset of costly diseases.[10] In addition,

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[3] The number of senior citizens living in the United States is expected to double by 2050. See Jack Goldstone, "The New Population Bomb," p. 35, Foreign Affairs (Jan/Feb 2010).

[4] As the senior population grows, so, too, will the number of people with disabilities. For example, per the Hearing Loss Association of America: "As baby boomers reach retirement age starting in 2010, [the number of Americans experiencing hearing loss] is expected to rapidly climb and nearly double by the year 2030."

[5] Comments of The 60 Plus Association, GN Docket No. 09-191 (Jan. 5, 2010).

[6] Comments of Older Adults Technology Services, Inc., GN Docket. No. 09-191 (Jan. 14, 2010).

[7] FCC National Broadband Plan, p. 179-180.

[8] The U.S. Chamber of Commerce, in December 2008, released a report that highlights an array of additional uses of broadband by seniors. The report is titled "The Impact of Broadband on Senior Citizens."

[9] Comments of Older Adults Technology Services, Inc., GN Docket. No. 09-191 (Jan. 14, 2010).

[10] The FCC posits that "One way to increase the relevance of broadband for older Americans is to highlight how broadband can improve their access to health care information and services." FCC National Broadband Plan, p. 179.

seniors are among the immediate beneficiaries of emerging telemedicine tools that enable in-home, remote monitoring services. *These tools, which allow healthcare providers to monitor vital signs and other health metrics in a **real-time** manner via broadband, are enabling seniors to age at home and to remain more independent for longer periods of time.*[11]

The disability community likewise "relies heavily on the network"[12] and uses broadband to access a universe of text- and video-based content. For example, the "blind and visually impaired population has benefitted greatly from…increased broadband connectivity and innovation over the past decade. New technologies have made what was once thought impossible [a] reality for many of those in [the] community. Communication, education and even recreation has become easier to access and all of these contribute to a greater sense of connectivity for people who are blind and visually impaired."[13] People who are deaf and people who are hard of hearing also benefit from broadband by, among other things, using new tools like Video Relay Services which operate in a ***real-time*** manner. As the FCC recently observed, these types of services have "revolutionized" the lives of many users with disabilities.[14]

Like with other demographics, people with disabilities are also using broadband to participate in a variety of educational and employment opportunities that might otherwise not be readily accessible.[15] For example, broadband enables a variety of targeted distance learning programs that can help increase educational achievement among the disability community. Broadband is also being used to launch small businesses and to telecommute, both of which are key to enhancing economic activity within this demographic group.[16]

C. <u>Broadband is Critical to Many Sectors of the Economy</u>

In addition to impacting individual users, broadband is driving key innovations in the delivery of cutting-edge healthcare, education, energy, and government services. For example, broadband is:

- *Enabling the development and deployment of cutting-edge telemedicine and health information tools and services.* Such services include: video-enabled consultations between patients and doctors; real-time remote monitoring of vital signs; delivery of telerehabilitation services such as remote delivery of rehabilitation and home health services; the creation and maintenance of

[11] Ibid. at p. 202.

[12] Comments of the Center for Accessible Technology, GN Docket No. 09-191 (Jan. 8, 2010).

[13] Comments of the St. Louis Society for the Blind and Visually Impaired, GN Docket No. 09-191 (Jan. 13, 2010).

[14] Declaratory Ruling, The Matter of Structure and Practices of the Video Relay Service Program, at paragraph 1, CG Docket No. 10-51 (Feb. 25, 2010).

[15] In comments to the FCC in this proceeding, the American Associate of People with Disabilities (AAPD) cites to a recent report by the U.S. Chamber of Commerce – "The Impact of Broadband on People with Disabilities" – as a key resource that "captures much of [the relevant] research and data of the past several years" regarding the positive impacts of broadband on the disabled community. Comments of AAPD, GN Docket No. 09-191 (Jan. 14, 2010).

[16] FCC National Broadband Plan, p. 5.

electronic health records; and cybersurgery.[17] These services, many of which occur in a real-time manner, are expected to enhance the quality of medical care, shift the healthcare paradigm towards more individualized care, and result in enormous cost-savings.[18]

- *Allowing seniors to age longer at home.* Broadband is being used to remotely monitor the real-time movements of seniors in order to alert emergency personnel if they fall or fail to get out of bed in the morning, and to help doctors identify the onset of certain types of cognitive diseases (e.g., Alzheimer's).[19]

- *Transforming education from preschool through college.* A large number of studies have observed that effectively integrating broadband and broadband-enabled technologies into curricula improve learning outcomes across the continuum of education.[20] In addition, broadband-enabled education has the potential to facilitate more individualized and targeted learning opportunities for all students.[21]

- *Facilitating the deployment of a national smart grid that will enable a variety of key innovations in the transmission, distribution, and consumption of energy*.[22] A broadband-enabled smart grid will allow for the utilization of a wider array of fuel sources and will serve as a platform for a number of real-time, smart home innovations that empower consumers to more carefully manage consumption.[23]

- *Enhancing the openness and availability of government services.* Successfully leveraging broadband will allow local, state, and federal government agencies to provide more robust services online and to more fully engage the populace.[24]

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[17] Ibid. at p. 200-203.

[18] The FCC estimates that increased utilization of these and other e-health tools could result in hundreds of billions of dollars in healthcare cost savings over the next 15-25 years. Ibid. at p. 201.

[19] Ibid. at p. 202.

[20] The FCC recently observed that students in hybrid learning environments – i.e., those that mix broadband and non-broadband components – tend to perform tasks more efficiently and score better on advanced placement tests than counterparts in traditional educational environments. Ibid. at p. 228.

[21] Ibid. at p. 225-226.

[22] Ibid. at p. 249-251.

[23] The FCC estimates that a national smart grid could cut down on carbon emissions by approximately 360 MM tons annually and could ultimately save billions of dollars for consumers. Presentation of the National Broadband Team, at slide 25, FCC Open Commission Meeting, Feb. 16, 2010.

[24] FCC National Broadband Plan, p. 283.

> Examples range from electronically filing tax returns to watching government proceedings live via streaming video.[25]

Such broadband-enabled innovations, too numerous to address in detail here, form the core of the FCC's vision for broadband in America.[26] Indeed, for the FCC and an array of stakeholders, broadband is a key component of a new social policy, whereby high-speed Internet is used to deliver services that are of critical importance to users.[27] Ubiquitous access to and robust adoption of broadband is poised to "unlock[] greater innovation, education, entrepreneurship, opportunity, and…social justice."[28] But if this vision is to be fully realized, then public policy must be sufficiently flexible to adapt to emerging and future uses of broadband and not so rigid as to discourage experimentation or impede innovation by technology developers, application and service providers, and network owners.

D. The Delivery of Broadband-Enabled Services Requires Flexibility by Network Managers & by Regulators

The many uses of broadband described above – from increased use of in-home telemedicine services by seniors and people with disabilities to the deployment of a national smart grid – will drive the deployment of more advanced network infrastructure, more robust services, and more bandwidth-intensive applications to consumers and service providers across the United States. Increased capacity will undoubtedly invite more bandwidth-intensive usage by users and innovators in sectors like healthcare, education, and energy.[29] *Such increased usage and more high-capacity usage will, in turn, lead to moments of network congestion or other issues, that, if left unmanaged, could degrade the user experience for all users and possibly delay the delivery of critical services to some users.* At present, there appears to be some dissonance between the FCC's vision for broadband in America on the one hand and its proposed vision for a nondiscriminatory Internet (in the "traffic" sense) on the other.

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[25] The cost savings associated with these types of uses are potentially enormous. For example, the FCC estimates that the IRS has saved over $300 million in processing tax returns over five years via electronic filing. Presentation of the National Broadband Team, at slide 34, FCC Open Commission Meeting, Feb. 16, 2010.

[26] As the FCC notes in the Introduction to its National Broadband Plan: "Broadband is a platform to create today's high-performance America – an America of universal opportunity and unceasing innovation, an America that can continue to lead the global economy, an America with world-leading, broadband-enabled health care, education, energy, job training, civic engagement, government performance, and public safety."

[27] This is framed most persuasively in a speech by Blair Levin titled "Wired for Social Justice," which was given during the Minority Media and Telecommunications Council's Broadband and Social Justice Summit on Jan. 22, 2010.

[28] Ibid.

[29] The FCC recently observed that "bandwidth supply and demand are co-dependent. More bandwidth begets more data-intensive applications which begets a need for more bandwidth. Indeed, it is this virtuous cycle that has made broadband an innovation growth engine over the past decade—but also makes forecasting difficult." FCC National Broadband Plan, p. 84.

We respectfully submit that there will be instances when broadband providers should have the latitude to prioritize or otherwise manage (in a "traffic" sense) those tools, services, and applications that are fundamental to the Commission's own vision of social justice and digital equity. Without sufficient regulatory latitude, service providers will likely be unable to guarantee reliable delivery of vital, real-time services for, as capacity increases, so, too, will the intensity of use across all user groups.[30]

We also respectfully submit that the proposed rules currently being considered could unduly limit the ability of service providers and innovators to ensure the delivery of important social, healthcare, communications, and other such services. The following examples highlight but several of the vital uses of broadband that, under the proposed rules, could be vulnerable to network congestion, reliability issues, or other problems in an environment where broadband providers are prohibited from managing or prioritizing traffic.

- *Broadband-enabled communication among users with disabilities.* Video Relay Services (VRS) are increasingly popular among people who are deaf and people who are hard-of-hearing since they facilitate real-life, face-to-face communication by providing real-time video connectivity. Delayed or dropped communications resulting from network congestion would deprive users of equal opportunities to participate in the full range of online activities.

- *Real-time, remote telemedicine services.* The FCC envisions a future where a "patient's heart rhythm can be monitored continuously, regardless of her whereabouts, and diabetics can receive continuous, flexible insulin delivery through real-time glucose monitoring sensors that transmit data to wearable insulin pumps."[31] The FCC has highlighted other such services, including: "Mobile sensors in the form of disposable bandages and ingestible pills relay real-time health data (e.g., vital signs, glucose levels and medication compliance) over wireless connections."[32] In order to be effective, many of these services must be delivered in real-time via broadband.[33] Delays could result in a missed dosage of

[30] As a preliminary matter, we agree with others that more broadband capacity is important. More capacity allows for more robust broadband-enabled services and applications. More capacity also encourages more bandwidth-intense innovation. As capacity increases, so does the proliferation of services that utilize that bandwidth. As such, no matter what the reasonable capacity of the nation's broadband networks, there will likely always be potential for congestion (and for other network-impairing scenarios as well). Ibid.

[31] Remarks of FCC Chairman Genachowski to the New America Foundation, "Mobile Broadband: A 21st Century Plan for U.S. Competitiveness, Innovation and Job Creation," Feb. 24, 2010.

[32] FCC National Broadband Plan, p. 202.

[33] The FCC has linked the ability of collecting health information in real-time to enhancing the ability of health agencies to bolster their responsiveness to disease outbreaks: "Accurately measuring health status, identifying trends and tracking outbreaks and the spread of infectious disease at a population level are extremely difficult. Health IT enables widespread data capture which in turn allows better real-time health surveillance and improved response time to update care recommendations, allocate health resources and contain population-wide health threats." Ibid. at p. 207.

medication or, more fatally, an oversight of symptoms leading up to a sudden health event.

- *Delivery of time-sensitive medical services.* Cybersurgery is another cutting-edge telemedicine service that relies on broadband.[34] As with traditional in-person surgical procedures, timing is critical. Delaying a procedure or communication among attending personnel could result in injury or death.

- *IP-based emergency calls.* The FCC has signaled a desire to transition towards an all IP-based telephone network, which means that VoIP-like telephone service will become standard in the near-future.[35] This also means that all emergency calls will eventually be sent over the IP network. Delays in delivering emergency communications could result in injury or loss of life.

- *Management of a national smart energy grid.* One of the many positive impacts of a national smart grid will be the ability of utilities to more closely manage fuel supplies, which will allow for the incorporation of renewable fuel sources (e.g., wind and solar), provided that they can be seamlessly swapped out for more reliable fuels whenever the wind dies down or the sun sets.[36] Indeed, without the ability to monitor fuel supplies in real-time via broadband, service providers would likely be unable to guarantee reliable delivery of cleaner, more affordable service to customers. Moreover, real-time monitoring of energy infrastructure could prevent large-scale blackouts.[37]

In a world where broadband-enabled tools and services are components of everyday life and especially important for key demographic groups (e.g., senior citizens and people with disabilities) and in core sectors of the nation's social and economic life (e.g., the healthcare and energy arenas), *there will likely always be instances when certain types of information packets should receive priority over others.* That is not to say that such prioritization can be based on speech, unfair competitive practices, or the like. *But, there will be times, for example, when a video relay communication between two people who are hearing impaired or the in-home, real-time monitoring of a senior citizen might have to be prioritized over other traffic, such as a peer-to-peer gaming application.*

Public policy, including this rulemaking by the FCC, must allow a sufficiently flexible regulatory approach to ensure that tools and services consistent with the FCC's vision of

[34] These services were briefly discussed during the FCC's staff workshop on health care, which was held on Sept. 15, 2009.

[35] NBP Public Notice No. 25, Comment Sought on Transition from Circuit-Switched Network to All-IP Network, FCC (Dec. 21, 2009); FCC National Broadband Plan, p. 59.

[36] FCC National Broadband Plan, p. 249

[37] Ibid.

broadband in America – one that leverages broadband to enhance social equity and advance key national purposes – are reliably and consistently delivered.

E. Guiding Principles

In light of the above discussion, the undersigned offer the following principles to guide the FCC's policymaking efforts:

- Broadband is a transformative tool that is quickly becoming an integral component of life for all users and that is poised, in the short-term, to be an essential medium for delivering life-enhancing services to senior citizens and to people with disabilities.

- Increased utilization of broadband by larger numbers of Americans and by additional sectors of the economy will increase the amount of traffic flowing through broadband infrastructure. This will spur further investment in bolstering networks, but will also invite more intensive utilization of broadband by individual and institutional consumers. Thus, regardless of how much bandwidth is available, network congestion and other issues will continue to challenge service providers.

- Consistent with the FCC's vision for broadband in America, certain types of socially-valuable tools and services will require priority when networks are congested in order to assure reliable delivery. Failure to allow for these types of arrangements could impede further development and deployment of life-enhancing services.[38]

- The FCC's existing framework for addressing potential conflicts in managing networks – i.e., its four Internet principles – has, to date, proven to be sufficient in correcting the few instances of discriminatory behavior. As such, the undersigned support codifying the current approach until consumer demand for advanced broadband services and applications has matured.

- Consumers should have the ability to work with service providers to ensure that the content they demand is delivered without delay. For example, a senior household should have the ability to assign priority to its telemedicine services,

[38] For example, in its comments in this proceeding, the Center for Accessible Technology cautions that "uncertainty about the changes in regulation of [broadband] markets has the potential to lead to less innovation and less investment, which would be harmful for this community." Comments of the Center for Accessible Technology, GN Docket No. 09-191 (Jan. 8, 2010). Older Adults Technology Services makes a similar point in its comments: "ambiguous or overly narrow rules regarding certain services of immediate value to seniors (e.g., in-home health monitoring systems) could be challenged in court or could send mixed signals to innovators in the marketplace. As a result, key benefits stemming from the use of these innovations could be delayed." Comments of Older Adults Technology Services, Inc., GN Docket. No. 09-191 (Jan. 14, 2010).

> while college students living in off-campus housing should have the ability to assign priority to movie downloads. Similarly, service providers should have the ability to subject these agreements to reasonable network management needs in order to assure a reliable and consistent user experience in furtherance of the FCC's vision of broadband in America.

****

F. Conclusion

The undersigned are enthusiastic and optimistic about the ability of broadband to profoundly change lives for the better. The undersigned support the FCC's vision for broadband in America and look forward to working with the Commission to fully realize it. The undersigned also endorse the FCC's recent observation regarding the relationship between regulation and innovation in the broadband sector:

> "While we must build on our strengths in innovation and inclusion, we need to recognize that government cannot predict the future. Many uncertainties will shape the evolution of broadband, including the behavior of private companies and consumers, the economic environment and technological advances. As a result, the role of government is and should remain limited. We must strike the right balance between the public and private sectors."[39]

Thus, the undersigned respectfully urge the FCC to implement a sufficiently flexible and adaptable regulatory approach that encourages and supports continued innovation and adoption of new broadband-enabled services.

Respectfully submitted,[*]

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[39] FCC National Broadband Plan, p. 5.

[*] The comments herein represent, collectively, those of the individual signatories to the comments and do not necessarily represent the positions of their organizations.

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Attachment #8

THE IMPACT OF BROADBAND ON PEOPLE WITH DISABILITIES

A Study Commissioned by the U.S. Chamber of Commerce

DECEMBER 2009

A REPORT TO THE U.S. CHAMBER OF COMMERCE

THE IMPACT OF BROADBAND ON PEOPLE WITH DISABILITIES

Charles M. Davidson
Michael J. Santorelli

The Advanced Communications Law & Policy Institute
at New York Law School

The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School thanks the U.S. Chamber of Commerce for commissioning this report. The ACLP also thanks Lesley O'Neill and Ann Turner for their research assistance.

Throughout the preparation of this report, the ACLP consulted with a variety of experts and practitioners who work with or advocate on behalf of people with disabilities. Many of these individuals are referenced in the paper. The ACLP thanks them for their input and the resources they provided. Their comments provided unique insights into the real life impacts that broadband is having on people with disabilities and the many unique issues raised by broadband and broadband-enabled technologies. In particular, the ACLP thanks Jenifer Simpson of the American Association of People with Disabilities for her help in soliciting feedback from her constituents regarding their broadband use. Their stories, which are highlighted throughout the report, were very helpful and inspiring.

The views expressed herein are those of the authors and do not represent those of New York Law School.

About the U.S. Chamber of Commerce

The U.S. Chamber of Commerce is the world's largest business federation representing more than 3 million businesses of all sizes, sectors, and regions. It includes hundreds of associations, thousands of local chambers, and 106 American Chambers of Commerce in 94 countries. Its members include businesses of all sizes and sectors—from large Fortune 500 companies to home-based, one-person operations. In fact, 96 percent of its membership encompasses businesses with fewer than 100 employees.

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The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School is a public policy program that focuses on identifying and analyzing key legal, policy, and regulatory issues facing the advanced communications sector. ACLP's mission is to promote robust and solution-focused dialogues amongst state and federal policymakers, academe, service providers, the financial community, and consumers concerning changes to the state and federal regulatory regimes governing wireline, wireless, broadband, and IP platforms.

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1. EXECUTIVE SUMMARY

Broadband is a transformative technology that is impacting the lives of its users in a wide variety of ways. In general, broadband:

- Facilitates convenient and cost-effective communication among family and friends;
- Enables a range of life-enhancing technologies;
- Encourages the creation of innovative products and services that can be delivered to users regardless of location;
- Allows senior citizens to reconnect with their communities;[1]
- Provides rural users with access to cutting-edge telemedicine tools;[2] and
- Creates a number of economic opportunities (e.g., telecommuting and small business creation) and cost-savings that have direct and measurable impacts on individual users and the wider economy.[3]

For people with disabilities, broadband is a flexible and adaptable tool that is being used to deliver affordable, convenient, and effective services, and that enables a range of social, economic, and health-related benefits. Moreover, broadband is poised to serve as a primary medium through which next-generation interactive assistive technologies are developed, deployed, and delivered. In short, broadband is having and will continue to have profound impacts on people with disabilities. However, a number of obstacles remain that could impede the full realization of these benefits.

This paper discusses the upward trend in broadband adoption and use among people with disabilities generally and focuses specifically on the numerous positive impacts that broadband is having on this very diverse segment of the population. This paper also highlights an array of user-specific issues raised by the emergence of broadband and articulates a set of policy recommendations for ensuring that, across the spectrum, people with disabilities have meaningful opportunities to benefit from broadband and broadband-enabled technologies.

1.1 Definitions

The Americans with Disabilities Act ("ADA") is the primary federal statute addressing people with disabilities in the United States. It was enacted in 1990 and originally defined a person with a disability as someone who (a) has a physical or mental impairment that substantially limits one or more major life activities, (b) has a record of

such impairment, or (c) is regarded as having such impairment.[4] In 2008, Congress amended the ADA in order to clarify and expand the definition of "disability" in light of a series of Supreme Court decisions that seemed to narrow it.[5] The Americans with Disabilities Act Amendments Act of 2008 ("ADAAA") expanded the original ADA definition to include disabilities that affect "one or more major life activity" and that include activities outside of work, such as communicating and reading.[6] These new definitions were implemented on January 1, 2009.

The U.S. Census Bureau employs a similarly inclusive definition of "disability" when gathering its population data. In particular, its American Community Survey ("ACS") identifies six broad classes of disability: (1) sensory (e.g., hearing or vision impairment); (2) physical (e.g., a condition that impairs one's ability to walk); (3) mental/emotional; (4) self-care (i.e. inability to care for oneself); (5) go-outside-home (i.e. inability to go out by oneself); and (6) employment (i.e. inability to work due to disability).[7]

For the purposes of this paper, use of the term "disability" will encompass the broad array of disabilities outlined in the definitions included in the ADAAA and used by the ACS.

1.2 Broadband & People with Disabilities

As an overview, broadband and broadband-enabled technologies provide people with disabilities access to a growing universe of products, applications, and services that enhance lives, save money, facilitate innovation, and bolster health and wellbeing. For example, broadband:

- Facilitates interactive communications via email, instant messaging, text messaging, and video relay services;
- Enhances the number and types of educational opportunities available to people with disabilities by enabling a growing universe of distance learning applications;
- Provides employment opportunities by enabling telecommuting and encourages entrepreneurship by providing a robust platform for conveniently launching and managing a home business; and
- Ensures access to cutting-edge health and medical applications by delivering a variety of in-home and remote telemedicine services.

Ensuring that these types of broadband-enabled technologies are available and accessible to people with disabilities is critical. The total number of Americans with disabilities is over 50 million[8] and is poised to increase as baby boomers age and develop disabilities in their later years. Thus, policies forged now will have a profound

impact on how people with disabilities access and use broadband in both the short-term and long-term.

1.3 Overview of the Paper

Section 2 provides a broad overview of the current population of people with disabilities. Understanding the diversity of this segment of the population underscores the many contours associated with broadband policymaking vis-à-vis people with disabilities. This section then analyzes current levels of broadband use among people with disabilities by focusing on four key topics:

- Availability of broadband;
- Awareness & demand for broadband;
- Adoption of broadband; and
- Usage of broadband.

As an overview, broadband is widely available across the United States, and people with disabilities are increasingly aware of and demanding it. *However, despite increasing adoption, a large number of people with disabilities remain offline for a variety of reasons*. Many perceive the Internet to be inaccessible or broadband to be prohibitively expensive or of little practical value. Others simply lack a computer or are unable to afford the cost of assistive technologies (e.g., a screen reader) that make a connection usable. This section highlights unique approaches to providing training and education to people with disabilities in order to promote the relevance of broadband, assuage fears regarding accessibility, and spur adoption.

Section 3 assesses the impacts of broadband on people with disabilities. Three broad areas are examined:

- The social impacts of broadband on the daily lives of people with disabilities;
- The economic impacts of broadband on people with disabilities, including individual and economy-wide welfare gains; and
- The effects of broadband on the health and wellbeing of people with disabilities.

To assess the impacts that broadband is having on people with disabilities, this section includes testimonials and case studies of people with a variety of physical, sensory, and cognitive disabilities; of service providers; and of organizations that specialize in disability issues. These real world stories illustrate the practical impacts of broadband

and highlight the types of challenges that remain for increasing adoption among a wider swath of this population.

Section 4 discusses the importance of greater broadband availability and technological innovation on people with disabilities. In the near term, innovation at the network level will ensure that advanced broadband infrastructure is available to all consumers regardless of geographic location. Moreover, these robust networks will spur innovation and the deployment of applications and services available via the Internet. As a result, people with disabilities will have more opportunities to consume an increasing amount of accessible and life-enhancing content. Successes in the near term will enable robust innovation in the long term, producing ever more useful services, devices, and applications, many of which will rely on broadband.

Section 5 articulates a set of policy recommendations that seeks to increase the adoption and use of broadband among the disabilities community, support efforts that demonstrate why broadband is of value to people with disabilities, enhance the availability of broadband, decrease the overall price of the service, assist public and private sector education programs, spur innovation by service and applications providers, and further incorporate broadband technologies into the lives of people with disabilities. In sum, there are a number of areas where government can and should play a key role in enabling further adoption of broadband, which include a focus on demand stimulation and encouraging investment and innovation at the network level and at its edge.

1.4 Foundational Principles

As discussed throughout this paper, a number of *foundational principles* should drive public policy for increasing broadband adoption and use among people with disabilities:

- Broadband is an interactive tool that enables a universe of useful applications and services for people with disabilities.
- Broadband facilitates an array of social, economic, and health-related welfare gains for people with disabilities, including the ability to stay in touch with family and friends, participate in their community, work from home, launch a small business, and access online medical services.
- Although the number of people with disabilities who subscribe to broadband continues to increase each year, a sizeable portion of the population remains offline for a variety of reasons, including lack of a home computer, the price of broadband and assistive technologies

required to effectively use a connection, and negative perceptions associated with the accessibility and utility of broadband.

- Once online, however, people with disabilities are avid and skillful users who participate in a wide array of activities.
- A number of models exist for increasing broadband use among people with disabilities and should be supported by policymakers at every level of government.
- Access to broadband is critical but is only the first step in helping more people with disabilities realize the full range of benefits enabled by this technology.
- The federal stimulus package is an important source of funding in the short-term for supporting education and awareness efforts that promote the value of a broadband connection and highlight the many positive impacts of broadband for people with disabilities.

2. An Overview of Broadband & People with Disabilities

The U.S. broadband market is increasingly robust. The Federal Communications Commission ("FCC") recently reported that the total number of broadband connections in the United States was 132 million by the middle of 2008,[9] compared to only 6.7 million at the end of 2000.[10] Consumers have a wealth of options for getting online via broadband. The FCC reports that there are nearly 1,400 different broadband providers across the U.S., up from just 105 in 1999.[11] Competition in the broadband sector has led to a diversity of service offerings and lower prices.[12]

Broadband adoption and use continues to increase across all demographics. Senior citizens, for example, are increasingly ardent users.[13] *Similarly, as this section highlights, broadband adoption and use among people with disabilities is also increasing each year*. However, a significant number of people with disabilities remain offline for a wide variety of reasons. The numerous life-enhancing benefits associated with broadband use, which are discussed in Section 3, underscore the importance of spurring greater adoption and use of broadband and broadband-enabled technologies amongst people with disabilities.

Section 2.1 presents a demographic overview of people with disabilities. Understanding the many different types of disabilities provides essential context for appreciating the diverse array of challenges that people with disabilities encounter when trying to use broadband. Section 2.2 discusses four key features associated with broadband use amongst people with disabilities: availability, awareness and demand, adoption, and levels of usage.

2.1 A Demographic Overview of People with Disabilities

In 2006, the U.S. Census Bureau reported that there were 50 million people with disabilities in the United States,[14] 41.3 million of which were non-institutionalized people over the age of five.[15] Of those between the ages of 16 and 64, 7.1 percent reported an employment disability.[16] In the 2006-07 school year, 14 percent of school children – nearly 7 million – participated in some kind of disabilities program.[17]

The number of people with disabilities varies according to age group, with older seniors reporting the highest incidence of disabilities. According to a 2007 report, the prevalence of disability in the United States was 14.9 percent for all persons over age five, 12.8 percent for persons between the ages of 21 and 64, 29.7 percent for persons between the ages of 65 and 74, and 52.9 percent for those over the age of 75.[18]

In order to appreciate the various types of impacts enabled and challenges raised by broadband among people with disabilities, understanding the vast spectrum of individual disabilities is crucial. Snapshot 1 provides a broad survey of recent statistics regarding the number of people with physical, sensory, cognitive, developmental, and a number of other disabilities. This Snapshot is by no means exhaustive but is representative of the diversity in the current population of people with disabilities in the United States.

SNAPSHOT 1 - A Survey of Statistics re People with Disabilities

Physical[19]	Sensory[20]
▪ Nearly 26 million adults in the United States report some form of physical disability.[21] ▪ The number of people with spinal cord injuries was estimated to be 259,000 as of April 2009.[22] ▪ Over 33 million adults report some sort of physical functioning difficulty.[23] ▪ 16 million adults are unable to walk a quarter of a mile.[24]	▪ In 2006, 21.2 million non-institutionalized Americans reported "vision loss."[25] The number of noninstitutionalized adults over the age of 18 reporting "vision trouble" was over 25 million in 2008.[26] ▪ In 2006, 37 million adults in the United States reported being deaf or hard of hearing.[27]
Cognitive[28]	**Developmental, Learning, Speech, etc.**
▪ Over 20 million people in the United States have a cognitive disability.[29] ▪ An estimated 57.7 million people over the age of 18 suffer from a diagnosable mental disorder in a given year, while nearly 6 percent of the population suffers from a serious mental illness.[30] ▪ Over 5.3 million people in the United States have Alzheimer's disease. Ten million baby boomers will develop Alzheimer's.[31] ▪ Over 800,000 people in the United States have some degree of cerebral palsy.[32]	▪ Between 30 and 50 percent of the United States population has undiagnosed learning disabilities.[33] ▪ As many as 1 out of every 5 people in the United States has a learning disability, with nearly 3 million public school children (ages 6 through 21) having some form of a learning disability and receiving special education in school.[34] ▪ Over 14 million Americans have some sort of speech/communication disability not associated with hearing loss.[35] ▪ 1.5 million Americans are living with the effects of autism spectrum disorder.[36]

The number of people with disabilities is expected to increase significantly as the more than 78 million baby boomers age.[37] Indeed, the total number of seniors is expected to double by 2050.[38] Currently, those over the age of 65 account for 36 percent of all people with disabilities over the age of 5.[39] Age-related disabilities include hearing and vision loss or degradation and the development of a debilitating disease, such as Alzheimer's. One study estimates that the total number of adults experiencing hearing loss will double by 2030 due to the aging of boomers.[40]

As discussed in more detail below, broadband and broadband-enabled technologies have a number of positive, life-enhancing impacts on those people with disabilities who adopt and use this technology (see Section 3). However, a large number of people with disabilities remain offline for a variety of reasons even though broadband is often

readily available. *The primary challenge going forward will be bridging the gap between availability and adoption among this segment of the population.*

The sheer diversity of disabilities, however, underscores the fact that one overarching policy or approach for spurring awareness, demand, and adoption of broadband will not work for people with disabilities. As such, policymakers must craft policies to support an array of approaches that promote adoption and use amongst people with all types of disabilities. Enhancing the relevance and utility of broadband and broadband-enabled technologies amongst people with disabilities is thus paramount and will be discussed in greater detail below.

2.2 An Analysis of Broadband Use Among People with Disabilities

Technology has always played an important role in enhancing the lives of people with disabilities. Indeed, many people with disabilities use an assistive technology device or service at some point in their lives. An assistive technology is defined as "any item, piece of equipment, or product system…that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."[41] Common examples include powered wheelchairs, assistive driving controls, and hearing aids. Broadband is quickly becoming an essential assistive technology, both as a medium for the delivery of critical services to a person with a disability and as a vehicle that enables a wide range of services and tools (see Sections 3 & 4).[42] However, broadband must first be adopted for it to be useful. Thus, it is critical to understand the contours of broadband adoption and use among this segment of the population before its actual and potential impacts can be assessed.

In analyzing the conditions under which people with disabilities begin to use broadband, four discrete issues play a prominent role. *Availability* of broadband is the first and perhaps most important factor. If broadband is not available, then a person with a disability does not have the option of using it. Even though broadband is widely available, where a person with a disability lives (e.g., a rural town or an urban center) often matters when assessing availability.

Awareness of and demand for broadband is the second factor. If broadband is available, are people with disabilities demanding it? A number of factors influence demand for broadband among people with disabilities, including perceptions associated with its accessibility, exposure to the technology, and an understanding of the real value of a broadband connection. If a person with a particular disability thinks that broadband is inaccessible by someone with a given disability, or if a person is not exposed to other people with disabilities using broadband, then demand may be low.

Adoption of broadband is arguably the most challenging issue. A number of factors (e.g., access to a computer, cost, and accessibility) contribute to a relatively low (but

increasing) adoption rate among people with disabilities even though awareness of broadband might be high. Bridging this gap is a challenge, but innovative approaches have been successful in spurring adoption.

Finally, the amount and types of *usage* will be discussed briefly here and more fully in Section 3. For an overview, please see Snapshot 2.

SNAPSHOT 2
An Overview of the Availability, Awareness/Demand, Adoption, and Use of Broadband by People with Disabilities

Availability	*Awareness & Demand*	*Adoption*	*Usage*
▪ Broadband is widely available across the United States. ▪ However, a number of unserved and under-served areas of the country remain, especially in rural America.	▪ People with disabilities are generally aware of broadband. ▪ Perceptions that broadband is an inaccessible technology, however, are fairly common. ▪ Programs that seek to educate people with disabilities about the benefits of broadband have succeeded in spurring demand.	▪ The broadband adoption rate among people with disabilities is increasing. ▪ Obstacles to a more robust adoption rate include lack of home computers, the price of broadband, and the costs associated with assistive technologies that make the connection usable.	▪ Once online, people with disabilities are avid users of their broadband connections. ▪ People with disabilities participate in a wide array of online activities and pursuits, including e-commerce, health-related research, telecommuting, and community participation.

2.2.1 Availability of Broadband

Broadband is widely available across the United States as network owners continue to invest billions of dollars in their physical infrastructure in order to deploy next-generation networks to every corner of the country.[43] However, for a wide variety of reasons, certain parts of the country remain unserved. Indeed, although the FCC has found that broadband is available in 100 percent of zip codes in the United States, service remains relatively scarce in those zip codes with very low population densities.[44]

Availability of broadband in rural areas is a key issue for people with disabilities, as they are more likely than most other groups to live in these areas. It is estimated that upwards of 20 percent of people with disabilities – roughly 11 million people – live in rural parts of the country,[45] compared with just 12 percent of the general population.[46]

Ensuring that broadband is available in unserved areas is a top issue for the current presidential administration. Economic stimulus legislation provides billions of dollars for spurring network build-out to these areas (see Section 5).[47] The FCC has issued a rural broadband strategy to spur deployment and adoption in these areas.[48] Market-driven efforts, combined with targeted policymaking, will remain important in expanding broadband availability. According to the National Telecommunications Cooperative Association's *2008 Annual Broadband/Internet Availability Survey Report*, 91 percent of customers in its 2008 Survey area had access to broadband,[49] up from 70 percent in 2007.[50]

Broadband enables a wide array of employment and healthcare opportunities for rural users generally and, more specifically, has the potential to transform the lives of people with disabilities (see below). But it has been observed that lack of demand and adoption, rather than lack of availability, is the chief issue of concern regarding rural broadband efforts.[51] More generally, a recent study by Pew concluded that, among those U.S. adults that are offline, only 16 percent cited lack of available broadband as their primary reason for not having broadband at home.[52] In addition, a significant number of adults said that they were either not interested in broadband or would not switch from their dial-up connection.[53]

In light of these findings and other data cited below, *raising the awareness of and demand for broadband, and increasing adoption rates among both rural and urban people with disabilities, are of paramount concern.* A central component of these efforts should focus on casting broadband and broadband-enabled technologies as relevant and essential to people with disabilities. A recent series of Pew studies found that only three percent of all non-Internet users reported being "physically unable" to use these types of technologies,[54] whereas 22 percent of non-users responded that they were not interested in getting online.[55] These and other findings discussed throughout the paper highlight the lack of clear value propositions for non-users across all demographics and user groups, including people with disabilities. Targeted efforts to educate people with disabilities on the relevance of broadband to their lives – and to enhance the utility of broadband for such users – are thus critical (as discussed further in this Section and in Section 3).

2.2.2 Awareness of & Demand for Broadband

Measuring the awareness of and demand for broadband among people with disabilities is more difficult than assessing its availability or adoption rate. However, a number of public and private initiatives have been launched recently to raise awareness of and spur demand for broadband at the state and local levels. Unfortunately, these efforts do not focus specifically on people with disabilities, but their general observations are helpful, nonetheless, in assessing current levels of demand for broadband among

people with disabilities and highlighting the wide variety of reasons why demand is generally lower relative to other groups.

For example, Connected Nation, a public-private partnership focused on spurring broadband deployment and adoption in the states that have implemented its model, has noted that a key factor in its successes over the years has been the creation of local eCommunity Leadership Teams to educate consumers on the benefits associated with broadband.[56] More than half of the residents who eventually adopted broadband did so after learning about the many benefits of broadband Internet access.[57] California's Broadband Taskforce has recommended a number of digital literacy programs and initiatives, including a statewide education campaign to notify all residents of the benefits of broadband.[58] Measuring the success of these and other endeavors is complex, but broadband adoption has consistently increased in each of the fifty states over the last few years.[59]

Among people with disabilities, a number of issues impact their awareness of and demand for broadband. First, people with disabilities are less likely to have a computer at home than many other segments of the population. Owning a computer is an essential prerequisite to using broadband, and those with a computer are much more likely demand broadband.[60] A 2000 study found that only 24 percent of people with disabilities had a computer at home, compared to nearly 52 percent for people without a disability.[61] By 2006, the number of people with disabilities who had a home computer had risen substantially, to nearly 40 percent, but this number was still lower than that for people without disabilities.[62] In 2008, slightly more than half of people with disabilities – 51 percent – reported having a computer at home.[63]

In light of a low rate of computer ownership, public computers are an important resource for some people with disabilities who wish to get online. Libraries, public computing centers, and other such places that offer free access to computers and the Internet may be "viable alternatives" for some people with disabilities who do not have a computer at home.[64] Frequently, however, access to public sites that provide public Internet access and computers are structurally inaccessible to people with certain types of disabilities, representing a significant barrier to computer use.[65] Despite accessibility mandates for places of public accommodation, many libraries, community centers, and other locations may still lack ramps or elevators leading to computer terminals.[66] And even when adequate physical access to public computers is provided, necessary assistive technologies and custom configurations to utilize computers and the Internet are often unavailable.[67]

Second, in addition to being less likely to have a computer at home or having limited access to public computers, people with disabilities are generally less exposed to, and thus less aware of, broadband. Exposure to the positive impacts of broadband tends to stimulate demand among potential users.[68] For example, a recent study found that 64 percent of people

without a disability access the Internet "anywhere," compared to only 31 percent of people with disabilities.[69] The reasons for why people with disabilities lack exposure to broadband are multiple and include having less physical mobility[70] and less access to the technology via work, since people with disabilities have a lower rate of employment than people without a disability.[71]

Third and perhaps most important, broadband demand among people with disabilities is generally lower than that of people without disabilities due to a fairly common perception that the technology is inaccessible. Indeed, a 2003 study found that 21 percent of people with disabilities remained offline because they thought it was confusing and hard to use.[72] Moreover, a variety of disabilities make it physically difficult to use a computer or broadband connection without using some kind of assistive or adaptive technology. To this end, a number of assistive technologies have been developed to enhance the accessibility of broadband for people with disabilities. These include screen readers for use by people who are blind, speech recognition technologies to facilitate navigation and writing (e.g., email), and mouse devices that are controllable by eye or head movements.[73] Yet many people with disabilities remain unaware that these and other assistive technologies can assist in accessing the Internet and broadband-based applications.[74] Anecdotal data suggest that such perceptions feed into a feeling among some people with disabilities that computer and broadband technologies are of little value because they are difficult to access and use.

However, the practical value of these technologies is real. For example, John, who is a quadriplegic broadband user, views his Dragon 9 voice recognition software as indispensible. "This AT allows me to use the computer for longer and in a more effective manner because I can only type with one finger. When I have to type, my shoulders get sore and my arms tire very easily. With voice-recognition [software], I do not have to type. I use this tool when typing long responses or participating in a chat room." Promoting similar success stories and highlighting the wide availability of these types of tools could further spur demand for broadband among people with disabilities. (See Snapshot 3 for additional information regarding the types of computer-related assistive technologies available to people with disabilities.[75])

SNAPSHOT 3
Assistive Technologies for Use With or Enabled by Computers

Physical Disability	*Speech Disability*	*Vision Impairment*	*Hearing Impairment*	*Cognitive Disability*
▪ Eye-tracking devices ▪ Voice-operated computer controls ▪ Sip and puff switches ▪ One-button access	▪ Natural voice software (text-to-speech) ▪ Voice recognition software ▪ Microphones & other input devices	▪ Screen readers ▪ Text magnifiers ▪ Instant Braille devices ▪ Braille printers ▪ Adaptive keyboards	▪ Video relay services ▪ Real-time captioning ▪ TTY/TDD via VoIP	▪ Large-key keyboards ▪ Touch screens ▪ Oversize mouse ▪ Planning software

Despite these challenges, awareness of and demand for broadband among people with disabilities has increased significantly over the last several years, due in large part to the efforts of programs that work directly with this segment of the population. As discussed in greater detail below, national efforts like the Alliance for Public Technology's "Broadband Changed my Life!" campaign[76] help raise awareness and spur demand for broadband generally, while more grassroots efforts like Closing the Gap (www.closingthegap.com) provide users, educators, and parents with information on how to adopt and use assistive technologies. A number of local organizations also provide people with disabilities access to and training on a variety of computer-related ATs (see Case Study 1).

CASE STUDY 1
Georgia Tools for Life

Georgia Tools for Life (www.gatfl.org) is a statewide program that seeks to increase access to assistive technologies for people with disabilities. The program offers assistive technology scholarships and donations in addition to training through hands-on demonstrations and workshops. In 2007, GATFL assisted over 3,000 people by providing them with training in how to use various assistive technologies. Via its ReBoot program, GATFL has placed refurbished computer equipment with over 7,000 people with disabilities since 1994.

GATFL supplements its work by partnering with Touch the Future (www.touchthefuture.us), which provides affordable, refurbished computer equipment and training to people with disabilities. Touch the Future offers AT demonstrations and other programs that seek to introduce people with disabilities to assistive technologies in the hope of spurring awareness and use of these essential tools.

Moreover, a number of companies and groups, ranging from broadband service providers to international standard-setting bodies, are focused on making the Internet more accessible for people with disabilities. For example, accessibility guidelines for Web 2.0 content were released by the World Wide Web Consortium ("W3C") in December 2008. These guidelines articulate "a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these."[77]

Another trend regarding accessibility of content and devices for people with disabilities is an increased adherence to universal design principles by hardware and software developers. These principles provide guidance for ensuring that products are accessible and usable for as wide and diverse an audience as possible (see Section 4.2 for further discussion of trends regarding accessibility and universal design). These types of efforts have spurred demand and increased adoption of broadband among people with disabilities.

2.2.3 Adoption of Broadband

Adoption of broadband in the United States continues to increase each year. According to a recent report by the Pew Internet & American Life project ("Pew"), 63 percent of homes had adopted broadband by April 2009, up from 55 percent in April 2008 and 42

percent in March 2006.[78] *Adoption of broadband among people with disabilities, however, remains low relative to the general public*. According to one study, less than a third of people with disabilities – 24 percent – had adopted broadband by 2008.[79] A number of reasons account for this.

First, the cost of broadband is a barrier for some people with disabilities. Even though prices have remained flat over the past several years,[80] people with disabilities generally have lower incomes than most other demographics. A 2007 study found that working-age people with disabilities earn approximately $6,500 less per year than people without disabilities.[81] The same study also found that, in 2007, the poverty rate of working-age people with disabilities in the United States was 24.7 percent, compared to only 9 percent for people without disabilities[82] (the poverty rate for the entire U.S. population rose to 13.2 percent in 2008).[83] Moreover, the full-time employment rate for people with disabilities is much lower than that of people without disabilities.[84] However, as discussed below, broadband enables an array of employment opportunities for people with disabilities, which include telework options and the ability to launch small businesses from home (see Section 3.2). These and other economic gains (e.g., from online shopping, prescription drug savings, etc.) could help offset the price of a monthly broadband subscription.

Second, the total cost of broadband access is often higher for people with disabilities because many need to purchase add-on assistive or adaptive technologies as a result of their disability. These might include an adaptive keyboard to facilitate typing for people with motor disabilities, screen readers for people who are blind or visually impaired, speech recognition software, and a wide array of similar types of hardware that make navigation easier (see Snapshot 3).[85] Some of these technologies are relatively expensive. For example, the JAWS screen reader, a popular brand among people with a visual disability,[86] retails for almost $900.[87] A number of efforts seeking to enhance the accessibility of Web content for people with disabilities and implement notions of universal design[88] of Web pages and applications have successfully brought these issues to the attention of public and private sector stakeholders.[89] As described below, many service providers are beginning to implement universal design notions (see Section 4.2).

Third, as mentioned above, demand for and adoption of broadband remains low among people with disabilities relative to the general public because many people with disabilities perceive the Internet generally as either unusable or unnecessary.[90] Many often perceive that a particular disability makes it impossible to use a computer or the Internet[91] and are unaware of the many assistive technologies that are available to help them get online.[92] Others, including those who are offline altogether or who use a dial-up connection, often do not recognize or appreciate the many benefits associated with a broadband connection.[93]

Given these trends, it is critical to implement and support programs at the local and state levels that inform people with disabilities about the accessibility of the Web, the universe of assistive technologies available to them, and the benefits of broadband in order to help spur adoption and use. Educational efforts have been successful where carefully implemented. For example, in Kentucky, ConnectKentucky and its parent, Connected Nation, fostered demand and identified viable network solutions in order to bring broadband to unserved areas. Availability increased from 60 percent in 2004 to 95 percent in 2007, while adoption increased 83 percent between 2005 and 2007.[94] Moreover, as discussed in Section 5, policymakers should consider an array of approaches for making broadband access more affordable for people with disabilities, including tax credits for the purchase of computer- or Internet-related ATs, using stimulus funding to support the education, awareness and training efforts of local nonprofits, and a more concerted effort to promote the relevance of broadband and broadband-enabled technologies among this segment of the population.

2.2.4 Broadband Usage

A more thorough analysis of specific uses and impacts of broadband on people with disabilities will be provided in Section 3. As an overview, those people with disabilities who have adopted broadband are generally active and enthusiastic users.

Data indicates that the use of broadband by people with disabilities tracks, overall, that of the general public. For example, a 2000 study found that the top two Internet uses among people with disabilities were sending and receiving email and searching for information; these were also the top two activities for people without disabilities.[95] By 2006, these Internet uses remained the most popular, but people with disabilities tended to search for information on health topics and government services more often than people without disabilities.[96] A 2007 Pew report concluded that "once online, people with chronic conditions [which include people with disabilities] pursue most online activities at the same rate as other users."[97]

People with disabilities are also using wireless broadband to enable a number of services and applications (see Section 4 for specific examples). Generally, wireless technologies – especially cell phones – are of enormous value to people with disabilities. According to the Wireless Rehabilitation Engineering Research Center ("RERC"), an interdisciplinary policy group, "wireless information and communications technologies play an increasing role in education, employment, healthcare, and other aspects of independent living for people with and without disabilities."[98] In particular, "3G mobile wireless technologies make it possible to exchange information and perform activities anywhere and anytime."[99] A recent survey by RERC found that approximately 86 percent of people with disabilities have a cell phone.[100] This study also found that, after voice communications, text messaging, email, and Internet access were the most important uses of a cell phone among people with disabilities.[101]

Broadband is also facilitating the use of more interactive and multimedia services and applications among people with disabilities, including multiplayer games, video relay services, and a growing variety of applications discussed in more detail below. In short, people with disabilities are using their broadband connections to enhance their lives and to realize a number of social, economic, and health-related impacts.

2.3 Conclusions

Available data supports a number of conclusions:

- Broadband is widely available across the United States. However, there continue to be pockets of unserved areas scattered across the country.
- People with disabilities are demanding and adopting broadband in increasing numbers. Yet a number of obstacles impeding more robust adoption remain. These include correcting negative perceptions regarding broadband accessibility, increasing computer ownership, and demonstrating the utility and value of broadband to those people with disabilities who feel it is irrelevant or unnecessary.
- The total price of broadband access for people with disabilities remains a challenge because many require assistive technologies to effectively use their broadband connection. Once online, however, people with disabilities are active and avid broadband users who participate in a diverse array of activities.
- Enhanced public and private education and outreach efforts are likely required to spur awareness of and demand for broadband among people with disabilities and to quell any concerns regarding accessibility.
- Policymakers should experiment with policies that seek to reduce the total price of broadband, including tax credits for ATs and stimulus funding to support training and demand stimulation programs.

3. THE CURRENT ROLES & IMPACTS OF BROADBAND ON PEOPLE WITH DISABILITIES

Broadband is enhancing the lives of people with disabilities in a number of important ways. This section focuses on three primary areas that this technology has impacted.

First, this section examines the social impacts of broadband on people with disabilities. Broadband provides a robust, interactive communications medium that increases interactions with family and friends, promotes social inclusion, encourages participation in an array of activities, enables a number of cutting-edge communications services (e.g., video relay services) for use by people with a variety of disabilities, and generally empowers its users. Moreover, broadband provides family, friends, and caretakers with a medium for gathering and exchanging key health information and for establishing support groups and other care networks.

Second, broadband is enabling a number of economic benefits for people with disabilities. Broadband allows people with disabilities to supplement their education, which can in turn lead to better and more diverse employment opportunities, including the ability to launch a small business. Moreover, many employers now encourage employees to telecommute, providing people with disabilities a convenient and affordable option of procuring work. Broadband also enables a variety of e-commerce options. Taken together, these individual economic gains have a large impact on the wider economy and could increase productivity and output in the long run.

Third, this section highlights the increasing number of health-related benefits facilitated by broadband. In addition to providing access to relevant and useful health information, broadband is increasingly being built into a variety of healthcare options for people with disabilities. Broadband-enabled telemedicine services, for example, allow people with disabilities to visit their doctor or obtain certain types of care remotely, while an array of cutting-edge in-home telemedicine systems allow for remote monitoring of vital signs and other metrics.

Snapshot 4 provides a summary of these impacts.

SNAPSHOT 4
The Social, Economic, and Health-related Impacts of Broadband on People with Disabilities

Social Impacts	*Economic Impacts*	*Health-Related Impacts*
▪ Broadband increases connectivity with family and friends. ▪ Broadband provides people with disabilities an interactive outlet to the world. ▪ Family, friends, and caretakers use broadband for support and for the exchange of critical care information.	▪ Individual economic gains include: enhanced education opportunities; e-commerce; and enhanced employment opportunities. ▪ Economy-wide gains include increases in: small business creation; workforce participation; productivity; and innovation vis-à-vis tailored content, services, and applications.	▪ Broadband is generally enhancing the wellbeing of people with disabilities. ▪ Broadband enables life-enhancing telemedicine services like in-home monitoring and other remote services. ▪ The potential for broadband-enabled healthcare services and applications is tremendous.

3.1 The Social Impacts of Broadband on People With Disabilities

> *"Broadband has made my life much, much easier."*
> ~ Lise

Lise, who is hard of hearing, uses her broadband connection for a variety of personal and professional tasks. For her, having a text-based medium that allows for the fast transmission of documents and written communications allows her to participate more fully in many aspects of her work and her life in general.

John, a quadriplegic who lives in Florida, uses his broadband connection for "just about everything." In particular, he uses it to shop, to look up health information, and to keep in touch with family and friends, either via email or "live" in chat rooms.

For Larry, of Hawaii, broadband has had a profound, life-altering impact. "It is my lifeline to the world, to my friends, and to my work," he says. Larry is deaf and uses his broadband to "do more work, be more productive, and have better self-esteem."

For the homebound, like Helen, of Logan, Utah, broadband is often the only viable means of communications. “It is my main contact with the outside world,” says Helen, who is unable to get out of bed most days. “Broadband has been valuable to me in terms of time saved and stress reduced.”

Broadband is having similar impacts on a range of people with disabilities because it enables tools and services that bolster communication capabilities, increases participation in a number of activities, and enhances personal empowerment (see Case Study 2 for a testimonial on how broadband impacts the life of a paraplegic user). This section analyzes how broadband connects the disconnected to their communities and empowers the isolated by focusing on three components of social engagement: communication, participation, and empowerment.

CASE STUDY 2
The Impact of Broadband on Flicka, who is a Paraplegic

I am a 57-year old woman who has been a T 4-5 paraplegic for 24 years. I live in Paso Robles, CA and began using the Internet in 1997. I first used dial-up to upload work-related data. At the time, my service provider was AOL, so I started investigating the Web with its user-friendly help. It was, however, a long distance call from our home, so I didn't spend much time getting familiar with the Web. Once our area got a local service provider, I moved to it to avoid the phone charges. We didn't get DSL to our rural area until about 3 years ago.

I use the Internet daily (I do not use an assistive technology to access it). I worked in legal research for several years. The Internet turned doing research into a snap! Now, I use it for everything—shopping, health info, banking, socializing. I am now used to looking up anything I have a question about—from recipes to word definitions. I have no idea how I survived prior to its invention.

Broadband absolutely helps me stay in better contact with family and friends. Living in a rural area, I had to travel at least 10 miles one way to interact with other people who are disabled.

I would just like to say that access to the Internet has changed my life more than any other invention during my life time. It's incredible!

3.1.1 Communication

People who have difficulty communicating orally (e.g., speech disabilities related to hearing impairments, brain injuries, paralysis, etc.) or via traditional methods (e.g., the basic telephone) benefit from broadband in a number of ways.

Broadband provides a text- and video-based medium that supports viable and affordable alternatives to traditional speech-based communication for people with an array of disabilities. Broadband facilitates the rapid exchange of information among family, friends, and caretakers by enabling email, chat services, and a number of video-based applications. These types of communications "allow [an] individual with a disability to encounter and interact with others to a degree that may not be possible offline."[102]

Email is the most popular Internet service among people with disabilities. Indeed, a number of recent surveys have found that well over 80 percent of people with disabilities who are online use the Internet to send and receive emails.[103] Chat services (e.g., instant messaging programs) are also popular[104] and represent another important social outlet for people with disabilities, particularly those with speech and hearing disabilities, liberating them from dependence on a telephone.[105]

SNAPSHOT 5
Perspectives on Broadband-Enabled Communications

"TTYs are so last century!"
~ Lucy, Lihue, HI

"I use my video phone as often as hearing people use their telephones."
~ Larry, Philadelphia, PA

"It's a great way to keep in touch with family, friends, and community"
~ Sheila, Sacramento, CA

"As a visually impaired person, I can say that the Internet has been integral to my success as a professional and as an active member of my community."
~ Day, Washington, D.C.

Broadband also enables more personal and interactive communications via video, which has recently emerged as a critical medium for people who are hard of hearing or deaf. In the past, people with hearing and speech disabilities used telecommunications relay services ("TRS") to place telephone calls. A TRS "allows people who are deaf, hard of hearing, or speech impaired to communicate through a communications assistant ["CA"] with people who use a standard telephone. A CA relays the TTY (text telephone or telecommunications device for deaf and hard of hearing people) input to the telephone user and types that person's response back to the TTY user."[106] The current generation of TRS services is compatible with mobile phones and computers.[107] However, Video Relay Services ("VRS") enhance traditional text-based telephone

communications by making interpreter services widely available and convenient for people who are deaf. A deaf person with a web-cam or other broadband-enabled video device calls an interpreter via the Internet, who then facilitates communication with a hearing person.

VRS is a booming industry that is supported by fees collected and administered by the FCC. The FCC's VRS funds total approximately $800 million each year and are used to support innovative providers like Viable (www.viable.net/vrs) and Sorenson (www.sorensonvrs.com).[108]

A similar service that is enabled by broadband is remote Communication Access Real-time Translation ("CART"). A person who is deaf or hard of hearing can log on to a CART provider's Website and receive instantaneous captioning of a telephone call directly on their computer. In the near-future, more advanced broadband-enabled services like telepresence will likely become common communications tools for people with disabilities (see Section 4.2).

These and other types of broadband-enabled communications services are very popular among users, especially those who use sign language to communicate (see Snapshot 4). In sum, broadband levels the communications playing field by facilitating the real-time delivery of written messages and video communiqués.

3.1.2 Participation

Some people with disabilities who are unable to effectively communicate or otherwise partake in community activities can become socially isolated. Broadband, however, is being used to facilitate more robust participation by isolated or detached individuals. Moreover, given the interactive and multimedia nature of broadband-enabled Internet access, broadband allows people with disabilities to participate in an array of activities that traditional telephone or dial-up Internet services are unable to support.

In general, high-speed broadband enhances the user experience for all consumers by ensuring the fast delivery of robust, multimedia content. For example, a fast Internet connection provides the opportunity to engage in real-time activities like chatting and conducting business (see Section 3.2). In particular, for people with certain mental or learning disabilities, broadband encourages more avid Internet use and participation by easing frustrations associated with slow connection speeds (e.g., decreasing the amount of time it takes to download an application or to access a Website).[109]

Broadband is also used by people with disabilities to participate in a number of social applications. These include social networking sites, self-help or support groups, and multiplayer online games, all of which represent the next-generation of social interactions.

Social networking sites, like Facebook and MySpace, provide a creative outlet for its users. These sites enable group socializing and networking among family and friends. These applications are also used by parents or caretakers of people with disabilities to provide support and to share information and advice. For example, a Facebook networking group titled "Special needs kids and the joy of raising them" offers a supportive space for parents, caregivers, and friends of children or adults with disabilities.[110] A variety of informative topics are posted on a discussion board for each of the 1,237 members to share and discuss. Facebook and other such networking sites provide people with disabilities a more convenient outlet for participating in social or therapeutic activities.[111]

Interactive online gaming is another popular means of social participation. According to one study, gaming is one of only a handful of Internet uses that people with disabilities participate in more actively than people without disabilities.[112] Moreover, in addition to providing entertainment and spurring critical brain functions like problem-solving, a variety of games have the ability to connect people with disabilities and, in some cases, provide treatment or critical resources that might be unavailable or difficult to access in the real world. For example, researchers at Rensselaer Polytechnic Institute recently developed a game called "Capable Shopper" to "help individuals with disabilities develop life skills and obtain increased autonomy."[113] The game simulates a food shopping trip and offers an interactive way for people with certain disabilities "to practice learning their way around the supermarket, identifying the appropriate aisles in which to find items on their shopping list, and selecting specific items off of shelves."[114] Immersive online multiplayer games like Second Life are also being used by people with certain disabilities to participate in social situations that might otherwise be difficult (see Case Study 3[115]).

CASE STUDY 3
Second Life & People with Disabilities

Second Life (www.secondlife.com) is a massively multiplayer online game that provides users with the opportunity to participate in the game by using an avatar. Players have the ability to own property, buy and sell goods, and engage in a number of "real world" activities like chatting and developing relationships. These types of games are played in real-time and require a broadband connection. By its nature, Second Life is an experimental medium, which is proving to be fertile ground for the development of unique and cutting-edge programs for people with certain types of developmental disabilities like autism. Examples include:

- The island of Brigadoon was created in 2003 by a doctor who used the space to help people with Asperger's Syndrome develop the social skills that they lack. Asperger's, which is a higher functioning form of autism, often hinders the development of social relationships. Brigadoon was established to provide people with Asperger's and their friends, family, and doctors with a place to develop robust social skills that could be used offline. Thus far, the results have been promising.
- "Naughty Auties" is a virtual resource center that disseminates information on autism and that provides people with autism a space for practicing social interactions.
- Contact a Family, a British nonprofit that provides support, advice and information for families with disabled children, recently launched a virtual contact center in Second Life to provide parents and children with another outlet for support and advice.

3.1.3 Empowerment

Broadband also empowers people with disabilities to pursue a range of social activities, including blogging, policy advocacy, and traveling that might otherwise be difficult, impractical or unaffordable.

Blogs are a popular and increasingly powerful medium for fostering a sense of community among people with disabilities, their friends, family, caretakers, and advocates. Blogging, which is greatly enhanced by a broadband connection,[116] helps to "bring new voices to the online world," particularly younger users who are among the most avid users.[117] These types of programs provide users with a forum for expressing opinions and posting information. Indeed, an increasing number of blogs dedicated to disabilities have been created over the last several years. For example, Disaboom.com is an online community for people with disabilities and provides them with a number of outlets for expression, including blogs, chat rooms, and other similar forums.[118]

Similarly, people with disabilities are using their broadband connections to participate in social discourse and public policy advocacy on a variety of issues. Bob, of Sacramento, California, has cerebral palsy and uses his broadband connection to promote his advocacy for people with speech disabilities. In particular, he helps run a Web-based nonprofit – Speech to Speech (www.speechtospeech.org) – that helps people with speech disabilities use the telephone more effectively. Lloyd, of Bowie, Maryland, is deaf and has benefited so greatly from broadband that he has begun to advocate in favor of increased rural access to this technology.

Across the board, broadband enables people with disabilities to live more independent and empowered lives. Lucy, who is deaf and lives in Hawaii, is using her broadband connection to train her puppy to become a hearing dog via instructional videos available online. Broadband also facilitates mobility by making travel more accessible to people with disabilities. Travel Websites such as Access-Able Travel Source (www.access-able.com) provide information for travelers with a variety of disabilities regarding the accessibility of various airports, cruise ships, and destinations. For the homebound or those who are unable to physically travel, sites like The Armchair Travel Company (www.armchair-travel.com) offer high-quality virtual tours of a number of international sites. These and other broadband-enabled services provide a number of tools for empowering people with disabilities and enabling them to participate more fully in social interactions.

3.2 The Economic Impacts of Broadband on People with Disabilities

That broadband has positive impacts on national, state, and local economic activity is undisputed. It has become a critical cog in economic development and currently serves as a key enabler of various forms of economic activity. Positive correlations have been found between broadband availability and job creation,[119] and between broadband use and productivity. Indeed, one recent study estimated that a seven percentage point increase in broadband adoption "could result in [direct annual income growth of] $92 billion through an additional 2.4 million jobs created or saved annually, $662 million saved per year in reduced healthcare costs…and $134 billion per year in total direct economic impact of accelerating broadband across the United States."[120] Another recent report estimates that a "stimulus package that spurs or supports $10 billion of investment in 1 year in broadband networks will support an estimated 498,000 new or retained U.S. jobs for one year."[121] Indeed, President Obama has cited broadband as being a key part of 21st-century economic growth and competitiveness.[122]

For people with disabilities, broadband provides a number of economic opportunities. The technology allows for many diverse uses like participating in e-commerce, enhancing one's education via online courses, telecommuting, and establishing a small business, each of which enables individual economic welfare gains for people with disabilities. In

the aggregate, these individual gains have the potential to provide a significant economic impact on the wider economy via gains in employment, consumer spending, and tax revenue from new businesses. This section analyzes both individual and economy-wide economic gains enabled by broadband.

3.2.1 Individual Economic Gains

The economic opportunities enabled by broadband are increasingly important to people with disabilities since they earn less, as a group, than people without disabilities. Indeed, in 2007 the median annual income of a person with a disability working full-time was $34,200, compared to over $40,000 for a person without a disability.[123] At a household level, the discrepancy between the earning power of people with a disability and people without is even greater. In 2007, the median annual income of households with at least one working-age person with a disability was $38,400, while households without a person with a disability earned over $60,000.[124]

Broadband facilitates a number of economic opportunities, including education, employment, and e-commerce, each of which is discussed below.

3.2.1.1 Education

Overall, people with disabilities have completed less schooling than people without disabilities. For example, according to one study only 12.5 percent of people with disabilities between the ages of 21 and 64 had a bachelor's degree in 2007, compared to nearly 31 percent for people without a disability.[125] Broadband is being used to close these gaps by providing enhanced, convenient, and affordable education to people with disabilities of all ages.

Broadband provides parents and children with a number of educational opportunities. Distance learning is increasingly popular and allows the homebound or those who are unable to travel long distances to enroll in classes. Many universities now offer online classes, enabling people with disabilities to earn college and advanced degrees. Moreover, parents with disabilities can use their broadband connections to monitor their child's progress in school, to stay in regular contact with teachers via email, and to participate in videoconferences with teachers.[126] Federal and state governments provide funding and other support for enhancing these types of educational opportunities.

Outside of the physical and virtual classroom, a number of unique organizations supplement broadband-enabled educational opportunities for people with disabilities. For example, an Iowa-based distance learning program called ASSIST (www.blind.state.ia.us/assist/assist-details.htm) offers digital computer training to people with visual impairments. This state-run, federally-funded program uses broadband-enabled distance learning courses to "provide instruction on Microsoft

Office software to blind and visually impaired individuals" in order to prepare them for careers in the IT field. Another program that uses broadband to spur education among people with disabilities is DO-IT, which is a project run by the University of Washington (www.washington.edu/doit). One of DO-IT's programs, AccessCollege, provides educators with information on how to make classrooms more accessible and helps prepare people with disabilities for college.[127] Another program – DO-IT Scholars – prepares high school students for college and career by providing them with information on the many facets of post-secondary education.[128]

These and other broadband-enabled educational programs facilitate the acquisition of job skills and, ultimately, boost employment among people with disabilities.[129]

3.2.1.2 Employment

Perhaps the most important immediate impact of broadband on people with disabilities is the increase in employment opportunities that this technology makes available. *Indeed, according to Jenifer Simpson of the American Association of People with Disabilities ("AAPD"), there is a direct correlation between education, employment, and broadband use.* "Almost half of people with disabilities are unemployed," she observes, "and if you're not working, you're less likely to be using broadband."[130] Conversely, using broadband at home facilitates a number of employment opportunities that otherwise might remain unavailable to people with disabilities.

Understanding the various ways that broadband impacts the employment opportunities available to people with disabilities is challenging because of the many different types of disabilities and the "multiplicity of barriers" faced by this very heterogeneous population.[131] However, across the entire demographic, employment is lagging relative to people without disabilities. In 2007, the employment rate of people with disabilities aged 21 to 64 was about 37 percent, compared to nearly 80 percent for people without disabilities in the same age range.[132] Moreover, the employment rate varies greatly depending on the type of disability. For example, people with sensory disabilities have a higher rate of employment (46 percent) than people with physical disabilities (31 percent).[133] Within the very diverse demographic of physical disabilities, employment rates differ according to the scope and severity of the disability. For example, approximately 57 percent of persons with spinal cord injuries reported being employed *at the time* of their injury, but 10 years post-injury, only 32 percent of persons with paraplegia and 24 percent of those with tetraplegia were employed.[134] Overall, the unemployment rate of people with disabilities reached 16.2 percent in September 2009, compared to 9.2 percent for people without disabilities.[135]

Broadband enhances employment opportunities for people with disabilities in several ways. First, as previously discussed, broadband provides an array of non-traditional educational opportunities. Increased formal education, coupled with computer training,

allows people with disabilities to be competitive for a wider range of jobs. In addition, broadband also allows organizations like YAI/National Institute for People with Disabilities Network (www.yai.org) to leverage the ubiquity of the Internet to "reach out to an even broader audience in order to fulfill [its] long time mission to build brighter futures for individuals with disabilities and their families" (see Case Study 4).[136]

CASE STUDY 4
YAI/National Institute for People with Disabilities Network

Founded in 1957, YAI provides career services, education, and training to people with a range of developmental and learning disabilities. YAI uses its Website to "further the impact of education and training by reaching individuals and communities who would not otherwise have access to this network of information that can make a difference in their lives." Increasingly, it bases its offerings and training around broadband Internet access, which facilitates faster, more consistent access to job postings and other employment opportunities.

YAI also utilizes the Internet to enhance its "greatest resource" – its employees. Via its Dream Careers site (www.yaidreamcareers.org), YAI has expanded its recruiting footprint in order to ensure that it is able to "promote understanding and respect for both developmentally and learning disabled individuals and all those who work with them."

Source: www.yai.org

Second, broadband provides access to a universe of job postings, career sites, and other employment resources that might otherwise be inaccessible to many. For example, in 2008, Disaboom, an online community for people with disabilities, partnered with online career resource JobCentral to launch Career Center 2.0.[137] This service provides "employment opportunities, resources, and services to the Disaboom community and corporations. Through this partnership, Disaboom will fully integrate JobCentral's advanced search engine technology into the Disaboom Career Center," allowing "registered Disaboom members to search and apply directly for employment opportunities from a database of currently over 500,000 open positions."[138] The federal government (www.usajobs.gov/ei11.asp) and many state governments also use the Internet to provide information on job openings for people with disabilities. In addition, broadband provides a text-based medium for the fast and convenient delivery of time-sensitive job information, which is essential to people with a variety of disabilities, like hearing impairments (see Case Study 5).

CASE STUDY 5

The Impact of Broadband on Garrison, who is Hearing Impaired

Garrison, 79, who lives in New York City, has a hearing impairment as a result of his service during the Korean War. Without his hearing aid, he finds it very difficult to participate in a conversation, both in person and over the phone. As an actor who depends on frequent interactions with his agent regarding casting calls and other business matters, the ability to communicate is essential. In addition, as one of the caregivers for his 102-year old mother, who still lives at home in West Virginia, Garrison must stay in constant contact with the nurses and other aides who provide her with essential medical services. For Garrison, the text-based and instantaneous nature of the Internet, facilitated by a fast broadband connection, has been life-changing. "It is extraordinary," says Garrison. "Broadband is my life and it has opened up a whole new world."

Curiosity first pushed Garrison to take a basic computer and Internet training course at his local library. "It was a good introduction but it was very basic. There is only so much you can learn in two half-hour classes." However, he soon noticed that a more intensive training program was being offered at his local SAGE center. Older Adults Technology Services (OATS) was offering free 10-week classes that provided seniors with comprehensive hands-on training. "OATS changed my life," says Garrison, who now volunteers at OATS and blogs at Senior Planet, which is affiliated with OATS (Garrison's blog—Everyday Strolls—can be found at www.seniorplanet.org/blogs/everydaystrolls).

Broadband provides Garrison with convenient access to casting calls and other items passed along to him by his agent. He is able to stay in more regular contact with his mother's nurses, and his blog has empowered him to opine on topics of personal and professional interest. In general, broadband "keeps me active." Having grown up in rural West Virginia, Garrison's newfound technological interests and prowess still amazes him. "I've gone from a horse and wagon on a farm to the Internet. It has been a remarkable journey."

Third, broadband increases access to a growing number of telecommuting jobs, which is an important option for some people with disabilities. Approximately 42 percent of employers currently offer employees a telework option, up from 30 percent in 2007.[139] Gartner, a consultancy, estimates that 12 million people telecommute more than eight hours per week, double the amount in 2000.[140] By the end of 2009, Gartner expects this number to reach 14 million.[141] These types of positions are especially attractive to workers with physical disabilities or those who are homebound. Telecommuting has the potential to enable dramatic cost-savings for employers, who are able to cut overhead costs; employees, who are able to work from home and save money and time by not having to commute; and consumers, who benefit from lower prices. Indeed, one

recent study found that a significant increase in telecommuting could lead to $228 billion in welfare-gains for consumers and $260 billion for employers.[142]

Fourth, and perhaps most importantly, broadband encourages entrepreneurship among people with disabilities. In general, people with disabilities have traditionally demonstrated a strong desire to work for themselves, and, over the last several decades, evidence suggests that people with disabilities "have a higher rate of self-employment and small business experience than people without disabilities."[143] As such, broadband is a boon to people with disabilities because it lowers the costs associated with starting and running a small business. Moreover, "VoIP, assistive technology devices, video services, and other [broadband-enabled technologies] expand employment opportunities and help people with disabilities be more productive."[144] To this end, the federal government provides a number of resources via its START UP/USA project for people with disabilities who wish to become self-employed (www.start-up-usa.biz), including resources for developing a business plan and access to case studies that provide best practices for launching a business. Anecdotal evidence suggests that many people with disabilities are using their broadband connections to run their own businesses from home (see Snapshot 6).

SNAPSHOT 6
Broadband, Employment & Small Business Creation

- Louis, who is deaf and lives in Florida, uses her broadband connection to run her financial planning business. According to her, "broadband is the reason for my business's success and growth." Among other things, Louis uses her broadband connection to communicate with clients and to manage their investments.
- Helen, of Logan, Utah, is self-employed as a consultant thanks to broadband. She is homebound due to a physical disability and uses her connection to communicate with customers and engage in research.
- CM is deaf and uses broadband to run a Web design business (www.spiralshell.com). His connection allows him to work from home everyday in Connecticut.
- Rick, of Northridge, California, is blind and uses his broadband to work from home everyday. According to him, "Without it, I would be unemployed." Broadband allows Rick to conduct all of his business and professional communications (e.g., marketing, sales, networking) from his home computer.

3.2.1.3 *E-Commerce*

E-commerce is an increasingly popular and affordable shopping option for all users. According to the most recent data available, even though e-commerce has slowed over the past few quarters, e-commerce sales as a percentage of total sales continue to increase.[145] Moreover, Pew has found that two-thirds of American Internet users had purchased something online in 2008.[146] However, participation appears to be linked to the type of Internet connection utilized by the user. Pew has observed that "people with broadband at home are more likely than dial-up users to have bought something online, by a 74 percent to 59 percent margin."[147]

Broadband greatly enhances the e-commerce experience by enabling users to make convenient purchases from home. Cost-savings often flow from e-commerce, due to the ability to comparison shop for a wide range of items. Part of these savings could offset the cost of subscribing to broadband. Moreover, for those with disabilities that make traveling to a store difficult or impossible, broadband-enabled e-commerce provides a wealth of home-delivery options for prescription drugs, groceries, and other essentials. *However, concerns persist regarding the accessibility of many e-commerce Websites. Many of these concerns vary depending on the type of disability*. For example, people who are blind often rely on screen readers to access and use a website. Some retail sites remain inaccessible. Even though federal and state laws require that retailers make accommodations for people with disabilities, these types of modifications are still being made in cyberspace.[148] However, as a result of state and federal law, most government sites are accessible to people with disabilities.

Structuring education, awareness and training campaigns around the potential cost-savings associated with shopping online could spur additional demand and use of broadband among those people with disabilities who remain offline by providing a tangible example of the utility of a broadband connection for them. Such efforts could also include information regarding the increasing accessibility of many e-commerce Websites, which could allay fears and correct misconceptions regarding the general accessibility of the Web and of broadband.

3.2.2 Potential Economy-Wide Gains

Broadband enables a wide variety of individual economic gains. As discussed above, a number of studies have found direct correlations between broadband use, job creation, and economic expansion. In the aggregate, the individual economic gains by people with disabilities facilitated by broadband could have a large impact on the U.S. economy.

As people with disabilities use their broadband connections to complete more schooling and acquire additional training, to telecommute or start their own businesses, and to

shop online, U.S. gross domestic product will likely rise. *For example, a 2005 study estimated that a one percentage point increase in the employment rate of people with disabilities would result in an increase of over $11 billion in total economic output between 2010 and 2030.*[149]

Realizing potential economic gains is essential to the entire population of people with disabilities and to the nation at large. People with disabilities, as a group, typically earn less than people without disabilities. Moreover, people with disabilities are much more likely to live in poverty than people without a disability.[150] One recent study observed that "[p]overty rates increase with the period of time that individuals experience work disability or limitation."[151] Broadband can and should be used to close this gap by enhancing educational opportunities and enabling an array of employment opportunities.

3.3 The Health-Related Impacts of Broadband on People with Disabilities

From the wheelchair to in-home monitoring devices, technology has long been used to enhance the lives of people with disabilities. As discussed above, broadband Internet access has had a similarly profound impact on people with disabilities, facilitating a number of social and economic gains. This section discusses the health-related impacts of broadband generally and analyzes how people with disabilities are using their connections to access robust health information online, receive more individualized medical treatments and services in their homes, and save money on a variety of healthcare items.

3.3.1 Broadband Enhances Access to Online Health Information

Accessing relevant and timely information online empowers all users. *For people with disabilities, accessing information related to their individual healthcare needs is particularly empowering because it increases a sense of independence and self-determination*.[152] Broadband significantly enhances the range of health information available to people with disabilities. While many text-based health Websites are accessible via slower dial-up connections, broadband connections facilitate faster delivery of more robust, multimedia content. For example, a simple search of the term "disability" on You Tube produces 32,000 videos, which range from personal videos by people with disabilities to snippets of seminars on providing disability-related health services.

In general, people with disabilities are more likely to search for health-related information while online than people without disabilities. Indeed, one 2006 study found that 57 percent of people with disabilities who regularly go online looked for health information, compared to only 48 percent of people without disabilities.[153] A study by

Pew in 2007 estimated these numbers to be 86 percent and 79 percent.[154] These numbers also vary according to the type of disability and demographic group. For example, it has been found that approximately 95 percent of people with psychiatric disabilities who use the Internet search for information on mental health treatments and medications.[155] In contrast, while over half of persons over the age of 75 report at least one disability,[156] only 28 percent of those over age 70 go online.[157]

Increasing broadband adoption among all people with disabilities, especially those over age 70, is essential in order to ensure that they have access to a growing universe of valuable health information. Indeed, a 2005 report issued by the Kaiser Family Foundation found that seniors have the most to gain from online health and medical resources because seniors "face a greater number of health conditions and use prescription drugs and healthcare services at a far higher rate than younger adults."[158] Overall, by gaining timely and reliable information regarding individual conditions, many people with disabilities or family members of people with disabilities are able to self-diagnose, self-treat in certain situations, and, increasingly, communicate more effectively with their healthcare providers.[159]

3.3.2 Broadband Enables an Array of Telemedicine Tools That Provide Remote Care to People with Disabilities

In addition to facilitating access to vital health information, broadband is also spurring the deployment and adoption of advanced telemedicine tools and services, which provide sophisticated medical services across long distances.

Telemedicine is a broad term that refers to "the use of electronic communications and health information technology to provide clinical services" for remote patients.[160] Examples include teleconsultations and telesurgery. Telemedicine also includes telehealth applications, which encompass a "broader application…of electronic communications and information technologies" that is used to "support healthcare services."[161] Examples include videoconferencing, transmission of images, and remote monitoring of a patient's vital signs.[162] Broadband-enabled telemedicine has the ability to extend effective medical care to remote parts of the country, provide patients with a variety of in-home services, and save billions of dollars in healthcare costs each year.[163]

In general, broadband-enabled telemedicine has a number of beneficial impacts on people with disabilities. First, telemedicine helps level the playing field between urban and rural healthcare facilities and ensures more uniform and enhanced healthcare for all Americans.[164] Broadband improves the quality of care and the quality of life of those not located near advanced facilities. These services are especially critical to the large number of people with disabilities who live in rural parts of the country, as the number

of doctors living in these areas is significantly less than the number of doctors in urban areas.[165]

Second, telemedicine reduces or eliminates travel time for people with disabilities. Via services like broadband-enabled videoconferencing, people with disabilities who are unable to travel long distances or who are homebound can consult with their doctors remotely. A number of innovative programs have been established to provide these types of local healthcare opportunities for people with disabilities by leveraging high-speed broadband networks. For example, the Flatlands Disability Network ("FDN") (www.ndcpd.org/fdn) is a "dedicated high speed data network linking the disability service providers, consumer groups, and disability advocacy groups of North Dakota."[166] FDN provides a "mechanism to provide training, therapy services, supervision, and coordination in the delivery of services to people with disabilities. Specific services [include] speech/language therapy, wellness training, nutrition counseling, and behavioral health monitoring."[167]

Third, telemedicine brings effective healthcare into the home and allows people with a variety of disabilities to easily access critical medical services. One such service that relies on broadband is remote patient monitoring. This encompasses a wide range of tools and services, including the use of sensors to record movements (e.g., ensuring that older disabled seniors get out of bed each day[168]) and the use of wireless devices to monitor vital signs and symptoms. While many of these systems are still in nascent stages of development, a number of organizations are experimenting with them to assess their value to people with disabilities. For example, in 2007, YAI/National Institute for People with Disabilities received a grant to develop a "telehealth program providing nurses, caregivers and healthcare professionals with accurate, easy-to-evaluate data on consumers' medical conditions via a 24-hour, Web-based system."[169] This program "place[s] computerized health monitoring systems in group residences and individual apartments, where individuals with autism, mental retardation, Down syndrome and other developmental disabilities live. These systems measure blood pressure and glucose levels, weight, pulse, and respiration. A camera can photograph a wound, infection, or other condition."[170] Feedback is in real-time and accessible remotely by nurses, who "can make an assessment and provide a recommendation for treatment based on the data."[171] In the near future, technologies like telepresence will dramatically enhance these types of in-home services.

Remote monitoring systems are not a panacea for people with disabilities. Indeed, the value of such systems varies greatly depending on the type of disability.[172] But, in general, these systems signal a shift in the way that healthcare is being provided and represent an important first step toward more individualized, convenient healthcare and medical treatment. Moreover, remote monitoring systems and other broadband-enabled telemedicine services will lead to vast cost-savings. Indeed, one study has estimated that "a full embrace of remote monitoring alone could reduce healthcare

expenditures by a net of $197 billion (in constant 2008 dollars) over the next 25 years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[173]

3.3.3 Broadband Leads to Healthcare Cost-Savings

According to one estimate, broadband-enabled health and medical services can save some $927 billion in healthcare costs for seniors and people with disabilities.[174] A large percentage of these cost-savings will be realized via the development and deployment of broadband-enabled telemedicine services, specifically the in-home health monitoring technologies and other remote care services discussed in the previous section.

These cost-savings encompass a variety of items. For example, various broadband services can reduce or eliminate costly travel for many people with disabilities. In addition, broadband-enabled telemedicine services can help detect the development of a disability. To this end, in-home monitoring systems are being tested to detect the early onset of Alzheimer's, a cognitive disability that affects millions of older adults.[175] Costs associated with treating these types of diseases total "more than $148 billion annually in Medicaid and Medicare services and in indirect costs to businesses that employ [Alzheimer's] and dementia caregivers."[176] Yet it is estimated that the early "interventions that could delay the onset of Alzheimer's disease by as little as one year would reduce prevalence of the disease by 12 million fewer cases in 2050," which could lead to dramatic cost savings for this disease alone.[177]

Any individual health cost-savings realized by people with disabilities who use broadband-enabled services help offset the cost of monthly Internet access or the price of a required assistive technology. In the aggregate, these cost-savings could provide some relief to an otherwise overextended system of public health entitlements.[178] However, in order for these cost-savings to be realized, people with disabilities must adopt and meaningfully use broadband and broadband-based services and applications. Thus, as described below, it is essential that efforts be made to boost the broadband adoption rate among people with disabilities in order to ensure that this segment of the population is able to fully reap the many benefits of this vital technology (see Section 5).

3.4 Conclusions

Broadband provides people with disabilities the opportunity to use an array of technologies, services, and applications that enable real social, economic, and health-related gains. In particular, broadband:

- Facilitates convenient and affordable communications between people with disabilities and their family and friends.
- Encourages active participation in community affairs and provides a number of options for socializing and making friends.
- Empowers people with disabilities to voice their opinions and advocate for issues of personal importance via blogs, chat rooms, list-serves, and other online forums.
- Increases the number and type of educational opportunities available to people with disabilities and provides more individualized learning vehicles.
- Enhances employment opportunities by enabling telecommuting and encourages entrepreneurship by providing people with a cost-effective medium for launching a business.
- Greatly improves and diversifies the healthcare options available to people with disabilities regardless of geographic location.
- Provides healthcare cost-savings via a variety of broadband-enabled telemedicine services.

4. The Impact of Greater Broadband Availability & Technological Advances on People with Disabilities

Greater availability of broadband connections, continued innovation at the network level, and further development of robust and accessible online content over the next several years will have a number of impacts on people with disabilities.

4.1 Innovation at the Network Level

The wide availability of advanced broadband network infrastructure is essential to enable the welfare gains for people with disabilities outlined above and to the continued development of useful online content. As a result, innovations at the network level in the near-term are crucial to the long-term success of the broadband market generally and people with disabilities specifically.

Network owners are investing billions of dollars each year in order to provide users with enhanced and more widely available broadband connections. The FCC reported that, by June 2008, 100 percent of the U.S. population lived in 100 percent of zip codes in which there is at least one broadband provider.[179] Moreover, network owners have outlined plans for even further expansion and innovation. Traditional telephone and cable companies, for example, continue to deploy fiber-optic systems that currently

provide users with very fast connections and that will eventually transmit data at speeds above 100 megabits per second. Recent fiber deployments by Verizon,[180] AT&T,[181] and Comcast,[182] among others, signal that an increasing number of consumers will have faster, more reliable and more versatile next-generation connections.

Similarly, wireless carriers are leveraging their portions of spectrum to deploy third-generation ("3G") and fourth-generation ("4G") networks. 3G networks are already widely available[183] and provide broadband connectivity to a sizeable portion of the population. Indeed, according to the FCC, nearly 60 million consumers receive broadband via mobile wireless systems.[184] In the near future, wireless carriers will begin deploying more robust 4G network infrastructure, which will provide faster and more reliable broadband connections.[185] In addition, more advanced wireless networks, like those based on the Long-Term Evolution ("LTE") standard, and continued competition in the marketplace will enhance mobile broadband, helping it become a vehicle for the type of innovation that will make universally designed products commonplace (see Section 4.2.2).[186] *Moreover, public-private endeavors, like the Flatlands Disability Network, will continue to build out and bolster proprietary broadband networks, connect more users, and enable the delivery of next-generation telemedicine services and applications to people with disabilities.*

Innovation at the network level and at its edge will continue to thrive under a regulatory framework that promotes competition, innovation, and experimentation. In view of the nation's current economic crisis and credit crunch, policies at every level of government should strive to promote investment in networks, in cutting-edge applications, and in job creation. The build-out, maintenance, and management of advanced networks, along with the development of useful and accessible content for people with disabilities, cost billions of dollars. Thus, legislative and regulatory policies should continue to encourage these advances (see Section 5).

4.2 The Outlook for Broadband & People with Disabilities: Assessing Near- and Long-Term Trends

Over the next several years, it is expected that an increasing number of people with disabilities will subscribe to broadband as awareness of the many benefits of the technology increases, as broadband prices continue to fall, and as assistive technologies needed to get online become more affordable. Increased usage of broadband by people with disabilities should, in turn, spur demand for more diverse and accessible content. As a result, a number of trends will become evident in both the near-term and long-term regarding broadband and people with disabilities.

4.2.1 Accessibility

Concerns regarding accessibility will increasingly be addressed by the efforts of industry stakeholders, collaborative working groups, and formal standard-setting bodies as more people with disabilities go online.

Recent technological innovations tend to produce more complexity as devices and services continue to converge around the Internet Protocol.[187] *Yet as the National Council on Disability ("NCD") has observed, these new technologies are also increasingly adaptive and flexible, making it "more practical and cost effective to build accessibility directly into these products."*[188] For example, YouTube, the most popular online video Website,[189] allows users to embed closed captioning in its videos.[190] YouTube also recently announced the adoption of a new technology that allows for the automatic translation of speech into captions.[191] These efforts enable people with hearing disabilities to view more accessible video content on this site.

New devices are spurring the development of innovations focused on affording accessibility for people with disabilities. For example, a number of next-generation screen-readers are being developed for use with touch screen devices.[192] To this end, Apple recently introduced a new version of its screen-reader – VoiceOver – for use on the iPhone 3GS[193] and has built additional accessibility tools into this phone for people with disabilities.[194] Several ATs have also been developed to enhance use of touch screen devices for people with disabilities. The Pogo Stylus, for example, can be used on the iPhone to navigate the touch screen. This device "simulates a human finger's capacitance and can be held like a pencil or attached to a mouth stick."[195]

Companies are also working individually and collaboratively to address accessibility issues. In addition to adopting and incorporating universal design standards into a growing range of products (see Section 4.2.2), many companies, including service providers and content developers, have announced a commitment to making more accessible products available and to making existing products compatible with accessibility solutions. For example, Verizon Wireless recently announced the availability of a text-to-speech assistive technology for some of its smartphones. The AT – TALKS – "converts displayed text into highly intelligible speech for…customers who are blind or visually impaired."[196] AT&T offers a similar tool – Mobile Speak – for disabled users.[197] Verizon Wireless and AT&T have both incorporated other such elements into many of its products to enhance accessibility. These include voice commands, large fonts, and the availability of alternative media formats.[198] Similarly, Microsoft has devised a strategy for building accessibility into a wide range of its products. In addition to making its products more accessible by building solutions directly into offerings like Windows, Microsoft designs its products to be interoperable with third-party ATs and other products that enhance accessibility.[199] Android, the mobile operating system developed by Google and used in a growing number of cell

phones (e.g., the T-Mobile G2),[200] enables a number of accessibility solutions, including a built-in screen reader and a text-to-speech engine that makes it possible to use most applications without looking at the screen, among others.[201]

Industry stakeholders have also begun to work with each other and with disability advocates on more wide-ranging accessibility solutions. Recently, these stakeholders joined together to form the Telecommunications and Electronic and Information Technology Advisory Committee ("TEITAC"), which provided the federal government's Access Board with recommendations for enhancing accessibility of new and existing technologies.[202] Other efforts include working groups organized by the Telecommunications Industry Alliance to address a variety of accessibility issues (e.g., hearing aid compatibility). These efforts signify a recognition on the part of innovators that more needs to be done to enhance accessibility and that a number of solutions and approaches are being considered.

Another important trend regarding accessibility is the clout of standard-setting bodies like the World Wide Web Consortium ("W3C"). The W3C is "an international consortium where Member organizations, a full-time staff, and the public work together to develop Web standards."[203] Even though membership is voluntary and its standards are nonbinding, W3C has published a number of influential recommendations that have been widely adopted.[204] In 2008, W3C published its Web Content Accessibility Guidelines 2.0 for so-called Web 2.0 content.[205] These guidelines seek to make advanced Web content more accessible to people with disabilities by ensuring that all content is perceivable, operable (e.g., users must be able to operate or navigate interfaces), understandable, and robust (i.e., "Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies").[206] Organizations like NCD support these types of standard-setting efforts and see the guidelines as but one part of a larger strategy for ensuring equal access to new technologies.[207]

These and other collaborative efforts are critical to ensuring a comprehensive approach to the complex and dynamic issue of accessibility. Bringing together industry stakeholders, advocates, and consumer representatives for discussions regarding an appropriate approach to accessibility will help to produce effective policies that spur the use of broadband and broadband-enabled technologies among people with disabilities.

4.2.2 Universal Design

Universal design "intends that products – especially software and computers – provide an interface that is suitable for all potential users, including persons with disabilities."[208] In other words, universal design provides product developers with a core set of design principles for ensuring that their products are accessible to as many

users as possible. The Center for Universal Design, based at North Carolina State University (www.design.ncsu.edu), has outlined a set of seven widely accepted universal design principles to ensure that "products and environments [are] usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."[209] These include: equitable use (i.e., "the design is useful and marketable to people with diverse abilities"), flexibility in use (i.e., "The design accommodates a wide range of individual preferences and abilities"), simple and intuitive, perceptible information (i.e., "the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities"), tolerance for error, low physical effort, and size and space for approach and use.[210]

Many broadband service providers have adopted and implemented universal design principles. For example, nearly 20 years ago Verizon became the first telecommunication company to "embrace a set of Universal Design Principles," which are now "part of [its] product design process."[211] Similarly, AT&T "supports universal design to make new telecommunications products and services accessible to and usable by individuals with disabilities."[212] In the wireless realm, universal design principles are also increasingly prevalent. AT&T, in 2008, released its Universal Design methodology "in an effort to encourage application developers and handset manufacturers to consider the needs of seniors and customers with disabilities when creating new mobile products and services."[213]

However, for a person with a disability to fully realize the many benefits of his or her broadband connection, the content online must be usable and relevant and the devices he or she uses must be properly designed. To this end, a number of examples of products and services that include universal design principles are illustrative. For example, Nokia, one of the world's largest producers of wireless handsets, has committed itself to universal design by including a number of such elements into its phones.[214] Apple has long been a leader in universal design by incorporating a range of services in its products to make them widely accessible.[215] All of Apple's Mac computers come with proprietary screen-reader software—VoiceOver—already installed.[216] In addition, Apple has built accessibility and universal design solutions into many of its products, including the iPod Nano (e.g., spoken menus and large font) and iTunes software (e.g., works with screen-reader technologies and makes available captioned movies).[217] Universal design also applies to online content. The efforts of groups like W3C are helping to disseminate universally-accepted standards for Web content (see Section 4.2.1).

4.2.3 Private-Sector Innovation & Adaptation

Key innovations that enhance the broadband user experience of people with disabilities will flow from the private sector for two reasons. First, a number of existing laws require many private actors to make their services and products accessible to all users (see Section 5.6).[218] As a result, these laws provide a minimum standard of accessibility for products and services offered by private companies.

Second, technological convergence and the use of broadband as the primary vehicle for delivering services will drive competition and spur innovation as companies compete for consumers, especially as market saturation increases. Such market dynamics will raise the minimum standard of accessibility as companies seek to maximize its customer base by providing as individualized a user experience as possible. For example, a number of home appliance manufacturers are designing a special class of products that appeal to aging baby boomers (e.g., ovens with easier-to-open doors), a very large segment of the population.[219] These types of strategies will increasingly be used for people with disabilities in a number of contexts, particularly in-home services enabled by broadband.

In addition to enabling a range of remote educational and employment opportunities, broadband also facilitates the delivery of critical in-home health-related services that are of enormous value to people with disabilities. In the future, these services will supplement the diverse array of health monitoring technologies discussed above. For example, OfCom, the British regulator of communications, released a report predicting that innovators will leverage the ubiquity of mobile handsets and the decreasing costs of wireless sensors to produce services that can monitor personal information in real-time and send emergency alerts when a person gets into an accident or suffers a sudden health event.[220] These types of broadband-enabled services will eventually be integrated into the architecture of the homes of people with disabilities, creating a sort of "smart" house that facilitates living by increasing automated functions (e.g., doors that automatically open or disabling an appliance[221]). In combination with similar "smart" technologies, like wearable and implantable devices,[222] people with disabilities will greatly benefit from a universe of innovative broadband-enabled services provided via the private sector.

4.3 Conclusions

With millions of people with disabilities still offline, and with their collective spending power equivalent to upwards of $200 billion, companies that deliver and use broadband will increasingly target their offerings to this very large segment of the population.[223] Indeed, as was discussed in this section, a number of trends are evident regarding broadband and people with disabilities. In particular:

- Innovation at the network level, in both the near-term and long-term, is critical to enabling the wide array of welfare gains described in Section 3 and the many next-generation services described in this section.
- As more robust broadband becomes more widely available, price competition should continue and the number of people with disabilities who use this technology for Internet access will increase exponentially.[224]
- Continued convergence around the Internet Protocol and the continued use of broadband as the means of delivering IP-enabled services will foster competition among providers and developers and spur innovation, all to the benefit of people with disabilities.
- Innovation will increasingly incorporate notions of accessibility and universal design as service and content providers seek to provide individualized services to people with disabilities.
- In the long-term, broadband will be an essential conduit for delivering life-enhancing and lifesaving tools, services, and applications to people with disabilities.

5. Government, People with Disabilities & Broadband: Recommendations for Meaningful Policymaking

According to a recent Pew report, one in five American adults reported "a disability, handicap, or chronic disease that keeps them from participating fully in work, school, housework, or other activities."[225] Broadband provides a unique, interactive, and reliable medium for ensuring that people with disabilities are able to fully participate in their communities and enjoy a number of personal, social, and economic welfare gains.

However, a number of obstacles remain, many of which can be overcome via meaningful and careful policymaking at each level of government. This section articulates a set of policy recommendations that seek to maximize broadband adoption and use among people with disabilities. These recommendations include:

1. Careful policymaking, targeted allocation of stimulus funds for network build-out, and the continued use of public-private partnerships are necessary to ensure continued deployment of advanced broadband networks to rural, under-served, and unserved parts of the country.

2. Stimulus funding should be used to support meaningful education, outreach and training efforts that seek to raise awareness and spur further adoption of broadband among people with disabilities.
3. Education and awareness efforts should continue to focus on promoting the relevance and utility of broadband to people with disabilities.
4. Policymakers and other stakeholders should pursue a multifaceted strategy for ensuring that the total cost of broadband access and use is affordable for people with disabilities.
5. Low computer ownership rates and lack of awareness regarding assistive technologies that enable broadband usage by people with disabilities should be addressed in ways similar to those that seek to stimulate demand for and adoption of broadband.
6. Stakeholders should consider an array of tools and approaches to address issues related to the accessibility of new technologies and services.
7. Going forward, policymakers should bolster the current pro-investment and pro-competition regulatory framework in order to encourage further innovations and deployments that benefit people with disabilities.

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5.1 RECOMMENDATION #1

Careful policymaking, targeted allocation of stimulus funds for network build-out, and the continued use of public-private partnerships are necessary to ensure continued deployment of advanced broadband networks to rural, under-served, and unserved parts of the country.

A recent report by the U.S. Department of Agriculture observes that the "growth in broadband availability since 2000 has been rapid."[226] According to the FCC, over 90 percent of zip codes have four or more broadband providers in them.[227] However, with regards to broadband availability, rural areas still lag behind urban areas. The FCC observes that areas with low population density have lower broadband availability and adoption rates relative to areas with higher population densities.[228] This dynamic is particularly important to people with disabilities, as this segment of the population is more likely than most other groups to live in rural areas. It is estimated that upwards of

20 percent of people with disabilities – roughly 11 million people – live in rural parts of the country,[229] compared with just 12 percent of the general population.[230]

A number of policy solutions have been implemented to spur further deployment to unserved areas, including a provision in the recently adopted economic stimulus package that provides over $7 billion in grant funding for broadband build out to unserved areas and for other efforts aimed at spurring adoption and use.[231] While these funds provide another mechanism for ensuring universally available broadband, it is crucial that these provisions be carefully implemented and supplemented by other efforts in order to be of value to all users and particularly people with disabilities.[232]

Market-driven efforts have succeeded in making broadband available to the vast majority of users across the United States. These efforts have been enhanced by public-private partnerships, which pair the creativity and innovative spirit of the private sector with public sector resources. A number of successful organizations have emerged and should be looked to as models during the implementation and disbursement of stimulus funds. For example, ConnectKentucky and Connected Nation have succeeded in spurring broadband availability and adoption in Kentucky, raising broadband adoption in the state by 83 percent between 2005 and 2007.[233] This model addresses broadband availability from both the supply side, by recommending deployment strategies that best suit particular localities and topographies, and the demand side, by providing training and otherwise increasing awareness of the technology. To date, it has been adopted in Minnesota, Ohio, Tennessee, and West Virginia.[234]

Stimulus funds allocated for broadband could be used to support these types of successful models. Funding could also be used to enhance the efforts of organizations that provide broadband access and training to people with disabilities (see Section 5.2). Moreover, programs that provide additional services of value to people with disabilities via broadband (e.g., telemedicine) would also benefit from additional funding, both via stimulus funding and other federally-administered grant programs (e.g., the FCC's Rural Health Care Pilot Program).[235] In sum, the agencies responsible for implementing the broadband provisions of the stimulus package should recognize the diverse needs of people with disabilities vis-à-vis broadband and ensure that appropriate measures are taken to support the wide array of programs and initiatives designed to spur availability, demand, adoption, and effective use of broadband among this segment of the population.

5.2 RECOMMENDATION #2

Stimulus funding should be used to support meaningful education, outreach and training efforts that seek to raise awareness and spur further adoption of broadband among people with disabilities.

Even though the number of people with disabilities who have adopted broadband continues to rise each year, a large portion of this segment remains offline. Price remains an obstacle for some users (see Section 5.4), while many continue to perceive the Internet, computers, and broadband as inaccessible (see Section 5.6). However, as discussed above, once online, people with disabilities are avid and capable users. Indeed, Section 3 highlighted the universe of individual and society-wide benefits enabled by broadband. In order to maximize these benefits for people with disabilities, support must be given to efforts that seek to raise awareness and spur adoption among this segment of the population.[236] A number of approaches that have proven effective in raising awareness and spurring adoption should be supported and extended.

First, a number of nonprofit organizations that specialize in providing broadband training and other educational services to people with disabilities have been launched over the last few years. This report has highlighted Georgia Tools for Life and YAI/National Institute for People with Disabilities Network as two successful models for promoting broadband as a necessary and essential tool for people with disabilities. These organizations are also unique because they are scalable, meaning that their models could be easily replicated in a variety of contexts across states. Indeed, Georgia Tools for Life already has four affiliates based in four cities across the state, each of which provides technical assistance to people with disabilities in a wide geographic area.[237] In addition to using broadband to provide services, nonprofits are increasingly leveraging the wide availability and affordability of the technology to expand their services and geographic footprint.

Second, disability groups are using the Internet and broadband-enabled applications to provide key resources to people with disabilities, along with their families, friends, and caretakers. For example, the Family Center on Technology & Disability ("FCTD") (www.fctd.info) uses broadband to coordinate among some 3,000 organizations that "share a concern for the families of children with disabilities."[238] In particular, FCTD disseminates a number of multimedia resource documents that provide families with information on how to incorporate assistive technologies into the care they give to their children, access to online discussions among experts and other parents, and, in the near future, Web-casts of interviews with leading doctors and advocates. Similarly, Lighthouse International (www.lighthouse.org) uses its Website to provide numerous

Web- and video-based educational opportunities regarding the spectrum of vision disabilities. These are available to professionals and other interested stakeholders.[239]

Another example is the American Foundation for the Blind's Senior Site, which focuses exclusively on the issue of senior vision loss.[240] This site provides a range of resources on vision loss to seniors, their families, and their caregivers. Most critically, the site is "designed to encourage aging adults with eye diseases to live independently and productively. The site connects seniors, family members, and caregivers to local services and showcases a wide range of assistive living products available to people with vision loss."[241]

Third, broadband provides advocacy groups with a means of expanding the reach of their efforts. The Alliance for Public Technology ("APT") (www.apt.org), a nonprofit group that seeks to "promote deployment of advanced telecommunications services in order to foster improved and more affordable healthcare for all citizens,"[242] has drawn attention to the life-enhancing impacts of broadband via its "Broadband Changed my Life Campaign!".[243] One of the recent winners of the competition was a woman with Amyotrophic Lateral Sclerosis, who described her Internet connection as an enabling technology that enhances her ability to stay in touch with family and friends and that provides a critical lifeline to essential services.[244]

Each of these efforts provides information regarding the value and accessibility of broadband for people with disabilities. FCTD and Georgia Tools for Life assuage fears and allay doubts regarding the value of assistive and computer technologies among people with disabilities. Groups like APT and Lighthouse International use broadband to disburse critical information on a variety of topics and to highlight the key role that the technology can and should play in the lives of people with disabilities.

Going forward, these types of programs should continue to focus on promoting the value and relevance of broadband to those people with disabilities who remain offline or who perceive broadband as inaccessible (see Section 5.4). In the near-term, these efforts can be immediately enhanced through the targeted allocation of stimulus funding that is earmarked for these purposes. Indeed, some $250 million is allocated to support innovative demand stimulation and training programs that enhance adoption and use.[245] Since the vast majority of programs that raise awareness of broadband and provide training and other services rely on public funding and private donations, the infusion of funds via the stimulus package would greatly bolster their efforts and encourage new programs to emerge, all to the benefit of people with disabilities.

5.3 RECOMMENDATION #3

Education and awareness efforts should continue to focus on promoting the relevance and utility of broadband to people with disabilities.

In addition to supporting the services and programs described in Section 5.2, it is essential that resources be dedicated to highlighting the utility and relevance of broadband for people with disabilities. As discussed above, a significant number of adults, including people with disabilities, remain offline and cite a lack of interest in getting online as the primary reason for not having adopted broadband.[246] There continues to be a gap between those people with disabilities who recognize and appreciate the life-enhancing benefits of broadband and those who either are unaware of the benefits or who are dissuaded by the perception of broadband technologies being inaccessible or prohibitively expensive.

In addition to information regarding accessibility (see Section 5.6) and the cost of broadband (see Section 5.4), educational efforts should focus on how broadband can be meaningfully incorporated into the lives of people with disabilities. In particular, education and awareness efforts should focus on including:

- How people with disabilities can use their broadband connections to stay in touch with family and friends, participate in their communities, work from home or start their own business, use telemedicine services, and otherwise live healthier, more independent lives;
- Information regarding accessibility and how assistive technologies, coupled with training, enable all people with disabilities to access the Internet;
- Why broadband is a valuable tool that can be used to realize a number of economic and health-related gains; and
- The availability of local, state, and national programs to provide training and other resources that help people with disabilities get online.

These guiding principles, in combination with each of the other policy recommendations in this Section, will ensure a comprehensive approach to spurring demand and adoption of broadband among people with disabilities.

5.4 RECOMMENDATION #4

Policymakers and other stakeholders should pursue a multifaceted strategy for ensuring that the total cost of broadband access and use is affordable for people with disabilities.

In addition to perceptions that the Internet is inaccessible, many people with disabilities are also unable to afford broadband access. This is partly due to a higher unemployment rate and lower median incomes of people with disabilities, relative to people without disabilities. However, the total cost of broadband access is often higher for those people with disabilities who require assistive technologies to use a computer or to effectively use their Internet connection. Concerns regarding computer ownership and accessibility will be addressed in Section 5.5. The price/value ratio can be addressed from several vantages (including, as addressed above, by educating consumers on the relevance and utility of broadband to their lives).

First, policymakers should continue to support and expand the pro-competition and pro-investment framework that has resulted in steadily decreasing broadband prices. Pew has found that broadband prices have generally decreased over the last several years.[247] Moreover, Pew reports that broadband adoption rates continue to increase across most economic demographics.[248] This data suggests that broadband is becoming more affordable for most consumers. However, the broadband adoption rate among people earning less than $20,000 per year, which includes a number of people with disabilities, continues to lag behind all other income groups.[249] Yet, in general, price is not the primary reason for lack of broadband at home. Indeed, a recent Consumer Electronics Association report found that one of the main reasons among consumers for not subscribing to broadband is the lack of a home computer, not lack of available broadband.[250] Overall, market-driven competition continues to bring down the price of a broadband connection. As a result, policymakers should continue to support these organic efforts.

Second, for those consumers, including people with disabilities, who are unable to afford broadband, policymakers should optimize existing subsidy programs in order to spur adoption. The primary vehicle for this is the Universal Service Fund ("USF"), particularly its Lifeline/Linkup program. Like the USF generally, Lifeline/Linkup is a program that helps ensure that low-income individuals have access to basic telephone service only.[251] However, a number of public and private sector stakeholders support extending Lifeline/Linkup funds to include broadband access. For example, the National Association of Regulatory Utility Commissioners, whose members include state regulatory commissioners from every state, recently adopted a resolution calling on the FCC to launch a three-year pilot program that would extend Lifeline/Linkup

funding for broadband Internet access services and enabling access devices.[252] Legislation was introduced in the U.S. House of Representatives in September 2009 that would devote a percentage of Lifeline funds for broadband purposes.[253] Many companies in the private sector, including most broadband service providers, support similar measures to expand the Lifeline/Linkup program.[254] As Congress and the FCC consider USF reform, each should look to enhance *existing* mechanisms for the continued adoption and use of broadband, while avoiding new direct or indirect taxation on service providers.

Third, in addition to careful USF reform, policymakers should consider extending tax credits or other similar tax benefits to people with disabilities who purchase broadband and any assistive technologies that might be necessary to effectively use that connection.[255] Tax credits could provide instant savings (e.g., via a lower priced item) or a deferred savings via a tax refund on the purchase of a computer (i.e., a key reason for not subscribing to broadband) or an AT. A number of states have offered these types of tax breaks to service providers in order to spur the deployment of broadband.[256] Extending these credits or other tax benefits to individuals with disabilities, however, could stimulate broadband adoption among those who would not be able to afford it otherwise. Moreover, making these types of tax incentives readily available to individual users, in addition to or in lieu of providers, would greatly enhance the value proposition being offered to people with disabilities regarding the utility of getting online via a broadband connection.

Fourth, policymakers should support, and stakeholders should expand, efforts to educate people with disabilities about the cost savings and income-generating opportunities enabled by broadband. As described in Section 3 and in Section 5.3, broadband has the potential to facilitate a diverse array of cost savings, ranging from more affordable healthcare solutions (e.g., better prices on prescription drugs) to discount shopping. In addition, broadband provides opportunities to telecommute or launch a small business from home, each of which generates income. The money earned or saved via broadband each month could be used to pay for the physical connection and any assistive technologies that might be needed. However, these efforts will only be successful if the additional educational efforts described throughout Section 5 are effective and amply supported.

5.5 RECOMMENDATION #5

Low computer ownership rates and lack of awareness regarding assistive technologies that enable broadband usage by people with disabilities should be addressed in ways similar to those that seek to stimulate demand for and adoption of broadband.

A little more than half of people with disabilities have a computer at home.[257] While this represents a significant increase from the 24 percent reported in 2000,[258] the number is still below the rate among people without disabilities. Moreover, computers are sometimes inaccessible to people with certain types of disabilities, requiring the identification and purchase of additional hardware (e.g., a certain type of mouse or keyboard) and software (e.g., a screen-reader program). People with disabilities who are unfamiliar with these types of assistive technologies might be overwhelmed by the vast number of products available. In addition, price and a general skepticism of computers and the Internet may blunt the desire to fully explore broadband connectivity (see Section 5.4). Policymakers have a number of tools available to them to spur computer ownership and the use of assistive technologies among people with disabilities.

An array of nonprofits has successfully boosted computer ownership and overall technological awareness among the lower-income demographic, senior citizens, and other underserved communities. For example, computer recycling programs like Per Scholas (www.perscholas.org), which operates in New York City and Miami,[259] are effective in refurbishing used computers and making them available to seniors and low-income consumers at discounted prices. In addition, Per Scholas has teamed with Older Adults Technology Services (www.oatsny.org) in New York City to provide seniors with a free computer, installation, and a lifetime warranty upon completion of a training class on how to use the computer and the Internet.[260] One Economy (www.one-economy.com) has also been effective in spurring computer ownership and broadband use among lower-income individuals by providing training and information regarding the personal and economic gains enabled by the technology. It has developed programs like the Digital Inclusion initiative and trained volunteers via its Digital Connectors program to connect the unconnected.[261] These and other models could be adapted and applied to people with disabilities by, among other things, applying for funding via the stimulus package (see Section 5.2).

Funding is also available in the broadband stimulus package for the expansion and modernization of computer centers across the country. Indeed, the $200 million in available funding will help to increase the supply of computers in community centers, libraries, community colleges, and other public places.[262] As previously discussed, increased computer access, coupled with effective training, has succeeded in spurring broadband adoption and use.

With regard to assistive technologies, awareness of the availability of these tools is crucial. As recently as 2001, approximately 60 percent of people with disabilities reported having received little or no information on how to obtain or use assistive technology services.[263] However, over the past several years, a number of organizations have succeeded in raising awareness and adoption. Closing the Gap (www.closingthegap.com), via its online portal and print publication, "highlights

hardware and software products appropriate for people with [disabilities], and explains how this technology is being implemented in education, rehabilitation, and vocational settings around the world."[264] Another model is one developed by the Northern Virginia Research Center ("NVRC") (www.nvrc.org), which provides training and information regarding a wide array of technologies to people with hearing disabilities. In particular, NVRC uses its Assistive Technology Demonstration Center to "demonstrate equipment that will improve communication and accessibility, and assist those who want to know how to work more effectively with deaf or hard of hearing staff, coworkers, visitors, clients, students, and colleagues."[265] Additional organizations, like Assistive Technologies (www.assistivetechnologies.com), use the Internet, print publications, and other media to raise awareness and assuage any fears or doubts of using these technologies among people with disabilities. These efforts, coupled with tax credits that drive the cost of these devices down, could greatly spur the use of ATs generally and the use of computer-related ATs specifically.

These types of grassroots efforts have been effective in spurring computer ownership and the use of assistive technologies among people with disabilities and should continue to be supported by the public sector. Stimulus funding is available to support the deployment of additional computers to public institutions like libraries and to enhance the efforts of organizations that train people with disabilities to effectively use a broadband connection. Tax credits and other novel approaches are available to help bring down the total cost of broadband use. In sum, these various efforts can be effective in spurring demand and adoption of broadband amongst people with disabilities.

5.6 RECOMMENDATION #6

Stakeholders should consider an array of tools and approaches to address issues related to the accessibility of new technologies and services.

In the advanced communications arena, technological innovation and market forces generally move faster than policymaking. As a result, policies intended to address a particular issue oftentimes become outdated or redundant soon after they are implemented. In the context of the broadband market, the pace of innovation is swift and has proven to be responsive to changes in consumer preferences and tastes due to high levels of competition in many segments of the market. Intermodal competition and technological convergence create incentives for providers to carefully tailor their offerings and to address consumer complaints more effectively than their competitors.[266]

In the disabilities context, a growing number of network owners, hardware developers, and content providers are responding to demand for more accessible technologies by adopting universal design principles and pledging to make available more accessible products (see Section 4.2). However, technological innovation continues to be challenged by existing legal frameworks. Indeed, some existing policies do not provide disabled users with ample incentives to adopt and use new technologies since these innovations may be beyond the scope of established laws. An example is instructive.

The iPhone supports text-to-speech applications that are increasingly popular among people with speech impairments. In particular, many find the iPhone to be much more portable and affordable and less ponderous than many existing standalone text-to-speech devices.[267] However, despite this preference among disabled users, insurance companies and plans (e.g., Medicare) do not cover these devices. The reason cited for this lack of coverage is that the iPhone is not a medical device and can be used for a number of non-medical purposes.[268] As a result, many people with speech impairments have to "spend 10 to 20 times as much for dedicated, proprietary [text-to-speech] devices that can do far less."[269]

Insurance laws have generally been slow to recognize the impact of new technologies like broadband and smartphones on healthcare. Many agree that these laws need to be updated to reimburse for the use of efficient and effective new technologies.[270] With regard to accessibility laws, however, there is much disagreement over whether similar legislative change is required given the rapid pace of innovation and the market dynamics that are pushing innovators to build accessibility into new products.

Some have called for the adoption of formal legislation to accelerate the development of accessible products and services. To this end, a bill was introduced in Congress in 2009 that seeks to update a variety of laws related to accessibility.[271] Others have called for a more markets-based approach that allows service providers to address accessibility issues on their own. For example, in its report to the Access Board, TEITAC observed that "The pace of technological advancement in [information and communication technology] is rapid and the level of innovation is high. In this environment, a static standard consisting of design specification and fixed checklists would tend to stifle innovation and to delay the availability of technology advancements to people with disabilities."[272] In light of the uncertainty regarding the need for legislative change, policymakers should adhere to the following set of foundational principles as they consider new legislation. These principles outline a multifaceted strategy for enhancing accessibility and ensuring that all users are able to use new technologies and services. In particular, this approach calls on policymakers to:

Enforce existing accessibility laws. There is currently a wide variety of federal and state laws that require communications companies to make their services and content accessible. For example, Section 255 of the Communications Act requires

"telecommunications providers and manufacturers to make their services and equipment accessible to and usable by people with disabilities if readily achievable."[273] Further, the 1996 Telecommunications Act called on the FCC to develop a number of accessibility policies. For example, Section 710 of the Communications Act charged the FCC with implementing policies to "ensure reasonable access to telephone service by persons with impaired hearing."[274] Over the past several years, as wireless telephony has emerged as a substitute for traditional telephone service, the FCC has revisited its rules regarding hearing aid compatibility and "set benchmark dates by which digital wireless handset manufacturers and service providers had to gradually increase the number of hearing aid-compatible digital wireless phones available to consumers."[275] In response, the industry has developed and made available a number of phones that are interoperable with hearing aids.[276] The set of existing laws help provide an effective counterbalance against companies that do not provide adequately accessible products and services.

Undertake a careful cost-benefit analysis of new mandates. When analyzing the potential effectiveness of new legislation, policymakers should consider whether new mandates will increase compliance costs for providers and end-users. Moreover, policymakers should assess, to the extent possible, whether a new mandate would accelerate accessibility relative to the organic efforts of industry stakeholders. Given the increasing demand for broadband and broadband-enabled services among people with disabilities, network owners, equipment manufacturers, and content providers will likely continue to tailor their offerings to this large pool of potential customers.

Encourage continued cooperation and collaboration among industry stakeholders, disability advocates, and disabled users, and include these groups in the policymaking process. The National Council on Disability[277] has called on Congress to create a "national panel, with representatives drawn from government, industry, and the disability community, tasked with identifying and recommending specific measures to overcome barriers" for people with disabilities vis-à-vis new communications technologies.[278] Such a panel would be a natural extension of existing collaborations among industry stakeholders, disability advocates, and users (see Section 4.2.1), and would provide policymakers with a wealth of information regarding innovative approaches to enhancing accessibility. Collaboration and consultation will be essential to crafting an effective approach to these issues and one that is inclusive of the diverse interests of each stakeholder.

Support educational efforts to raise awareness of accessibility issues and solutions among people with disabilities. As previously discussed, many people with disabilities remain unaware of the availability of tools, ATs, and training programs that are designed to increase the accessibility of broadband-related technologies. As a result, education campaigns that are national in scale may help to raise awareness regarding the accessibility issues and solutions. A number of proposals have been offered,

including the creation of a national "clearinghouse of information on the availability of accessible products and services and accessibility solutions required under sections 255 [of the Communications Act]"[279] and a national "informational and educational program designed to inform the public about the availability of the clearinghouse, and the protections and remedies available under [current law]."[280] These and other campaigns could supplement the effective grassroots training programs described above.

Foster an environment that is conducive to continued experimentation and innovation. As previously discussed, a growing number of service providers are focused on offering more accessible products to consumers. An increase in the supply of such products should spur demand for related services, thus putting market pressure on providers to deliver more accessible products. In addition, policymakers should experiment with incentives to spur these efforts along. To this end, NCD has endorsed an approach for "economically rewarding service providers, software developers, and equipment manufacturers who incorporate accessibility into their products and services through adherence to principles of universal design and through support for interoperability of AT."[281]

Capitalize on the scope of accessibility solutions. While many service providers are building accessibility directly into new products, third-party hardware and software developers are playing a key role in enhancing accessibility. Assistive technologies like screen-readers and various navigation tools have made most computers and devices accessible to people with disabilities. Similarly, software plays a critical role in enhancing the accessibility of online content. For example, as previously discussed, YouTube currently allows its users to provide captions for its millions of videos.

In addition, many companies allow developers to create add-on applications that enhance the value, utility, and accessibility of products. Perhaps the most innovative example of this is the iPhone "App Store," which makes available third-party applications that cater to a variety of interests and needs. In the disability context, a range of applications have been developed for use by people with disabilities. For example, one application allows people who have difficulty communicating verbally – e.g., people with autism, Down syndrome, etc. – to download a "talker" application that lets them push buttons that voice basic phrases and requests.[282] Another cutting-edge application for people with disabilities is offered on cellphones that contain the Android operating system (e.g., T-Mobile's G1 and myTouch phones). The vOICe application uses the phone's camera to take snapshots of a blind user's surroundings and translates those images into text.[283] This application also includes a talking compass to help in navigation and a "talking locator that speaks street names and intersections in [the] immediate vicinity as determined from GPS satellites or local cell towers, for increased location awareness."[284]

The modularity of new devices and services allows for accessibility solutions to be added onto a range of products. Continued convergence around the Internet Protocol, which uses a broadband connection for the fast delivery of IP content, will facilitate the continued development of these types of innovative accessibility solutions. As such, policymakers should appreciate the value of these business models in providing alternative solutions for enhancing accessibility and should craft policies that foster an environment that is conducive to continued experimentation and risk-taking by service providers, content developers, and other innovators.

* * * * *

In view of this multifaceted strategy and its demonstrated viability, it is incumbent upon policymakers to take a comprehensive approach to accessibility issues. In particular, policymakers should rely on the knowledge of innovators, industry stakeholders, disability advocates, and disabled users when crafting new policies. Policies that reflect the expertise of user groups and service providers, along with a general regulatory approach that provides innovators with continued freedom to experiment, are likely to be effective in enhancing accessibility.

5.7 RECOMMENDATION #7

Going forward, policymakers should bolster the current pro-investment and pro-competition regulatory framework in order to encourage further innovations and deployments that benefit people with disabilities.

In addition to policies that promote continued network deployment and further development of accessible innovations for people with disabilities, policymakers must also carefully develop policies that may directly or indirectly impact the various segments of the broadband market, including application development, network deployment, and adoption.

As described throughout this paper, people with disabilities are increasingly using broadband to access useful content, to stay in touch with family and friends, to participate in their communities, to work, to start businesses, and to stay healthy. As the number of people with disabilities who use broadband increases, so too will the number and type of broadband-enabled applications and services designed to enhance their lives. Demand for broadband and broadband-enabled services and applications will drive innovation at the edge of the network and within the network (see Section 4). As a result, policymakers should continue adhering to the pro-competition framework that has facilitated the development of a vibrant marketplace in order to assure continued innovation and investment across the sector.

The current regulatory framework includes a variety of policies that seek to provide all market participants with certainty that the government will not intervene in the market except under very limited circumstances. For example, the majority of the stimulus funds earmarked for broadband seeks to provide assistance for network deployment to those unserved parts of the country where a market failure has resulted in the unavailability of broadband.[285] In the wireless context, a national regulatory framework has provided competitors with ample certainty and latitude to innovate, deploy new networks, and provide consumers with a vibrant array of new handsets and services.[286] By classifying broadband as an "information service," the FCC has taken a decidedly minimalist regulatory approach to the growing variety of platforms that deliver broadband. There are some who advocate for a more assertive and intrusive regulatory approach,[287] but the successes of the current framework are clearly evident. Even though there are areas of the country that lack sufficient broadband access, and even though there are segments of the population (e.g., senior citizens, people with disabilities) that have low adoption rates relative to the general population, the organic efforts described throughout this paper support the notion that the current framework is sufficient to spur further innovation, investment, and competition. As such, policymakers must carefully balance the costs of reforming the current regulatory approach against the many benefits that continue to flow because of it.[288]

6. CONCLUSION

Broadband is impacting the lives of people with disabilities in a variety of ways. This interactive technology facilitates convenient and affordable communication, enhances employment opportunities, and provides life-enhancing health and medical information and services. Each of these benefits produces important welfare gains for people with disabilities and the general population. In the aggregate, these individual gains create the potential for the emergence of a large new class of active online users with ample spending power and the capacity to generate innovative ideas for new services, applications, and businesses. Indeed, a recent study by LECG estimates that the "addition of ten more broadband lines per 100 individuals across the U.S. (30 million new broadband lines) would raise U.S. GDP by over $110 billion."[289] Thus, it is essential that more people with disabilities subscribe to and use broadband in order to enable these economy-wide gains and to ensure that this segment of the population is able to enjoy the many other benefits facilitated by a broadband connection.

While this report has identified a number of obstacles that may slow adoption of broadband among people with disabilities – including lack of a home computer, affordability of broadband access and required ATs to make use of the connection, and negative perceptions associated with the accessibility and utility of broadband – those who are already online are avid and skillful users who have largely succeeded in using

their connections to enhance their lives. Going forward, it will be necessary to increase awareness of broadband by promoting the utility and value of a connection and to ensure that new users receive proper training on how to use this technology. To this end, one recent study that measured the positive impacts of broadband on economic development conditioned its estimates on "useful connectivity," which depends "not just on the number of people connected to a network or infrastructure, but how well those connected people utilize the network or infrastructure."[290]

Deployment and availability of broadband across the United States are only the first steps in realizing the vast economic and social potential of broadband. This report has offered policymakers a number of recommendations for the development and implementation of policies that will increase broadband adoption among people with disabilities and, more importantly, ensure that this segment is able to effectively use this technology. Focusing solely on network deployment raises the risk that an entire segment of users will be unable to participate fully in the global digital marketplace. As such, a more comprehensive approach to broadband, one that focuses on each aspect of use (availability, awareness, demand, adoption, etc.) and that is amply supported by an array of public and private sector efforts, is the only way to ensure that all users, particularly those people with disabilities who remain offline, appreciate the benefits of broadband and recognize the real value of incorporating it into their lives.

ENDNOTES

[1] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Senior Citizens*, U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.uschamber.com/NR/rdonlyres/edp7qgdm6hxo6d7jm365ckwgynjgkihfk27obqr5csczpf3sgmd6vy2xut45vdljkdoz62wa7y55awtolulbkqr57ih/BroadbandandSeniors.pdf ("*Broadband & Seniors*").

[2] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Telemedicine*, U.S. Chamber of Commerce (April 2009), *available at* http://www.uschamber.com/NR/rdonlyres/ec5epgwk7vyanosellij36hyzht3udur5ceemxscfgfayigcrkyfuntto6adiwt7s2rw2g73epqddifjvykf7n6pj6h/BroadbandandTelemedicineApril2009.pdf ("*Broadband & Telemedicine*").

[3] For example, one recent study estimates that telecommuting could save consumers $228 billion and business $260 billion due to, among other things, a decrease in transaction costs and an increase in employee productivity. *See* Jesse Masai, *Widespread Telecommuting Could Save Consumers $228 billion, Businesses $260 Billion*, March 13, 2009, BroadbandCensus.com, *available at* http://broadbandcensus.com/blog/2009/03/widespread-telecommuting-could-save-consumers-228-billion-businesses-260-billion/ ("*Telecommuting Study*").

[4] 42 U.S.C. § 12102 (2) (a)–(c).

[5] The ADAAA reverses two Supreme Court cases – *Toyota Motor Manufacturing, Kentucky, Inc. v. Williams*, 534 U.S. 184 (2002) and *Sutton v. United Airlines, Inc.*, 527 U.S. 471 (1999) – and reflects an intent by Congress to broaden the Supreme Court's interpretation of the ADA and its definition of "disabled." *See* Renee Cullota, *ADA Amendments Act take effect January 1, 2009*, FRILO LLC, *available at* http://www.frilot.com/PDF/ADA%20Amendment%20Act2%20-%20Renee%20Culotta.pdf.

[6] *See* Suzanne Robitaille, *For the Disabled, More Power for Play*, TOP TECH NEWS, Dec. 26, 2008, *available at* http://www.toptechnews.com/story.xhtml?story_id=63727&loc=interstitialskip.

[7] *See, e.g., 2007 Disability Status Report – United States*, at p. 44, Rehabilitation Research and Training Center on Disability Demographics and Statistics, Cornell University, *available at* http://www.ilr.cornell.edu/edi/disabilitystatistics/StatusReports/2007-PDF/2007-StatusReport_US.pdf?CFID=7676403&CFTOKEN=73912389&jsessionid=f030ad698d2ccb1a9bcc34517277762361b1 ("The ACS definition of disability is based on three questions. (1) Does this person have any of the following long-lasting conditions: (a) blindness, deafness, or a severe vision or hearing impairment? [Sensory Disability]; (b) a condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying? [Physical Disability] (2) Because of a physical, mental, or emotional condition lasting six months or more, does this person have any difficulty in doing any of the following activities: (a) learning, remembering, or concentrating? [Mental Disability]; (b) dressing, bathing, or getting around inside the home? [Self-Care Disability] (3) Because of a physical, mental, or emotional condition lasting six months or more, does this person have any difficulty in doing any of the following activities [asked of persons ages 16 and older]: (a) going outside the home alone to shop or visit a doctor's office? [Go-Outside-Home Disability]; (b) working at a job or business? [Employment Disability]. A person is coded as having a disability if he or she or a proxy respondent answers affirmatively for one or more of these six categories.") ("*2007 Disability Status Report*").

[8] The exact number of Americans with disabilities is difficult to gauge, with current estimates varying from 40 million to 50 million. For example, the Rehabilitation Research and Training Center on Disability Demographics and Statistics at Cornell University, which employs a rather inclusive definition of "disability" reports that there are over 40 million people with disabilities in the U.S. over the age of 5. *2007 Disability Status Report.* The U.S. Census Bureau, however, reported in May 2007 that the number stood at over 50 million. *See* Press Release, *Americans with Disabilities: July 26*, May29, 2007, U.S. Census

Bureau, *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/010102.html ("*2007 Census Stats*").

[9] *See High-Speed Services for Internet Access: Status as of June 30, 2008,* FCC Wireline Competition Bureau Report (July 2009), Table 1, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf ("*FCC Broadband Stats - July 2009*").

[10] *See High-Speed Services for Internet Access: Status as of December 31, 2006,* FCC Wireline Competition Bureau Report (Oct. 2007), Table 10, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-277784A1.pdf.

[11] *FCC Broadband Stats - July 2009* at Table 7.

[12] Pew reports that average broadband prices increased from 2008 to 2009, but have remained flat for the last five years. In addition, broadband prices tend to decrease in areas where there are multiple providers. *See* John Horrigan, *Home Broadband Adoption 2009*, Pew Internet & American Life Project, at p. 25-27 (June 2009), *available at* http://www.pewinternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf ("*Home Broadband Adoption 2009*").

[13] *Broadband & Seniors*, section 2.

[14] *2007 Census Stats.*

[15] *See* Matthew Brault, *Disability Status and the Characteristics of People in Group Quarters: A Brief Analysis of Disability Prevalence Among the Civilian Noninstitutionalized and Total Populations in the American Community Survey*, U.S. Census Bureau, American Community Survey, 2006 Data (Feb. 2008), *available at* http://www.census.gov/hhes/www/disability/GQdisability.pdf ("*Census ACS 2008*").

[16] *Id.*

[17] *See* U.S. Dept. of Education: National Center for Education Statistics, Question: How many students with disabilities receive services? http://nces.ed.gov/fastfacts/display.asp?id=64.

[18] *2007 Disability Status Report* at p. 16.

[19] According to the ACS, a physical disability is defined as condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying." *Id.* at p. 44.

[20] According to the ACS, a sensory disability is defined as someone who experiences "blindness, deafness, or a severe vision or hearing impairment." *Id.*

[21] *Id.* at p. 7.

[22] *See* National Spinal Cord Injury Statistical Center, University of Alabama, Facts and Figures at a Glance (April 2009), http://images.main.uab.edu/spinalcord/pdffiles/FactsApr09.pdf ("*Spinal Cord Stats*").

[23] *See* National Center for Health Statistics, Disabilities/Limitations, http://www.cdc.gov/nchs/FASTATS/disable.htm.

[24] *Id.*

[25] *See Special Report on Aging and Vision Loss*, American Foundation for the Blind ("AFB"), Sept. 2008, *available at* http://www.afb.org/Section.asp?SectionID=15&DocumentID=4423 ("vision loss" includes "individuals who reported that they have trouble seeing, even when wearing glasses or contact lenses, as well as to individuals who reported that they are blind or unable to see at all") ("*Special Report on Aging and Vision Loss*").

[26] *See* National Center for Health Statistics, National Health Interview Survey 2008, www.cdc.gov/nchs/nhis.htm (the AFB definition of "vision loss" is the equivalent of the term "vision trouble" used in the National Health Interview Surveys, *Special Report on Aging and Vision Loss*).

[27] *See Health Status and Routine Physical Activities in Adults by Hearing Status*, Center of Disease Control, *available at* http://www.cdc.gov/Features/dsHearing-Disparities.

[28] The Coleman Institute for Cognitive Disabilities at the University of Colorado defines a cognitive disability as "a substantial limitation in one's capacity to think, including conceptualizing, planning, and sequencing thoughts and actions, remembering, interpreting subtle social clues, and understanding numbers and symbols. Cognitive disabilities include intellectual disabilities and can also stem from brain injury, Alzheimer's disease and other dementias, severe and persistent mental illness, and, in some cases, stroke." *See* David Braddock et al., *Emerging Technologies and Cognitive Disabilities*, at p. 1, J. SPECIAL EDUCATION TECH., Vol. 19, No. 4 (Fall 2004), *available at* http://www.colemaninstitute.org/article_braddock_1.pdf ("*Emerging Technologies & Cognitive Disabilities*").

[29] *Id.*

[30] Percentages are derived from using 2004 U.S. Census Bureau Data. *See* National Institute of Mental Health Website, *available at* http://www.nimh.nih.gov/health/statistics/index.shtml.

[31] *See* Alzheimer's Association, Facts & Figures, http://www.alz.org/alzheimers_disease_facts_figures.asp.

[32] *See* CerebralPalsy.org, The State of Cerebral Palsy – Facts and Figures, http://www.cerebralpalsy.org/what-is-cerebral-palsy/statistics (citing data from United Cerebral Palsy).

[33] *See* Community Partnerships for Adult Learning, *How Serious *are* Learning Disabilities? – How bad can it be?* Basics of Adult Literacy Eduction Module, *available at* http://www.c-pal.net/course/module1/pdf/LDstats.pdf (*citing* statistics from the National Institute for Literacy, http://www.nifl.gov/).

[34] *See* National Information Center for Children and Youth with Disabilities, *available at* http://www.nichcy.org/pubs/factshe/fs7txt.htm, *citing* 23rd Annual Report to Congress, Department of Education (2001).

[35] *See Criteria for Determining Disability in Speech-Language Disorders*, Agency for Healthcare Research and Quality ("AHRQ") Summary, Evidence Report/Technology Assessment, No. 52, AHRQ Publication No. 02-E009 (Jan. 2002), *available at* http://www.ahrq.gov/clinic/epcsums/spdissum.htm.

[36] *See* Autism Society of America, About Autism, http://www.autism-society.org/site/PageServer?pagename=about_home.

[37] *See* Press Release, *Oldest Baby Boomers Turn 60*, U.S. Census Bureau (rel. Jan. 3, 2006), *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/006105.html.

[38] *See* Jeffrey S. Passel and D'Vera Cohn, *U.S. Population Projections: 2005-2050*, at p. 20, Pew Research Center (Feb. 2008), *available at* http://pewhispanic.org/files/reports/85.pdf.

[39] According to the 2007 Disability Status Report issued by Cornell University's Rehabilitation Research and Training Center on Disability Demographics and Statistics, the total number of people over 65 with a disability is 14,730,000 while the total number of people over age 5 with disabilities is 41,306,000. *2007 Disability Status Report*.

[40] *See* Hearing Loss Association of America, Hearing Loss Stats for Adults, http://www.hearingloss.org/learn/factsheets.asp.

[41] Technology Related Assistance for Individuals with Disabilities Act of 1998, Pub. L. 100-407.

[42] *See generally* Frank G. Bowe, *Broadband and Americans with Disabilities*, Report of the National Association of the Deaf and the New Millennium Research Council (2002), *available at* http://www.newmillenniumresearch.org/archive/disability.pdf ("*Broadband & Disabilities - 2002*"); *see also* Albert M. Cook, *Future Directions in Assistive Technologies* in Assistive Technology: Matching Device and Consumer for Successful Rehabilitation 271-271 (Marcia J. Scherer, ed.) (2002) (discussing the role and impact of computers and the Internet on assistive technologies generally) ("*Future Assistive Technologies*").

[43] It is estimated that companies will have invested upwards of $60 billion in communications infrastructure in 2008. *See Statement of Jonathan Banks to the Subcommittee on Telecommunications and the Internet, Committee on Energy and Commerce, U.S. House of Representatives*, p. 2, July 22, 2008, *available at* http://energycommerce.house.gov/images/stories/Documents/Hearings/PDF/Testimony/TI/110-ti-hrg.072208.Banks-testimony.pdf (quoting a projection made by the Yankee Group).

[44] *FCC Broadband Stats – July 2009* at Table 18 (ranking high-speed subscribership by population density).

[45] *See* Diana Spas, *Update on the Demography of Rural Disability, Part One: Rural and Urban*, April 2005, Research and Training Center on Disability in Rural Communities, The University of Montana Rural Institute, *available at* http://rtc.ruralinstitute.umt.edu/RuDis/RuDemography.htm.

[46] *See* USDA Economic Research Service, Briefing, *Rural Population and Migration: Trend 6—Challenges From an Aging Population*, *available at* http://www.ers.usda.gov/Briefing/Population/Challenges.htm.

[47] The 2009 American Recovery and Reinvestment Act "("ARRA") creates a new Broadband Technology Opportunities Program within the National Telecommunications and Information Administration ("NTIA") of the Department of Commerce. The new grant program will distribute $4.7 billion to fund the deployment of broadband infrastructure in unserved and underseved areas in the country, and to help facilitate broadband use and adoption. An additional $2.5 billion in loans and grants will be administered by the Rural Utilities Service." *See Bill Summary: Energy and Commerce Provisions on Healthcare, Broadband and Energy,* U.S. House of Representatives Committee on Commerce, Feb. 12, 2009, *available at* http://energycommerce.house.gov/Press_111/20090212/economiceecoverysummary.pdf ("*ARRA Summary*").

[48] *See* Michael J. Copps, *Bringing Broadband to Rural America: Report on a Rural Broadband Strategy*, FCC (rel. May 22, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291012A1.pdf.

[49] The amount of unserved areas continues to decrease each year. According to the National Telecommunications Cooperative Association's 2008 Annual Broadband/Internet Availability Survey Report, 91 percent of customers in its 2008 Survey area had access to broadband, *NTCA 2008 Broadband/Internet Availability Survey Report*, p. 8, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2008ntcabroadbandsurveyreport.pdf.

[50] *See NTCA 2007 Broadband/Internet Availability Survey Report*, p. 7, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2007ntcabroadbandsurveyreport.pdf.

[51] *See* David P. McLure, *Deployment of Broadband to Rural America,* at p. 5, USIIA Report (rel. Mar. 4, 2008), *available at* http://www.usiia.org/pubs/Rural.pdf.

[52] *Home Broadband Adoption 2009* at p. 8.

[53] *Id.* at p. 7.

[54] *See* John Horrigan, *Obama's Online Opportunity II: If You Build It, Will They Log On*, p. 2, Pew Internet & American Life Project (Jan. 2009), *available at* http://www.pewinternet.org/pdfs/PIP_Broadband%20Barriers.pdf ("*If You Build It*").

[55] *Home Broadband Adoption 2009* at p. 7.

[56] *See, e.g., The Economic Impact of Stimulating Broadband Nationally*, at p. 16, A Report from Connected Nation (rel. Feb. 21, 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf ("*Connected Nation Report*").

[57] *Id.*

[58] *See The State of Connectivity*: *Building Innovation Through Broadband*, at p. 65-66, Final Report of the California Broadband Taskforce (rel. Jan. 2008), *available at* http://www.calink.ca.gov/pdf/CBTF_FINAL_Report.pdf ("*California Broadband Task Force Report*").

[59] *FCC Broadband Stats - July 2009* at Table 10 (providing data on the number of broadband subscribers in each state for the years 2003-2008).

[60] *See, e.g., Broadband in America: Access, Use and Outlooks*, Consumer Electronics Association, at 6, July 2007, *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf (finding that half of the U.S. households without broadband lack a computer. The other half has not adopted broadband for a wide variety of reasons.).

[61] *See* H. Stephen Kaye, *Computer and Internet Use Among People with Disabilities*, at p. 5, National Institute on Disability and Rehabilitation Research, U.S. Department of Education (Mar. 2000), *available at* http://dsc.ucsf.edu/pdf/report13.pdf ("*Computer & Internet Use – 2000*").

[62] *See* Kerry Dobransky & Eszter Hargittai, *The Disability Divide in Internet Access and Use*, at p. 322, INFORMATION, COMMUNICATION & SOCIETY, Vol. 9, No. 3, pp. 313-334 (June 2006) ("*The Disability Divide*").

[63] *See Consumer Insights to America's Broadband Challenge*, at p. 5, Connected Nation, *available at* www.nga.org/Files/pdf/0812broadbandchallenge.pdf ("*Consumer Insights*").

[64] *The Disability Divide* at p. 321.

[65] *See* Jenifer Simpson*, Comments of the Coalition of Organizations for Accessible Technology*, *In the Matter of A National Broadband Plan for Our Future*, GN Docket No. 09-51, COAT &American Association of People with Disabilities, June 8, 2009, at p. 8-9 ("*National Broadband Plan*").

[66] *Id*.

[67] *Id*.

[68] *Connected Nation Report; see also Broadband & Seniors* at p. 10-11 (discussing a unique program for spurring demand for and use of computers and broadband among senior citizens).

[69] *The Disability Divide* at p. 325.

[70] *Id.*

[71] In 2007, the percentage of working-age people with disabilities working full-time year-round was 21.2 percent. *2007 Disability Status Report* at p. 3.

[72] *See* John Horrigan et al., *The Ever-Shifting Internet Population: A New Look at Internet Access & the Digital Divide*, at p. 31, Pew Internet & American Life Project (April 2003), *available at* www.pewinternet.org/pdfs/PIP_Shifting_Net_Pop_Report.pdf.

[73] *See, e.g.,* Beth A. Loy, *Deciphering Access for People with Disabilities*, Oct. 1, 2001, Digital Divide Network, *available at* http://www.digitaldivide.net/articles/view.php?ArticleID=204.

[74] *Broadband & Disabilities – 2002* at p. 20.

[75] Please note that the categories and ATs used in this chart are illustrative and not meant to suggest that certain ATs are more useful to or meant only for certain types of disabilities. On the contrary, most ATs are of use to people with a range of disabilities. For example, quadriplegic users often use voice recognition software to navigate web pages and to produce text.

[76] *See* APT, Broadband Changed my Life!, http://www.apt.org/BB-changed-my-life/.

[77] *See* W3C, Web Content Accessibility Guidelines 2.0, http://www.w3.org/TR/WCAG20/#guidelines ("*W3C WCAG 2.0 Guidelines*").

[78] *Home Broadband Adoption 2009* at p. 9-10.

[79] *Consumer Insights* at p. 5.

[80] *Home Broadband Adoption 2009* at p. 25-27.

[81] *2007 Disability Status Report* at p. 30.

[82] *Id.* at p. 34.

[83] *See* Erik Eckholm, *Last Year's Poverty Rate Was Highest in 12 Years*, Sept. 11, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/09/11/us/11poverty.html ("*Last Year's Poverty Rate*").

[84] In 2007, the percentage of working-age people with disabilities that were employed full-time was 21.2 percent, compared to nearly 57 percent for people without disabilities. *Id.* at p. 28.

[85] *See, e.g.,* Web Accessibility in Mind (WebAIM), Assistive Technologies for Motor Disabilities, http://www.webaim.org/articles/motor/assistive.php; WebAIM, Introduction to Web Accessibility, http://www.webaim.org/intro.

[86] A recent survey by WebAIM found that 74 percent of respondents used the JAWS screen reader. Of the respondents, over 85 percent were blind or visually impaired. *See* WebAIM, Survey of Preferences of Screen Reader Users (Jan. 2009), http://webaim.org/projects/screenreadersurvey/.

[87] *See* Freedom Scientific, JAWS for Windows Screen Reader Software, http://www.freedomscientific.com/products/fs/jaws-product-page.asp.

[88] *Emerging Technologies & Cognitive Disabilities* at p. 4.

[89] *W3C WCAG 2.0 Guidelines*.

[90] *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Barriers to Broadband Adoption*, p. 25-26, A Report to the Federal Communications Commission (Oct. 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/ACLP%20Report%20to%20the%20FCC%20-%20Barriers%20to%20BB%20Adoption.pdf (observing that "Lack of exposure to broadband, along with a number of other factors, contributes to a general perception among many people with disabilities that broadband and broadband-enabled technologies are inaccessible") ("*Barriers to Broadband Adoption*").

[91] *The Disability Divide* at p. 327.

[92] *Broadband and People with Disabilities – 2002* at p. 20.

[93] *See, e.g.,* Jack Gillum, *A Third of Adults Without Internet Don't Want It*, Feb. 3, 2009, *available at* http://www.usatoday.com/printedition/life/20090203/internetusage03_st.art.htm (noting that "A report last month by the Pew Internet & American Life Project finds that although price is a barrier for

dial-up users in switching to broadband, one-third of those without a Net connection simply aren't interested in e-mailing or exploring the Web.")

[94] *Connected Nation Report* at pp. 8-9.

[95] *Computer & Internet Use – 2000* at p. 11.

[96] *The Disability Divide* at p. 328.

[97] *See* Susannah Fox, *E-patients With a Disability or Chronic Disease*, at p. 3, Pew Internet & American Life Project (Oct. 2007), *available at* http://www.pewinternet.org/pdfs/EPatients_Chronic_Conditions_2007.pdf ("*E-Patients*").

[98] *See* Wireless RERC, Background: Addressing a Significant Need, http://www.wirelessrerc.org/about-us/background-addressing-a-significant-need.html ("*RERC Wireless Background*").

[99] *Id.*

[100] *See Second Report: Findings of the Survey of User Needs (SUN), 2007-2009,* at p. 5, Wireless RERC (March 2009), *available at* http://www.wirelessrerc.org/publications/SUN%20Second%20Findings%20Report_2009-03-25.doc.

[101] *Id.* at p. 9.

[102] *The Disability Divide* at p. 316.

[103] *E-Patients* at p. 3 (finding that 89 percent of people with disabilities and chronic diseases send and receive email); *see also The Disability Divide* at p. 328 (observing that in 2006 nearly 84 percent of people with disabilities used email or instant messaging services).

[104] *E-Patients* at p. 3 (observing that nearly 40 percent of people with disabilities and chronic diseases use their Internet connection to send instant messages.).

[105] *See, e.g.,* American Association of People with Disabilities, Summary Fact Sheet: High Speed Internet and People with Disabilities, www.aapd.com/TTPI/AAPD_CWA_High_Speed_Internet_Access_WORD.doc ("*High Speed Fact Sheet*").

[106] *See* National Institute on Deafness and Other Communication Disorders, Facts about TRS and National 711, http://www.nidcd.nih.gov/health/hearing/telecomm.asp.

[107] *See* Wikipedia: Telecommunications Relay Services, http://en.wikipedia.org/wiki/Telecommunications_Relay_Service.

[108] *See* Jonathan Blum, *Viable Helps Deaf Callers Connect,* Sept. 15, 2008, CNN Money, *available at* http://money.cnn.com/2008/09/11/smallbusiness/helping_deaf_callers_connect.fsb/index.htm.

[109] *High Speed Fact Sheet.*

[110] *See* Facebook, Group: Special needs kids and the joy of raising them, http://www.facebook.com/topic.php?uid=2480416749&topic=4767#/group.php?gid=2480416749.

[111] *The Disability Divide* at p. 315.

[112] *Id.* at p. 328.

[113] *See Gaining Independence For People With Disabilities Through Video Games*, May 15, 2008, SCIENCEDAILY, *available at* www.sciencedaily.com /releases/2008/05/080513191103.htm.

[114] *Id.*

[115] Sources for Case Study 2 include: Quin Parker, *Second Life: Disability Charity Sets Up Virtual Advice Service*, June 10, 2008, THE GUARDIAN, *available at*

http://www.guardian.co.uk/society/2008/jun/10/secondlife.disability; Nicole Saidi, iReport: 'Naughty Auties' Battle Autism with Virtual Interaction, March 28, 2008, CNN, *available at* http://www.cnn.com/2008/HEALTH/conditions/03/28/sl.autism.irpt/index.html; Scarlett Qi, *Researhc on Asperger's Syndrome Done in Second Life Shows Early Promise*, Jan. 18, 2008, SLNN.Com, *available at* http://www.slnn.com/article/aspergers-syndrome-brigadoon; Jessica Bennett and Malcolm Beith, *Alternate Universe*, July 30, 2007, Newsweek, *available at* http://www.newsweek.com/id/32824/page/1; Tom Loftus, *Virtual World Teaches Real-World Skills*, Fed. 25, 2005, MSNBC, *available at* http://www.msnbc.msn.com/id/7012645/; Contact a Family, About Us, http://www.cafamily.org.uk/about.html.

[116] *See* Amanda Leinhart and Susannah Fox, *Bloggers*, at p. 1-3, Pew Internet & American Life Project (July 2006), *available at* http://www.pewinternet.org/pdfs/PIP%20Bloggers%20Report%20July%2019%202006.pdf (finding that 70 percent of bloggers have a broadband connection while 20 percent of bloggers use dial-up).

[117] *Id.* (finding that 54 percent of bloggers are between the ages of 18 and 29).

[118] *See* Disaboom, About Us, http://aboutus.disaboom.com/About-Us.aspx.

[119] *See* Sharon E. Gillett et al., *Measuring the Economic Impact of Broadband Deployment*, at p. 3-11 , Final Report, Prepared for the U.S. Department of Commerce, Economic Development Administration (Feb. 2006), *available at* http://www.eda.gov/ImageCache/EDAPublic/documents/pdfdocs2006/mitcmubbimpactreport_2epdf/v1/mitcmubbimpactreport.pdf.

[120] *See The Economic Impact of Stimulating Broadband Nationally*, at p. 5, A Report from Connected Nation (rel. Feb. 21, 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf ("*Connected Nation Report*").

[121] *See* Rob Atkinson, Daniel Castro & Stephen Ezell, *The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America*, at p. 1-2, Info. Tech. & Innovation Foundation (Jan. 2009), *available at* http://www.itif.org/files/roadtorecovery.pdf.

[122] *See* Barack Obama, Issues: Technology, http://www.barackobama.com/issues/technology/.

[123] *2007 Disability Status Report,* at p. 30.

[124] *Id.* at p. 32.

[125] *Id.* at p. 42.

[126] *See* Jessica Rothschuh, April KirkHart & Wendy Lazarus, *Helping our Children With Disabilities Succeed: What's Broadband Got To Do With It?*, at p. 5, Digital Opportunity for Youth Issue Brief, No. 2, The Children's Partnership (July 2007), *available at* http://www.childrenspartnership.org/AM/Template.cfm?Section=Home&Template=/CM/ContentDisplay.cfm&ContentFileID=2284 ("*Helping our Children*").

[127] *See* DO-IT, AccessCollege, http://www.washington.edu/doit/Resources/postsec.html.

[128] *See* DO-IT, Programs: Scholars, http://www.washington.edu/doit/Brochures/Programs/scholars.html.

[129] *Helping our Children* at p. 5.

[130] Telephone interview with ACLP staff; *see also Barriers to Broadband Adoption* at p. 24-25 (discussing the impact of lower levels of exposure to broadband on people with disabilities).

[131] *See* Robert Silverstein, George Julnes & Renee Nolan, *What Policymakers Need and Must Demand from Research Regarding the Employment Rate of Persons with Disabilities*, 23 Behav. Sci. Law 399, 413-414 (2005), *available at* http://www.disabilitypolicycenter.org/docs/BSL_v23_2005.pdf.

[132] *Disability Status Report* at p. 25.

[133] *Id.*

[134] *Spinal Cord Stats.*

[135] *See* Bureau of Labor Statistics (August-September 2009), *available at* http://www.bls.gov/cps/cpsdisability.htm.

[136] *See* YAI, About Us, http://www.yai.org/about.cfm.

[137] *See* Press Release, *Disaboom and JobCentral.com Partner to Improve Unemployment Rate Among People Living With Disabilities*, Jan. 14, 2008, JOB CENTRAL, *available at* http://www.jobcentral.com/2008_Disaboom_Partnership.asp.

[138] *Id.*

[139] *See* Carol Wilson, *Telecommuting Interest Soars*, Aug. 28, 2008, TELEPHONY ONLINE, *available* at http://telephonyonline.com/access/news/telecommuting-increases-0828/.

[140] *See* Eve Tahmincioglu, *The Quiet Revolution: Telecommuting*, Oct. 5, 2007, MSNBC, *available at* http://www.msnbc.msn.com/id/20281475/.

[141] *Id.*

[142] *Telecommuting Study.*

[143] *See* U.S. Dept. of Labor, Office of Disability Employment Policy, Small Business and Self Employment for People with Disabilities, http://www.dol.gov/odep/programs/promotin.htm,

[144] *See* Frank Bowe, *Universal Service and the Disability Community: The Need for Ubiquitous Broadband Deployment*, at p. 12, Benton Foundation (undated manuscript), *available at* http://www.benton.org/benton_files/Bowe.doc.

[145] *See* Press Release, *Quarterly Retail E-Commerce Sales: 1st Quarter 2009*, U.S. Census Bureau (rel. May 15, 2009), *available at* http://www.census.gov/mrts/www/data/html/09Q1.html (finding that "e-commerce sales in the first quarter of 2009 accounted for 3.5 percent of total sales," up from 3.3 percent in the first quarter of 2008).

[146] *See* John Horrigan, *Online Shopping*, at p. 2, Pew Internet & American Life Project (Feb. 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Online%20Shopping.pdf ("*Online Shopping*").

[147] *Id.* at p. 12.

[148] In 2006, blind users of the Target online retail store brought a class-action suit against the company for failing to make its website fully accessible to the blind. At issue was the inability of these users to effectively use screen-readers to navigate the site. *See, e.g.,* Bob Tedeschi, *Do the Rights of the Disabled Extend to the Blind on the Web?* Nov. 6, 2006, N.Y. TIMES, *available at* http://www.nytimes.com/2006/11/06/technology/06ecom.html?_r=1 ("*Blind on the Web*"). Target settled with the suit out of court in 2008. *See Target Settles Web Suit,* Aug. 27, 2008, ASSOC. .PRESS, *available at* http://www.nytimes.com/2008/08/28/business/28target.html?scp=1&sq=target%20blind%20settle&st=cse. Most other sites, like Amazon, are fully accessible, *Blind on the Web.*

[149] *See* Robert E. Litan, *Great Expectations: Potential Economic Benefits to the Nation From Accelerated Broadband Deployment to Older Americans and Americans with Disabilities*, New Millennium Research

Council (Dec. 2005), available at http://www.newmillenniumresearch.org/archive/Litan_FINAL_120805.pdf ("*Great Expectations*").

[150] *2007 Disability Status Report,* at p. 34.

[151] *See* Peiyun She & Gina A. Livermore, *Long-Term Poverty and Disability Among Working-Age Adults*, at p. 2, Research Brief, Cornell University Institute for Policy Research (June 2006), *available at* http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1224&context=edicollect.

[152] *The Disability Divide*, at p. 315.

[153] *Id*. at p. 328.

[154] *E-Patients* at p. 3.

[155] *See* Judith Cook et al., *Information Technology Attitudes Among Individuals with Psychiatric Disabilities who Use the Internet: Results of a Web-Based Survey*, Disabilities Studies Quarterly, Vol. 25, No. 2 (Spring 2005).

[156] *2007 Disability Status Report* at p. 16.

[157] *See* Susannah Fox, *Are Seniors Sitting Ducks?* at *p.*1, Pew Internet and American Life Project (April 2006), *available at* http://www.pewinternet.org/pdfs/PIP_Wired_Senior_2006_Memo.pdf.

[158] *See* Victoria Rideout et al., *e-Health and the Elderly: How Seniors Use the Internet for Health Information*, at p. 1, Kaiser Family Foundation (Jan. 2005), *available at* http://www.kff.org/entmedia/upload/e-Health-and-the-Elderly-How-Seniors-Use-the-Internet-for-Health-Information-Key-Findings-From-a-National-Survey-of-Older-Americans-Survey-Report.pdf.

[159] The use of email or other broadband-enabled communications services to interact with physicians is a very sparsely used method, but it is gaining in popularity. One government study found that in 2003, only 7 percent of Internet users had communicated online with a healthcare professional. That number rose to 10 percent by 2005. *See Online Patient-Provider Communication: Rare Despite Popularity of Internet and Email*, Health Information National Trends Survey ("HINTS"), HINTS Brief No. 8 (Nov. 2007), *available at* http://hints.cancer.gov/docs/HINTS_Briefs8-110607.pdf. In general, the use of broadband-enabled technologies among patients and healthcare providers is increasing. *Broadband & Telemedicine.*

[160] *See* Issue Paper, *Telemedicine, Telehealth, and Health Information Technology*, at p. 3, AMERICAN TELEMEDICINE ASSOCIATION (May 2006), *available at* http://www.americantelemed.org/files/public/policy/HIT_Paper.pdf ("*ATA HIT Paper*").

[161] *Id.*

[162] *Id.*

[163] *Broadband & Telemedicine*, at Section 3 (describing the various impacts of broadband on telemedicine).

[164] *See* Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Healthcare Facilities, *Report to Congress*, at p. 41 (rel. Feb., 2008), *available at* http://energycommerce.house.gov/Press_110/JAC.Report_FINAL%20Jan.3.2008.pdf ("*Joint Advisory Committee Report to Congress*").

[165] For example, the number of pediatricians in rural parts of the U.S. remains low relative to the percentage of the population that lives in these areas. A 2001 study found that only 8 percent of pediatricians are located in rural parts of the country. *See* Greg Randolph, et al., *Trends in the Rural-Urban Distribution of General Pediatricians*, Pediatrics, Vol. 107, No. 2 (2001), *available at* http://pediatrics.aappublications.org/cgi/reprint/107/2/e18.pdf.

[166] *See* Flatlands Disability Network, About, http://www.ndcpd.org/fdn/about.htm.

[167] *See* Flatlands Disability Network, Activities, http://www.ndcpd.org/fdn/activities.htm.

[168] *Broadband & Seniors*, at p. 23-24.

[169] See Press Release, *YAI/National Institute for People With Disabilities Funded for Web-based "Telehealth" System to Serve Developmentally Disabled People*, Jan. 24, 2007, N.Y. State Health Foundation, *available at* http://www.nyshealthfoundation.org/content/article/detail/732.

[170] *Id.*

[171] *Id.*

[172] These types of in-home systems are extremely valuable to people with disabilities that severely limit or impair movement. For example, for people with spinal cord injuries who live in rural parts of the country, receiving specialized care for secondary conditions (e.g., autonomic dysreflexia) is made much easier by using broadband-enabled telemedicine. *Broadband & Disabilities – 2002*, at p. 5.

[173] *See* Robert Litan, *Vital Signs via Broadband: Remote Health Monitoring Transmit Savings, Enhances Lives,* at p. 2, White Paper of Better Healthcare Together (Oct. 2008), *available at* http://betterhealthcaretogether.org/SitesResources/bhctv2/Resources/Documents/VITAL%20SIGNS%20via%20BROADBAND%20FINAL%20with%20FOREWORD%20and%20TITLE%20pp%2010%2022.pdf ("*Vital Signs*").

[174] *Great Expectations.*

[175] The Oregon Center for Aging & Technology ("ORCATECH") is one institution that has launched a pilot program that uses in-home wireless sensors to monitor cognitive decline among older adults. For more information, *see* ORCATECH, Current Research, http://www.orcatech.org/research.php#etac.

[176] *See* International Conference on Alzheimer's Disease, *Highlights of Research Findings*, at p. 1, Alzheimer's Association, *available at* http://www.alz.org/icad/downloads/2008_ICADhighlights.pdf.

[177] *See* Press Release, *Alzheimer's Disease to Quadruple Worldwide by 2050*, June 10, 2007, Johns Hopkins University Bloomberg School of Public Health, *available at* http://www.jhsph.edu/publichealthnews/press_releases/2007/brookmeyer_alzheimers_2050.html (announcing a study by Ron Brookmeyer et al. entitled *Forecasting the Global Burden of Alzheimer's Disease*).

[178] U.S. healthcare costs are expected to increase to 20 percent of GDP by 2017, up from 16 percent in 2007. *See* Dept. of Health & Human Services, Centers for Medicare & Medicaid Services, National Health Expenditure (NHE) Fact Sheet, http://www.cms.hhs.gov/NationalHealthExpendData/25_NHE_Fact_Sheet.asp#TopOfPage. Moreover, the number of people covered by government-sponsored health plans (i.e., Medicare and Medicaid) increased from 80.3 million in 2006 to 83 million in 2007. *See* Carmen DeNavas-Walt, Bernadette D. Proctor, and Jessica C. Smith, *Current Population Reports*: *Income, Poverty, and Health Insurance Coverage in the United States: 2007*, at p. 21, U.S. Census Bureau (2008), *available at* http://www.census.gov/prod/2008pubs/p60-235.pdf.

[179] *FCC Broadband Stats - July 2009* at Table 18.

[180] Verizon will invest at least $23 billion dollars on its new FiOS system, *See* Peter Grant and Dionne Searcey, *Verizon's FiOS Challenges Cable's Clout*, WALL. ST. J., Oct. 24, 2007.

[181] AT&T will have invested upwards of $5 billion by the end of 2008 in its own fiber-optic network, *See* Todd Spangler, *AT&T Ups U-verse Spending Estimates by $500 Million,* MULTICHANNEL NEWS, Nov. 6, 2007.

[182] Comcast is currently deploying a new technology – DOCSIS 3.0 – which will boost broadband speeds that are comparable to fiber-optic speeds *See* Bob Wallace, *Comcast Details its First DOCSIS 3.0 Deployment*, XCHANGE, April 4, 2008, *available at* http://www.xchangemag.com/hotnews/comcast-details-its-first-docsis-3-0-deployme.html.

[183] *See, e.g., AT&T Increases 3G Wireless Network Speeds*, June 16, 2008, BROADBANDINFO.COM, *available at* http://www.broadbandinfo.com/news/att-increases-3g-wireless-network-speeds-214.html; Marguerite Reardon, *T-Mobile Launches 3G Network in NY*, May 5, 2008, CNET NEWS.COM, *available at* http://news.cnet.com/8301-10784_3-9936006-7.html.

[184] *FCC Broadband Stats - July 2009* at Table 9.

[185] There are two different 4G standards. The first, WiMAX, will be used by Sprint in collaboration with Clearwire, Intel, Google, Comcast, Time Warner Cable, and Bright House Networks. *See* Press Release, *Sprint and Clearwire to Combine WiMAX Businesses, Creating a New Mobile Broadband Compan*y, May 7, 2008, Sprint, *available at* http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1141088. The other standard, Long-Term Evolution ("LTE"), will be used by AT&T and Verizon. *See* Press Release, *Verizon Selects LTE as 4G Wireless Broadband Direction*, Nov. 29, 2007, Verizon Wireless, *available at* http://news.vzw.com/news/2007/11/pr2007-11-29.html; W. David Garner, *AT&T Plans Fast 4G Wireless Rollout*, April 4, 2008, INFO. WEEK, *available at* http://www.informationweek.com/news/mobility/3G/showArticle.jhtml?articleID=207001878.

[186] *RERC Wireless Background.*

[187] *See, e.g.,* TEITAC, *Report to the Access Board: Refreshed Accessibility Standards and Guidelines in Telecommunications and Electronic and Information Technology* (April 2008), *available at* http://www.access-board.gov/sec508/refresh/report ("*TEITAC 2008 Recommendations*").

[188] *See Over the Horizon: Potential Impact of Emerging Trends in Information and Communication Technology on Disability Policy and Practice*, at p. 1-2, National Council on Disability (Dec. 19, 2006), available at http://www.ncd.gov/newsroom/publications/2006/pdf/emerging_trends.pdf ("*Over the Horizon*").

[189] According to comScore, YouTube had a 39 percent market share of the online video market as of June 2009. *See* Press Release, *Major News Stories Drive June Surge in U.S. Online Video Viewing to Record 157 Million Viewers*, Aug. 14, 2009, COMSCORE, *available at* http://www.comscore.com/Press_Events/Press_Releases/2009/8/Major_News_Stories_Drive_June_Surge_in_U.S._Online_Video_Viewing_to_Record_157_Million_Viewers.

[190] *See New Captions Feature for Videos*, Aug. 28, 2008, YouTube Blog, *available at* http://www.youtube.com/blog?entry=mi8D3ntPgFQ.

[191] *See* Miguel Helft, *Google to Add Captions, Improving YouTube Videos*, Nov. 20, 2009, N.Y. TIMES.

[192] *See, e.g.,* Miguel Helft, *For the Blind, Technology Does What a Guide Dog Can't*, Jan. 4, 2009, N.Y. TIMES (discussing the efforts of a blind engineer at Google who is developing screen-reading software for the G1 one, which runs Google's Android software).

[193] *See An iPhone the Blind can Get Behind,* June 8, 2009, ABLEDBODY.COM, *available at* http://abledbody.com/profoundlyyours/2009/06/08/an-iphone-the-blind-can-get-behind/.

[194] *See* Press Release, *Apple Announces the New iPhone 3GS – The Fastest, Most Powerful iPhone Yet*, June 8, 2009, Apple, *available at* http://www.apple.com/pr/library/2009/06/08iphone.html (other accessibility features include "The new universal Zoom function magnifies the entire screen, and the White on Black feature reverses the colors on screen to provide higher contrast for people with low vision. iPhone 3GS also supports Mono Audio which combines left and right audio channels so that they can be heard in both earbuds for those with hearing loss in one ear.").

[195] *See People with Disabilities or Long Nails Can't Use iPhone without Special Tech*, June 24, 2008, WIRELESS & MOBILE NEWS, *available at* http://www.wirelessandmobilenews.com/2008/06/long_nails_people_with_disabil.html.

[196] *See* Press Release, *TALKS For Verizon Wireless Offers Mobile Accessibility To Blind And Visually Impaired Customers*, March 12, 2009, Verizon Wireless, *available at* http://news.vzw.com/news/2009/03/pr2009-03-12a.html.

[197] *See* AT&T, Mobile Speak and Mobile Magnifier by Code Factory, http://www.wireless.att.com/learn/articles-resources/disability-resources/mobile-speak-magnifier.jsp ("Mobile Speak is a powerful full-fledged screen reader with an easy-to-learn command structure, intuitive speech feedback in several languages, and Braille support that can be used with or without speech. Unlike other screen readers for mobile phones, Mobile Speak automatically detects information that the blind user should know, just as a sighted user would easily find highlighted items or key areas of the screen at a glance.").

[198] *See* Verizon Wireless, Accessibility: Products & Services Overview, http://aboutus.vzw.com/accessibility/index.html.

[199] *See* Microsoft, Accessibility: Mission, Strategy & Progress, http://www.microsoft.com/enable/microsoft/mission.aspx.

[200] By the end of 2009, approximately 18-20 cell phones will include the Android operating system. *See* Matt Richtel, *Google: Expect 18 Android Phones by Year's End,* May 27, 2009, N.Y. Times Bits Blog, *available at* http://bits.blogs.nytimes.com/2009/05/27/google-expect-18-android-phones-by-years-end/.

[201] *See* T.V. Raman, *More Accessibility Features in Android 1.6*, Oct. 20, 2009, The Official Google Blog, *available at* http://googleblog.blogspot.com/2009/10/more-accessibility-features-in-android.html.

[202] *TEITAC 2008 Recommendations.*

[203] *See* W3C, About, http://www.w3.org/Consortium/.

[204] *See* W3C, History, http://www.w3.org/Consortium/history (listing its major accomplishments, including standards for HTML and XML, among many others).

[205] *W3C WCAG 2.0 Guidelines.*

[206] *See* W3C, Introduction to Understanding WCAG 2.0, http://www.w3.org/TR/UNDERSTANDING-WCAG20/intro.html#introduction-fourprincs-head.

[207] *See National Disability Policy: A Progress Report*, at p. 185, National Council on Disability (Jan. 2008), *available at* http://www.ncd.gov/newsroom/publications/2008/pdf/RevisedProgressReport.pdf ("*NCD Progress Report 2008*").

[208] *Emerging Technologies & Cognitive Disabilities* at p. 4.

[209] *See* Center for Universal Design, Principles, http://www.design.ncsu.edu/cud/about_ud/udprincipleshtmlformat.html#top.

[210] *Id.*

[211] *See* Verizon, Universal Design Principles, http://responsibility.verizon.com/home/information/design-principles.

[212] *See* AT&T, Solutions for Customers with Disabilities: Universal Design Policy, http://www.att.com/gen/general?pid=10191.

[213] *See AT&T Opens Universal Design Methods to Developers,* Mar. 18, 2008, FIERCE DEVELOPER, *available at* http://www.fiercedeveloper.com/story/att-opens-universal-design-methods-to-developers/2008-03-18.

[214] *See* Center for Universal Design, Case Study: Nokia, http://www.design.ncsu.edu/cud/projserv_ps/projects/case_studies/nokia.htm.

[215] *See* Apple, Accessibility, http://www.apple.com/accessibility.

[216] *See* Apple, Accessibility: VoiceOver, http://www.apple.com/accessibility/voiceover/.

[217] *See* Apple, Accessibility: iPods & iTunes – Vision, http://www.apple.com/accessibility/itunes/vision.html; Hearing, http://www.apple.com/accessibility/itunes/hearing.html.

[218] The Coalition of Organizations for Accessible Technologies ("COAT) provides a good overview of the existing laws re AT. *See* http://www.coataccess.org/node/4 ("*COAT Laws Overview*").

[219] *See* Paul Glader, *Home Appliances to Soothe the Aches of Aging Boomers*, Dec. 3, 2008, WALL ST. J., *available at* http://online.wsj.com/article/SB122826077605073813.html.

[220] *See Tomorrow's Wireless World,* at p. 12, OfCom (rel. May 7, 2008), *available at* http://www.ofcom.org.uk/research/technology/overview/randd0708/randd0708.pdf; Adam Sherwin, *New Wi-Fi Devices Warn Doctors of Heart Attacks,* May 7, 2008, THE TIMES, *available at* http://technology.timesonline.co.uk/tol/news/tech_and_web/article3883082.ece.

[221] *Emerging Technologies & Cognitive Disability* at p. 5.

[222] *Over the Horizon* at p. 13-14.

[223] *See* Suzanne Robitaille, *For the Disabled, More Power for Play*, Dec. 26, 2008, TOP TECH NEWS, *available at* http://www.toptechnews.com/story.xhtml?story_id=63727&page=1.

[224] There is evidence that service providers are tailoring their offerings to specific user groups. For example, both AT&T and Verizon Wireless offer specially designed plans that cater to the needs of older users. Both offer seniors plans that include 200 anytime minutes, 500 night and weekend minutes, and unlimited in-network calling for less than $30 per month. *See* Verizon Wireless, Nationwide 65 Plus Plan, http://www.verizonwireless.com/b2c/store/controller?item=planFirst&action=viewPlanList&sortOption=priceSort&typeId=1&subTypeId=53&catId=1029; Press Release, *AT&T Introduces New Wireless Plan for Seniors,* Oct. 26, 2007, AT&T, *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=24612. With regard to people with disabilities, AT&T offers a text accessibility plan ("TAP") for people who are deaf, hard of hearing, have a speech disability and/or hearing loss. The TAP is available for the iPhone and provides unlimited texting and data and visual voicemail. *See* AT&T, Text Accessibility Plan for iPhone, http://www.wireless.att.com/about/disability-resources/text-accessibility-plan-for-iphone.jsp. Verizon Wireless offers a similar plan for use on its smartphones and PDAs. *See* Verizon Wireless, Accessibility: Nationwide Messaging Plans, http://aboutus.vzw.com/accessibility/nationwidemessaging.html (available to "those that do not use voice minutes to communicate.").

[225] *E-patients.*

[226] *See* Peter Stenberg & Sarah Low, *Rural Broadband At a Glance: 2009 Edition*, at p. 3, Economic Information Bulletin No. (EIB-47), USDA (Feb. 2009), *available at* http://www.ers.usda.gov/Publications/EIB47/EIB47.pdf.

[227] *FCC Broadband Stats - July 2009* at Chart 12.

[228] *Id.* at Table 18.

[229] *See* Diana Spas, *Update on the Demography of Rural Disability, Part One: Rural and Urban*, April 2005, Research and Training Center on Disability in Rural Communities, The University of Montana Rural Institute, *available at* http://rtc.ruralinstitute.umt.edu/RuDis/RuDemography.htm.

[230] *See* USDA Economic Research Service, Briefing, *Rural Population and Migration: Trend 6—Challenges From an Aging Population*, *available at* http://www.ers.usda.gov/Briefing/Population/Challenges.htm.

[231] *See* Peter Svensson, *Skepticism Arises Over Rural Broadband Stimulus,* Feb. 19, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/02/19/AR2009021902473.html (observing that there are those who think such funds are unnecessary in light of organic deployment efforts and noting that "Because Internet access is already widespread and still being expanded even in a shrinking economy, injecting more money for broadband could simply equate to giving more coffee to someone who's already downed three cups.").

[232] *See, e.g.,* Robert LaRose et al., *Closing the Rural Broadband Gap*, Michigan State University (Nov. 2008), *available at* https://www.msu.edu/~larose/ruralbb (evaluating a number of local public-private broadband initiatives and observing that "Infrastructure deployment alone is an insufficient driver, so it would be wise to encourage programs that link investments in training and use.").

[233] Connected Kentucky, the predecessor to Connected Nation, helped increase broadband adoption in the state by 83 percent between 2005 and 2007. *See The Economic Impact of Stimulating Broadband Nationally*, at p. 15, A Report from Connected Nation (rel. Feb. 21, 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf ("*Connected Nation Report*"); *see also* Arik Hesseldahl, *Bringing Broadband to Rural America,* Sept. 18, 2008, BUSINESS WEEK, *available at* http://www.businessweek.com/technology/content/sep2008/tc20080917_797892.htm.

[234] *See* Connected Nation, State Programs, http://www.connectednation.com/state_programs/.

[235] *Broadband & Telemedicine* at p. 20-23 (discussing federal telemedicine programs).

[236] *Barriers to Broadband Adoption* at p .28-29 (noting that lack of training and expertise vis-à-vis computers and broadband is a major barrier to broadband adoption for many people with disabilities).

[237] *See* Georgia Tools for Life, Assistive Technology Resource Centers, http://www.gatfl.org/sites.shtml (centers can be found in Atlanta, Augusta, Conyers, and Macon).

[238] *See* The Family Center on Technology & Disability, About, http://www.fctd.info/show/about.

[239] *See* Lighthouse International, Professional Education, http://www.lighthouse.org/education-services/professional-education/.

[240] *See* AFB Senior Site, Home, http://www.afb.org/seniorsitehome.asp.

[241] *See* AFB, About, http://www.afb.org/seniorsite.asp?SectionID=68.

[242] *See* APT, About, http://www.apt.org/about/.

[243] *See* Press Release, *Broadband Changed my Life! Winners Announced by Nonprofit Technology Leader,* APT (Dec. 2008), *available at* http://www.apt.org/news/apt-press-releases/2008/2008_bbcml_winners_pr.html.

[244] *Id.*

[245] *See* HR – 1, The American Recovery and Reinvestment Act of 2009, p. 14, *available at* http://readthestimulus.org/hr1_final.pdf ("*Stimulus Text*").

[246] *If You Build It* at p. 2; *Home Broadband Adoption 2009* at p. 7.

[247] *Home Broadband Adoption 2009* at p. 25-27.

[248] *Id.* at p. 12-18.

[249] *Id*. at p. 14.

[250] *See Broadband in America: Access, Use and Outlooks*, Consumer Electronics Association, at 6, July 2007, *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf.

[251] *See* FCC, Lifeline & Linkup, http://www.lifeline.gov/welcome.html.

[252] *See* Committee on Telecommunications, *Resolution on Lifeline and Linkup Program Support for Broadabnd Internet Access Services and Devices*, NARUC (Feb. 18, 2009), *available at* http://www.naruc.org/Resolutions/TC%20Resolution%20on%20Lifeline%20and%20Link-Up%20Program%20Support%20for%20Broadband%20Internet%20Access%20Services%20and%20Devices.pdf.

[253] *See* H.R. 3646 – The Broadband Affordability Act of 2009 (introduced Sept. 24, 2009), *available at* http://thomas.loc.gov/cgi-bin/query/z?c111:H.R.3646: (charging the FCC to "to establish a broadband lifeline program that enables qualifying low-income customers residing in urban and rural areas to purchase broadband service at reduced charges by reimbursing providers for each such customer served.").

[254] For example, a coalition of wireless and telecom companies, which included AT&T and T-Mobile, submitted a letter to the FCC in December 2008 "in support of increasing lower-income consumers' access to broadband through the universal service Lifeline and Link Up programs and encourage the [Commission] to adopt a program with sufficient subsidies to achieve that goal." *See* Letter of AT&T et al., *In re Lifeline/Link-Up Support for Broadband Internet Access (CC Docket No. 96-45; WC Docket Nos. 05-337, 04-36, and 03-109; and WT Docket Nos. 07-195 and 04-356)* (Dec. 10, 2008), *available at* http://files.ctia.org/pdf/081210_Coalition_Letter_in_Support_BB_Lifeline_and_Link_Up__4__3_.pdf. Similarly, the National Cable & Telecommunications Association ("NCTA"), the principal cable industry organization, has expressed support for "Expansion of the FCC's Lifeline and Link-Up Programs to help ensure that broadband access is extended to low-income households." *See* Press Release, *McSlarrow Highlights U.S. Broadband Success Story in Letter to House and Senate Commerce Committees; Says Just Released OECD Report is Misleading*, April 23, 2007, NCTA, *available at* http://www.ncta.com/ReleaseType/MediaRelease/4154.aspx.

[255] The authors previously offered this idea for senior citizens. *Broadband & Seniors* at p. 35.

[256] This approach has been adopted in a number of states across the country. *See, e.g.,* Press Release, *New Commerce Program Encourages Broadband Availability,* Feb. 28, 2007, Wisconsin Dept. of Commerce, *available at* http://commerce.wi.gov/NEWS/releases/2007/034.html. It has also been endorsed by the National Telecommunications & Information Administration, which provides telecom advice to the President. *See* Report, *Networked Nation: Broadband in America*, at p. 3, National Telecommunications & Information Administration, U.S. Department of Commerce (Jan. 2008), *available at* http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf.

[257] *Consumer Insights.*

[258] *Computer & Internet Use – 2000* at p. 5.

[259] *See* Per Scholas, Recycling, http://www.perscholas.org/recycling/index.html.

[260] *See* Per Scholas, Comp 2 Seniors, http://www.perscholas.org/c2s/index.html; *Broadband & Seniors* at p. 11 (profiling OATS).

[261] *See* One Economy, Broadband/Hardware, http://www.one-economy.com/ourwork/broadband.

[262] *Stimulus Text.*

[263] *See* Dawn Carlson et al., *Assistive Technology Survey Results: Continued Benefits and Needs Reported by the Americans with Disabilities,* at p. 5, National Center for the Dissemination of Disabilities Research(Sept. 2001), *available at* http://www.ncddr.org/products/researchexchange/v07n01/atpaper/ATpaper.pdf. .

[264] *See* Closing the Gap, About, http://www.closingthegap.com/about_us.lasso.

[265] *See* NVRC, Technology, http://www.nvrc.org/content.aspx?page=22&section=6.

[266] *See, e.g.,* Charles M. Davidson, *Losing the Forest for the Trees: Properly Contextualizing the Use of Early Termination Fees in the Current Wireless Marketplace*, ACLP Scholarship Series (June 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Early%20Termination%20Fees%20-%20June%202009.pdf (discussing this dynamic in the context of the wireless sector).

[267] *See* Ashlee Vance, *Insurers Fight Speech-Impairment Remedy,* Sept. 15, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/09/15/technology/15speech.html?_r=1.

[268] *Id.*

[269] *Id.*

[270] *Broadband & Telemedicine* at p. 41-42 (discussing the need for modernizing insurance reimbursement mechanisms); *Barriers to Broadband Adoption* at p. 37-38 (noting that outdated reimbursement mechanisms are a major barrier to further adoption and usage of broadband-enabled telemedicine tools).

[271] H.R. 3101 - Twenty-first Century Communications and Video Accessibility Act of 2009 – was introduced on June 26, 2009. Text of the law is *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-3101 ("*Draft Accessibility Law 2009*").

[272] *TEITAC Report – 2008*.

[273] 47 U.S.C. § 255.

[274] 47 U.S.C. § 610.

[275] *Id.*

[276] *See, e.g.,* Larry Brethower, *Cell Phone and Hearing Aid Compatibility, 2008*, Sept. 3, 2008, The Hearing Review, *available at* http://www.hearingreview.com/issues/articles/2008-09_03.asp (observing that "the industry has quickly achieved and surpassed the [FCC's] standards. It currently offers more than 90 models of phones with an acceptable M-3 emissions rating.").

[277] NCD is "an independent federal agency composed of members appointed by the President of the United States, by and with the advice and consent of the U.S. Senate [that] provides advice to the President, Congress, and executive branch agencies to promote policies, programs, practices, and procedures that guarantee equal opportunity for all individuals with disabilities, regardless of the nature or severity of the disability and to empower individuals with disabilities to achieve economic self-sufficiency, independent living, and inclusion and integration into all aspects of society." *See* NCD, Home, http://www.ncd.gov/.

[278] *NCD Progress Report 2008* at p. 198.

[279] *Draft Accessibility Law 2009* at new section 717(d), *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-3101&version=ih&nid=t0%3Aih%3A111.

[280] *Id.* at new section 717(e), *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-3101&version=ih&nid=t0%3Aih%3A112.

[281] *NCD Progress Report 2008* at p. 185-186.

[282] *See* Greg Toppo, *iPhone Applications Can Help the Autistic,* May 28, 2009, USA TODAY, *available at* http://www.usatoday.com/tech/news/2009-05-27-iphone-autism_N.htm.

[283] *See* Seeing with Sound, Android, http://www.seeingwithsound.com/android.htm.

[284] *Id.*

[285] The exact mechanisms and processes for disbursing these funds remain unclear. However, NTIA and RUS will develop these processes in consultation with a variety of stakeholders. Moreover, the economic recovery package calls on the FCC to develop a national broadband policy within one year of enactment. *ARRA Summary*.

[286] *See, e.g.,* Tony Clark & Michael J. Santorelli, *Federalism in Wireless Regulation: A New Model for a New World,* ACLP Scholarship Series (Feb. 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Clark%20%20&%20Santorelli%20-%20Wireless%20Federalism%20-%20February%202009.pdf (discussing the impact of a national regulatory framework on the wireless market and articulating a new framework for wireless consumer standards).

[287] *See, e.g.,* S. Derek Turner, *Dismantling Digital Deregulation*, Free Press (May 2009), *available at* http://www.freepress.net/files/Dismantling_Digital_Deregulation.pdf (arguing that the deregulatory policies implemented in the telecommunications market over the last decade have failed and that a new era of active regulation is required).

[288] *See generally* Charles M. Davidson & Michael J. Santorelli, *Network Effects: An Introduction to Broadband Technology & Regulation*, U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.uschamber.com/NR/rdonlyres/ew4ahwhwxqx6rxs4vrjebfzdxqt46nw5a67qsor3pa5jcvdgiuw2mwrmns4xe6kua5ce63mhjdk7ykfbx4ioliesrsa/ChamberIntroBroadbandPaperFinal121708.pdf (discussing the current regulatory framework for broadband).

[289] *See* Economic *Impact of Broadband: An Empirical Study*, at p. 8-9, LECG (Feb. 2009), *available at* http://www.connectivityscorecard.org/images/uploads/media/Report_BroadbandStudy_LECG_March6.pdf.

[290] *See* Press Release*, Study Shows Significant Economic Benefits From Broadband if Overall ICT Access and Skills are High*, March 5, 2009, Nokia Siemens Network, *available at* http://www.nokiasiemensnetworks.com/global/Press/Press%20releases/news-archive/Study%20shows%20significant%20economic%20benefits%20from%20broadband%20if%20overall%20ICT%20access%20and%20skills%20are%20high.htm (citing LECG/Nokia Siemens Network's *Connectivity Scorecard 2009*, *available at* http://www.connectivityscorecard.org/images/uploads/media/TheConnectivityReport2009.pdf).

Attachment #9

THE IMPACT OF BROADBAND ON TELEMEDICINE

A Study Commissioned by the U.S. Chamber of Commerce

APRIL 2009

A REPORT TO THE U.S. CHAMBER OF COMMERCE

THE IMPACT OF BROADBAND ON TELEMEDICINE

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The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School thanks the U.S. Chamber of Commerce for commissioning this report. The ACLP also thanks Lesley O'Neill and Ann Turner for their invaluable research assistance.

Throughout the preparation of this report, the ACLP consulted with a wide variety of experts and practitioners in the field of telemedicine, many of whom are referenced in the paper. The ACLP thanks them for their input and the resources they provided. Their comments provided unique insight into the role that broadband is playing in the development and deployment of current- and next-generation broadband-enabled telemedicine tools and the impact that these tools are having on patients across the country.

The views expressed herein are those of the authors and do not represent those of New York Law School.

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The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School is a public policy program that focuses on identifying and analyzing key legal, policy, and regulatory issues facing the advanced communications sector. ACLP's mission is to promote robust and solution-focused dialogues amongst state and federal policymakers, industry, academe, the financial community, and consumers concerning changes to the state and federal regulatory regimes governing wireline, wireless, broadband, and IP platforms.

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1. EXECUTIVE SUMMARY

Healthcare in the United States is at a critical crossroads and faces a number of challenges:

- *Costs continue to increase*. In 2007, healthcare costs represented 16 percent of U.S. Gross Domestic Product ("GDP"), or approximately $2.1 trillion, and are expected to rise to nearly 20 percent of GDP by 2017.[1]
- *Government-funded healthcare coverage continues to expand*. The number of people covered by government health programs (e.g., Medicare and Medicaid) increased from 80.3 million in 2006 to 83 million in 2007.[2]
- *The number of uninsured remains high.* In 2007, the number of uninsured stood at over 45.7 million, down slightly from 47 million in 2006.[3]
- *Improvement in the quality of healthcare has slowed*. By at least one measure, the quality of healthcare in the United States, though improving, has slowed substantially over the last several years.[4] One of the reasons cited for this stagnation is the disparate levels of healthcare available to patients across the United States.[5]
- *Demographic trends presage further strain.* The number of senior citizens in the United States is expected to double by 2050,[6] putting further strain on the healthcare system. Moreover, young adults comprise the largest and fastest growing segment of the uninsured population.[7]
- *The current health insurance framework is inefficient.* Antiquated reimbursement mechanisms fail to provide proper incentives for adopting new healthcare techniques.

Recent proposals for reforming healthcare have centered on enhancing efficiencies in its administration while increasing coverage and decreasing costs.[8] Many of these plans center on the integration and use of a variety of technologies to accomplish these goals. Indeed, a diverse array of telemedicine, telehealth, and health information technology ("HIT") tools has already been successful in leveraging the telecommunications infrastructure to deliver medical and health services to remote, under-served parts of the country. These tools have expanded the scope of healthcare by enabling the delivery of expert care to remote clinics and hospitals and, increasingly, patients' homes. The emergence of broadband as a viable and complementary platform for the delivery of these services has bolstered the quality, range, and effectiveness of these tools and holds the potential to further transform healthcare in the United States.

To date, broadband has helped to further broaden the scope of healthcare and has led to dramatic cost savings by facilitating the fast and reliable transmission of critical health information, multimedia medical applications, and lifesaving services to many parts of the country. *Most critically, the wider use of broadband-enabled telemedicine tools is helping to shift the healthcare paradigm towards more individualized care.* Indeed, these tools have the potential to empower patients with ready access to personal medical information and to facilitate more convenient and comfortable care by allowing for in-home treatment and remote monitoring. In short, the wide availability of robust broadband connections is driving innovation and increasing the adoption and use of telemedicine, telehealth, and HIT tools.

However, obstacles remain to integrating these technologies into everyday healthcare. As this paper makes clear, there is no shortage of technological innovation in the telemedicine and telehealth sectors, as the wide availability of broadband and its relative affordability have fostered an environment of experimentation in the development and use of these tools. *However, ancillary issues like antiquated insurance laws, inadequate reimbursement schemes, and restrictive physician licensure systems threaten to chill these efforts and impede further adoption.*

This paper discusses telemedicine and telehealth generally (Section 2), evaluates the roles and impacts of broadband on these services (Section 3), highlights current efforts to deploy broadband-enabled telemedicine solutions across the country (Sections 4 & 5), and provides recommendations for modernizing those laws and regulations that are holding back further utilization of these increasingly critical tools (Section 6).

1.1 Defining Telemedicine

Innovation in the administration and provision of remote healthcare generally revolves around three interrelated classes of technologies—telemedicine, telehealth, and health IT. Delineating the scope of each of these technologies highlights many areas of overlap and potential collaboration:

- Telemedicine refers to "the use of electronic communications and HIT to provide clinical services" for remote patients.[9] Examples include teleconsultations and telesurgery.
- Telehealth encompasses a "broader application…of electronic communications and information technologies" that is used to "support healthcare services."[10] Examples include videoconferencing, transmission of images, and remote monitoring of a patient's vital signs.[11]
- Health IT facilitates the timely transfer of health information among doctors, hospitals, clinics, nurses, patients, and other stakeholders.[12]

Perhaps the most widely known HIT application is the electronic health record ("EHR"), which stores an individual patient's medical history—test results, doctor recommendations, medications, etc.—in a digital form.

The speed, reach, and efficacy of telemedicine are enhanced by the use of telehealth applications and the implementation of a variety of HIT tools like EHRs.[13] As such, references to "telemedicine" in this paper, unless stated otherwise, will encompass telemedicine, telehealth, and other types of technologies that use telecommunications networks to deliver interactive healthcare solutions to remote patients. Health IT tools will be discussed separately where appropriate.

1.2 Telemedicine & Broadband: An Overview

Broadband is facilitating the development of a number of cutting-edge approaches to healthcare, many of which are expected to lead to vast individual and national cost savings and to an increase in the availability of quality health solutions. Moreover, broadband-enabled telemedicine services are shifting the healthcare paradigm by, among other things, enabling in-home care and real-time patient monitoring and focusing on disease prevention by enhancing personal wellbeing.[14] In addition, these services and applications have the potential to:

- Level the playing field between urban and rural medical capabilities, ensuring more uniform and enhanced healthcare for all Americans.
- Drastically reduce healthcare costs by enabling the widespread use of EHRs, which could lead to annual cost savings of approximately $80 billion.[15]
- Reduce costly medical errors by implementing solutions like e-prescribing, which can enhance physician accuracy.[16]
- Facilitate more timely and precise diagnoses and treatments of chronic diseases.
- Leverage the global nature of the Internet to find efficiencies in the practice of medicine (e.g., outsourcing medical test data for analysis and diagnosis; streamlining administrative tasks; etc.).
- Increase employment in the healthcare sector. One recent study, for example, estimates that an investment of $10 billion in HIT in one year would create or retain 212,000 U.S. jobs for a year.[17]
- Empower individuals to more carefully and effectively manage personal and family health decisions.

These and other advancements, however, are ultimately dependent on two key factors.

First, telemedicine service providers and consumers must have access to robust broadband connections. Policymakers should continue to craft policies that encourage further investment, innovation, and deployment of next-generation broadband network infrastructure.

Second, policymakers must also modernize a variety of laws and regulations that impact the telemedicine sector (e.g., insurance laws, physician licensure, etc.). Without amendment, these laws could stall innovation and chill adoption.

1.3 Overview of the Paper

Section 2 provides an introduction to telemedicine and discusses why these tools and services are important to healthcare generally and patients specifically. This section then analyzes how telemedicine has been transformed by the emergence of digital technologies. The rise of the Internet and the increased use of IT tools provided the sector with certain lower-cost alternatives for expanding care and decreasing the costs of administering healthcare.

Section 3 assesses the impacts of broadband on telemedicine. Broadband enables a range of innovative telemedicine tools and services that are currently revolutionizing healthcare in the United States. This section highlights how:

- Broadband has increased the range of healthcare across the United States;
- Broadband-enabled telemedicine facilitates in-home care;
- Broadband-enabled telemedicine further decreases the costs of healthcare; and
- Broadband-enabled telemedicine enhances the care available to children, senior citizens, and people with disabilities, among many others.

Section 4 analyzes how broadband is currently being utilized by telemedicine developers and providers across the country. In particular, this section provides a survey of public and private sector efforts that use broadband for the delivery of telemedicine services, including an examination of:

- Federal telemedicine grant programs;
- State-level telemedicine programs that rely upon statewide broadband networks;

- Public-private and hybrid approaches that combine public resources with private sector innovation; and
- Private-sector entities that are developing and deploying broadband-enabled telemedicine services in a variety of contexts in order to gauge their viability.

These and similar efforts have produced a myriad of services that are of increasing value to doctors, patients, hospitals, caregivers, and other stakeholders in the healthcare sector. However, even though innovation in the telemedicine arena is thriving, it is still a nascent industry with relatively limited availability. Adoption and use of more advanced telemedicine services often depends on the availability of broadband or one's proximity to a local telemedicine provider. This section details a number of efforts that are using various types of broadband connections in the provision of telemedicine to even the most remote parts of the country.

Section 5 discusses the impact that greater broadband availability and technological advances will have on telemedicine. The full potential of telemedicine cannot be realized without the continued deployment and adoption of advanced broadband networks, further innovation of telemedicine devices and applications, and the development of network protocols to efficiently and securely transmit these time-sensitive services.

In the near term, public and private sector stakeholders will continue to deploy more widespread telemedicine pilot programs and broadband-enabled prototypes to examine the usefulness and effectiveness of these tools. Over the next several years, as devices and services become more widely available, telemedicine will further shift the national healthcare paradigm by equipping individuals and caregivers with the information and tools necessary to enhance personal wellbeing.

Successes in the near term will enable even more robust innovation in the long term, much of which will likely revolve around broadband. Indeed, increased utilization of broadband and broadband-enabled services by all consumers over the coming decades will further transform the healthcare paradigm by pushing healthcare further into the home, enabling more individualized treatments, promoting a culture of personal wellness and healthcare management, and ultimately producing enormous cost savings.

Section 6 articulates a series of recommendations for use by local, state, and federal government when crafting policies that seek to encourage continued innovation in the telemedicine sector and spur the use and adoption of these services by more consumers. The telemedicine sector currently faces a number of hurdles that could potentially slow or impede further growth and innovation, including antiquated insurance, tort, and

physician licensure laws that do not fully support, recognize, or reimburse for the use of cutting-edge telemedicine services.

There are a number of areas, however, where government can and should play a constructive role in enabling further experimentation and adoption of broadband-enabled telemedicine tools. For example, policymakers should continue to adopt laws that promote investment in and deployment of cutting-edge broadband infrastructure, as these networks will be the primary means for transmitting next-generation telemedicine services, tools, and applications.

1.4 Foundational Principles

As discussed throughout this paper, a number of *foundational principles* should drive public policy vis-à-vis telemedicine:

- Broadband enables telemedicine and the delivery of critical healthcare services to remote and home-bound patients, facilitates enormous cost savings, and empowers individuals by providing them with access to critical medical information.
- Broadband is facilitating the development of a new generation of telemedicine tools, services, and devices, which have bolstered healthcare in this country and resulted in measurable and significant cost savings to providers and patients.
- Broadband-enabled telemedicine is shifting the healthcare paradigm towards more individualized and convenient care by, among other things, allowing for more robust in-home health monitoring and treatment.
- An array of public and private sector initiatives is spurring innovation, deployment, and use of broadband-enabled telemedicine services across the healthcare industry. Government programs that strategically subsidize private efforts, like the FCC's Rural Healthcare Pilot, have been particularly effective and represent a viable approach for bringing telemedicine services and broadband to every part of the country.
- Opportunities exist for local, state, and federal government to implement forward-looking policies that encourage continued innovation and use of telemedicine services. These include updating antiquated laws related to insurance reimbursement, reining in overly expansive tort laws, and modernizing privacy standards.

- Substantial investment in next-generation networks is essential in order to realize the full range of broadband-enabled telemedicine tools and services.

2. An Introduction to Telemedicine: Why it Matters & the Role of Digital Technologies in its Evolution

In many respects, the telemedicine industry is evolving parallel to the telecommunications industry—advances in network infrastructure and technological innovation in the latter have transformed the former into a robust, national (and increasingly international) sector. The wide availability of broadband is spurring investment and innovation across the sector and has positioned broadband-enabled telemedicine as a critical component of U.S. healthcare reform. Yet telemedicine, in its most basic form, has proven to be an invaluable cog in the modern machine of healthcare.

This section focuses on two core elements of modern telemedicine. First, it discusses why telemedicine is important. In addition to providing critical medical services to rural and remote patients, telemedicine, over many decades, has slowly shifted the healthcare paradigm in the United States toward more individualized care. Telemedicine originally brought expert healthcare to remote hospitals and clinics; now it is pushing further into patients' homes.

Second, this section examines the evolution of telemedicine and assesses the impacts of digital technologies like the Internet and HIT on it. The advent of digital technologies has dramatically reduced many of the costs associated with telemedicine services, which in turn has spurred adoption and raised the profile of telemedicine among patients, doctors, and policymakers.

2.1 Why Telemedicine is Important

Telemedicine first emerged in the United States about fifty years ago,[18] although experiments using radio and telephone equipment were recorded as early as the dawn of the twentieth century.[19] The first telemedicine program in the United States was housed at the University of Nebraska, where neurological examinations were broadcast across campus.[20] By 1964, the University had established a telepsychiatry program with a mental institution over 100 miles away.[21]

Today, telemedicine enables an increasingly wide range of services over much longer distances, including:

- Real-time patient consultations;
- Remote monitoring of patients' vital signs and conditions;
- The storing and forwarding of critical health information for analysis and diagnosis (e.g., MRI results) [22];
- The provision of specialized services over long distances (e.g., teledentistry, telepharmacy, and telepsychiatry); and
- The wide availability of health information to patients and care givers.

Originally, many of these services were transmitted either over the existing telephone infrastructure or via satellite. While both were effective in enhancing the scope of healthcare, the former quickly became unable to accommodate large amounts of data while the latter remained expensive and unreliable.[23] However, telemedicine in its most basic form—medicine over long distances via telecommunications[24]—makes available a variety of healthcare solutions that would otherwise be unavailable to many rural and homebound patients.

Real-world examples regarding the human impact of telemedicine are illustrative when assessing the range of care these services can provide. Telemedicine allows pregnant women living in remote areas to receive timely prenatal care[25] and to deliver babies safely. For example, a telemedicine network in Alaska has linked doctors with patients about to give birth upwards of 200 miles away in very remote parts of the state.[26] Telemedicine is also being used to monitor senior citizens in order to track their health, assess cognitive abilities, enable emergency medical responses should a senior fall or fail to get out of bed, and provide remote family members with peace of mind that their loved ones are receiving proper care.[27] Other real-world examples of the impacts of telemedicine services are discussed throughout this paper (see Case Study 2).

Telemedicine has thus become a key component of modern healthcare. It has helped to equalize access to expert medical services and continues to reshape the paradigm for patient care in the United States. Over the last decade, the reach and power of telemedicine has been further augmented by the rise of a number of digital technologies, including the Internet, HIT, and broadband. Each has had a distinct and measurable impact on telemedicine specifically and healthcare generally.

CASE STUDY 1
The Case of Grandma Helen, as told by her Grandson

My grandmother, Helen, is 94 and lives in Connecticut. Her closest relatives live at least two hours away. I am her primary caregiver and live three hours away. As her health has begun to fail, she has become increasingly isolated. In November, while on the way to visit the eye doctor, she fell and broke her shoulder. I made several trips to visit with her and was involved in her discharge planning, an experience that turned out to be an eye-opener regarding the current healthcare system.

Until her surgery, Grandma Helen lived a very independent life. Thus, one of my family's challenges was figuring out how she would be able to stay in her house and live as independently as possible for as long as possible. Like many other seniors, the longer she stays active at home, the less dependent she is on expensive nursing homes or in-patient hospital services. The discharge planning helped me realize how overly complicated and antiquated the healthcare system is. As someone who works in the tech industry, I know that many of these decisions could be made much simpler and care made much more effective through the use of new technologies and services.

Having observed a telemedicine trial using dial-up Internet service approximately ten years ago, I am aware of many solutions that could make my grandmother's life, and my life as her caretaker, infinitely easier. During that trial we connected a camera and diagnostic equipment like a stethoscope to a laptop to study the efficacy of doing remote home nurse visits for patients with congestive heart failure. We concluded that the equipment provided reliable results and observed that many elderly patients took rather easily to the technology.

In light of these experiences, I began to sort through my grandmother's discharge planning and assumed that, after ten years, the healthcare industry had evolved to include the use of cutting-edge technologies that would make caring for Grandma Helen and coordinating her healthcare easier. Indeed, with broadband readily available, great progress must have been made in making advanced care solutions widely accessible. Unfortunately, my experience proved me wrong. Even though our country has undergone a technological revolution, a number of legal and policy obstacles and still exist, preventing many people, like my grandmother, from fully realizing the benefits of these cutting-edge services.

Indeed, my grandmother could benefit from a number of broadband-enabled telemedicine solutions. For example, **electronic health records** would allow my grandmother's five doctors to coordinate care. **Telemedicine visits** would allow Grandma Helen to participate in routine doctor visits from the comfort of her home, rather than having to navigate the unreliable and physically taxing public transportation system. **Wireless sensors** installed on the doors to my grandmother's refrigerator and medicine cabinet would allow caregivers to assess whether she was eating and taking her medications. Sensors installed on her walker could measure pressure and movement, allowing her physician to know if she begins to favor one side of her body. **Digital locks**, which can be unlocked using a cell phone, would allow me to remotely monitor access to my grandmother's house.

These and other solutions, many of which are enabled by broadband, are increasingly available and, in my grandmother's case, could enhance care and decrease costs.

2.2 The Emergence of Digital Technologies & Their Impacts on Telemedicine

Digital technologies have had three primary impacts on telemedicine. First, unlike their analog predecessors, digital technologies have allowed for the efficient and fast transmission of large amounts of data over long distances, thus enhancing the speed and scope of telemedicine. Second, digitizing information greatly enhances sending, receiving, managing, and storing data. Third, the widespread adoption and implementation of these technologies have led to dramatic cost savings.

This section discusses the impacts on telemedicine of two core digital technologies—the Internet and HIT.

2.2.1 The Internet: Facilitating Digital Transfers of Health Information & the Delivery of Health Services

The Internet has enhanced the effectiveness and range of telemedicine services because of the way in which it transmits data. Information is sent over the Internet using a technique called "packet switching," which operates by breaking data down into small bits, sending them out across the Web via a number of different routes, and reassembling them on the other end. This method of transmission, along with a variety of digital compression techniques, has greatly enhanced the scope of telemedicine by allowing for the faster transmission of large data files at relatively lower costs. In particular, the Internet has had two key impacts on the telemedicine sector.

First, as the Internet exploded in popularity, increasing amounts of information began to migrate online. Consumers quickly became better informed about health issues and more attuned to the universe of healthcare options. Indeed, by 2000, more than half of all Internet users had used the Web to obtain medical or health information.[28] That number rose to 75 percent by the end of 2007.[29]

Second, consumers eventually began to demand more of their Internet connections—faster upload and download speeds, more reliability, and cheaper prices—which spurred innovation at the network level. Even though commercial Internet offerings were initially limited to slower dial-up connections, dedicated point-to-point digital data lines were available to businesses throughout the 1980s and 1990s. These types of lines, which included T1 lines, however, were very expensive and often only used by large hospitals or other well-funded entities. Yet, more often than not, these land-based networks were more affordable than the satellite technology that was initially used to provide telemedicine services over long distances.

2.2.2 *Health Information Technology: Streamlining the Administration of Healthcare*

Concomitant with the evolution of the Internet, hospitals and medical practitioners began to upgrade their internal data management systems with more efficient health information technologies. The first generation of HIT streamlined data management, enhanced back-office functions like billing, and allowed for a more comprehensive approach to medical data. Next-generation HIT services, like electronic health records (discussed in more detail below), leverage broadband networks to further enhance efficiency, extending the initial HIT model beyond caregivers and providing patients with easy access to personal health information. Many current HIT systems also facilitate better communication among healthcare providers, which in turn allows doctors to provide their patients with more comprehensive care.[30]

The adoption of HIT protocols and practices also cut administrative costs and promoted a culture of technological adoption in hospitals. In 2003, the GAO studied the impact of HIT adoption in 10 healthcare sites across the country. In its report to Congress, the GAO concluded that cost savings associated with HIT adoption were significant and had an impact on 13 different areas of a hospital's operation, from creating efficiencies in data management to savings realized in the transition from paper to electronic data.[31] Adoption of HIT was robust in the 1990s and early 2000s, and in 2005 the American Health Information Community, a federal advisory body, was chartered to make recommendations to the Secretary of the U.S. Department of Health and Human Services ("HHS") on how to further accelerate the adoption of HIT.[32] By 2006, 46 percent of community hospitals reported moderate or high use of HIT, compared to 37 percent in 2005.[33]

Anecdotal evidence supports the view held among a growing number of practitioners that these types of systems have a real, measurable, and substantial impact on patients.[34]

2.3 *Conclusions*

Whereas early telemedicine developers and providers relied primarily on basic transmission techniques like ISDN (see Case Study 2), the transition to digital networks and the use of digital tools like IT and the Internet enhanced existing service offerings (e.g., remote two-way video consultations) and spurred further innovation (e.g., the ability to transfer high-resolution photos and test results at much greater speeds). Moreover, as telemedicine services became more complex and effective, hospitals and other healthcare providers augmented these gains by adopting new IT technologies to reduce costs and streamline data management. HIT adoption and spending continues to

increase as next generation services like EHRs become more popular among practitioners[35] and politicians.[36]

CASE STUDY 2
The University of Virginia's Office of Telemedicine

Established in 1993, the University of Virginia's ("UVA") Office of Telemedicine (www.healthsystem.virginia.edu/internet/telemedicine/home.cfm) has consistently been at the forefront of telemedicine. Eugene Sullivan, the Office's Director, explains that the program was initially launched to demonstrate the general viability of telemedicine. The first demonstration was the establishment of a fiber-optic telemedicine link between UVA, Walter Reade Medical Center, and an Army base in Georgia. The success of this demo led to the launch of UVA's "civilian" telemedicine program in 1996. However, at that time in Virginia, fiber-optic networks were scarce, Sullivan recalls, which meant that most telemedicine links were established via ISDN technology. ISDN uses the telephone network to transmit data at speeds comparable to that of a dial-up modem. The advent of broadband had an enormous impact on the UVA program.

The arrival of broadband enhanced existing applications like teleconsultations and spurred critical new innovations like UVA's telestroke program—the Virginia Acute Stroke Telehealth network. This service allows for remote and rapid diagnoses of strokes, which enables quicker and more effective treatment. Thanks to broadband, telemedicine has "turned the corner," according to Sullivan. Demand for telemedicine continues to increase as programs like UVA's continue to provide innovative and lifesaving services to patients in every corner of the state.

3. KEY IMPACTS OF BROADBAND ON TELEMEDICINE

In 1999, the FCC observed that broadband access to the Internet was poised to "meaningfully improve [the Nation's]…healthcare services."[37] Moreover, the FCC found that demand for broadband was significant and that service providers were responding to increased demand by investing billions of dollars in their networks to provide more robust service.[38] As a result, during the late 1990s and early 2000s, first-generation broadband technologies like DSL and cable modem service were deployed across large parts of the United States. By the end of 2007, there were over 121 million broadband subscribers in the United States,[39] up from just 6.7 million at the end of 2000.[40]

High-speed data networks have played a key role in the innovation and mainstream adoption of more robust telemedicine applications. Recently, the HHS recognized how

important broadband will be to the continued growth of telemedicine and to the implementation of more robust HIT systems.[41] In particular, HHS observed that *broadband-enabled telemedicine programs "improve patient access to care over great distances, which can reduce costs from unnecessary travel, enhance chronic illness management, and improve health outcomes by facilitating regular and preventive care."*[42] Moreover, the deployment of even faster next-generation broadband networks will enable, among many other things, the faster transmission of very large image files and additional bandwidth-intensive applications like telesurgery[43] and make available a wide variety of health services and treatments in the home (see Section 5.1).

As a result of competition among broadband providers, wide availability, and robust network architecture, broadband is an affordable and critical tool for patients, care givers, and innovators in the telemedicine sector. While Section 4 will discuss a number of individual approaches to using broadband in telemedicine and highlight the successes of telemedicine programs from across the country, this section discusses how broadband has influenced the development and use of telemedicine services and impacted the U.S. healthcare sector (see Snapshot 1 for an overview).

SNAPSHOT 1
An Overview of Broadband's Impacts on Telemedicine

Increases the Range of Telemedicine	*Facilitates In-Home Care*	*Decreases Costs*	*Enhances Care for Children, Seniors & People w/ Disabilities*
▪ Broadband-enabled telemedicine tools extend the range of healthcare to rural and unserved parts of the country. ▪ Telemedicine tools assist in leveling the playing field vis-à-vis quality of care across all demographics and geographies.	▪ The wide availability and increasing affordability of broadband enables the use of effective in-home diagnostic, monitoring, and treatment services. ▪ Seniors in particular will benefit from these tools by having the ability to receive more care at home.	▪ Broadband enhances the use of EHRs, which can lead to annual savings of $80 billion. ▪ Early disease detection via these tools can save billions of dollars. ▪ Telemedicine reduces costly medical errors and decreases unnecessary patient travel.	▪ Broadband-enabled telemedicine provides effective and affordable care to rural and low-income children. ▪ Tools and services have been crafted for use by senior citizens and people with disabilities, leading to vast savings.

3.1 Broadband Increases the Range of and Access to Telemedicine

The availability of robust broadband technology has increased the speed of healthcare and expanded the geographic availability of telemedicine applications like

teleconsultations, teleradiology, and remote monitoring.[44] Further deployment of broadband networks will continue to extend the range of many telemedicine services. Examples of how broadband impacts the range of telemedicine include:

- *Telemedicine allows patients who live in remote parts of the country or who are physically unable to travel long distances to receive quality healthcare, often via real-time broadband-enabled services* like videoconferencing. Whereas in the past these types of patients would have to either delay treatment or risk traveling long distance to consult with a specialist, broadband-enabled telemedicine services provide fast, reliable, effective, and convenient healthcare to patients regardless of geographic location.
- *Broadband also allows telemedicine providers to leverage the global nature of the Internet and outsource critical medical data to specialists for diagnoses*. For example, teleradiology is increasingly popular in rural areas like Alaska, where local healthcare providers send x-rays via email to colleagues in other states or other countries. Indeed, over the past few years increasing amounts of radiological data have been outsourced to doctors in India for review and diagnosis.[45] While this and other types of "outsourced" medicine have been somewhat controversial,[46] these efforts produce synergies that maximize the readily available talents of those who live in distant places by using broadband connections and decrease costs for patients and doctors in the United States.

In particular, rural patients, who generally have more limited access to quality healthcare, advanced medical equipment, and specialists than non-rural patients, have benefited greatly from broadband-enabled telemedicine. Telemedicine was initially developed to link rural patients with larger hospitals and clinics in order to narrow this gap; broadband has further enhanced the scope and quality of services available to rural patients in their immediate geographic area. In particular, broadband helps to:

- *Reduce the number of physicians needed in rural areas by setting up facilities where patients can be seen by their doctors remotely or consult with a specialist based in an urban center.* Broadband helps to make up for a dearth of physicians who practice in rural areas. Indeed, a 2005 study found that only three percent of medical students expressed a desire to work in rural areas.[47]
- *Provide physicians with the opportunity to continue their medical education via chat groups, videoconferencing, and Internet-based continuing education programs based in urban healthcare facilities.* For example, the Telemedicine Program at Texas Tech University offers a number of distance learning opportunities for healthcare providers throughout

the state of Texas. One class, Telemedicine 101, introduces patients and doctors to the concept of remote healthcare and encourages healthcare providers to assess whether they need to implement such services in their towns.[48] These types of programs allow rural doctors and patients to stay abreast of new developments in the field of medicine and telemedicine.

- *Level the playing field between urban and rural medical capabilities*. Broadband-enabled telemedicine helps to ensure more uniform and enhanced healthcare for all Americans.[49] High-capacity broadband not only reduces the cost of healthcare, it also improves the quality of care and the quality of life of those not located near advanced facilities.

3.2 Broadband Facilitates In-Home Care

The wide availability and increasing affordability of broadband enables the use of effective in-home diagnostic, monitoring, and treatment services. Current in-home techniques are being used by small groups of patients, many of whom are seniors. However, in the long-term such in-home services will likely become commonplace (see Section 5.3). In the interim, these services, in combination with other approaches outlined below, will further shift the healthcare paradigm towards more individualized care and disease prevention.

Examples of broadband-enabled in-home services include:

- *Remote Monitoring Generally*. This technique encompasses a wide range of tools and services, including the use of sensors to record movements (see section 4.3.2) and the use of wireless devices to monitor vital signs and symptoms (e.g., glucose levels[50]). A recent study estimated that "a full embrace of remote monitoring alone could reduce healthcare expenditures by a net of $197 billion (in constant 2008 dollars) over the next 25 years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[51]
- *Remote Monitoring for Senior Citizens*. Remote monitoring systems hold much immediate promise for senior citizens. Indeed, one study projects the market for monitoring services will become a $2 billion per year industry by 2010.[52] The same study estimated that 3.4 million seniors will be using networked sensor applications to monitor and improve their health by 2012.[53]
- *In-Home Chronic Disease Management.* In 2002, the Veterans Association found that in-home chronic disease management tools (e.g., teleconsultations, remote diabetes monitoring) resulted in 40 percent

fewer emergency room visits and a 63 percent reduction in hospital admissions.[54]

- *In-Home Telecardiology.* A recent trial involving patients with various heart-related ailments found that in-home monitoring devices were effective and popular among both care providers and patients. In particular, one study estimated that broadband-enabled real-time video consultations could replace upwards of 45 percent of in-person visits regarding heart-related matters.[55]
- *Telenursing to Augment In-Home Care.* A number of organizations are leveraging the ubiquity of low-cost telemedicine tools to enhance their offerings and to meet greater demand. For example, in 2007 the Visiting Nurse Service of New York launched a program to equip those patients at risk of being re-hospitalized with in-home equipment to monitor vital signs in the hope of decreasing the number of unplanned or unnecessary hospitalizations.[56]

3.3 Broadband-Enabled Telemedicine Further Decreases Healthcare Costs

Broadband-enabled telemedicine and other advanced health technologies (e.g., EHRs) have produced measurable healthcare cost savings and increased efficiency through more effective treatment of chronic diseases and streamlined internal processes.[57] Examples include:

- *Telemedicine produces cost savings by decreasing the amount of travel required by a patient or a doctor.* If a patient requires medical services that are not being provided locally, telemedicine services like real-time remote consultations via broadband allow the patient to save time and money otherwise spent in the car or on gasoline.[58] Cost savings flow from money saved on not having to travel long distances and on the time saved from not having to take time off from work.[59] For example, one study estimates that telemedicine "could save the U.S. healthcare system $4.28 billion [annually] just from reducing transfers of patients from one location, such as a nursing home for medical exams at hospitals, physicians' offices, or other caregiver locations."[60]
- *Telemedicine increases accessibility to specialists, which allows for more efficient diagnosis and treatment*.[61] Leveraging the expertise and experience of a specialist often leads to more successful and effective treatments.[62]
- *Early disease detection is more prevalent via telemedicine*. For example, a number of in-home monitoring systems are being tested to detect the

early onset of cognitive diseases like Alzheimer's.[63] Treating these types of diseases "costs the United States more than $148 billion annually in Medicaid and Medicare services and in indirect costs to businesses that employ [Alzheimer's] and dementia caregivers."[64] Yet it is estimated that the early "interventions that could delay the onset of Alzheimer's disease by as little as one year would reduce prevalence of the disease by 12 million fewer cases in 2050," which could lead to dramatic cost savings for this disease alone.[65]

- *Telemedicine reduces the need for costly physician involvement*, which can be adequately replaced, in many cases, by nurse practitioners and physician assistants.[66] These types of healthcare providers can provide effective treatment for a wide range of ailments and can augment their skills and knowledge by using various services provided via a telemedicine network.
- *Cost savings result from using broadband for the continuing education of healthcare providers*. Rural healthcare facilities "often have to pay transportation, hotel, and per diem for out-of-area continuing education for professional personnel."[67] Broadband-enabled educational opportunities decrease or eliminate many of these costs by allowing providers to participate in these classes remotely.
- *Commercially-available broadband connections oftentimes represent a much more affordable option* for delivering telemedicine services than older, less reliable, and more costly alternatives (see Case Study 3).

CASE STUDY 3

The Telemedicine Program at Texas Tech University

Based in a rural part of Texas, Texas Tech University has quickly emerged as a leading provider of telemedicine services in the state. Launched in 1989 to link four campuses of the Health Sciences Center located in Lubbock, Amarillo, Odessa, and El Paso, the Telemedicine Program at Texas Tech (www.ttuhsc.edu/telemedicine) currently supports a broad range of services in rural areas, correctional institutions, and assisted living communities.

Debbie Voyles, Director of the Telemedicine Program at Texas Tech's University Health Sciences Center, observes that technology costs have played a major role in the level and type of services provided by the program over the past 18 years. Initially, "all services were provided via satellite," explains Voyles. "We have areas that are very remote and this was the only way to reach those rural communities."

In 1999, the program was able to convert from satellite to faster T1 lines, which allowed for tremendous savings ($20,000 per year compared to $150,000 per year). Currently, the program is in the process of rolling out DSL-based programs. DSL, which is widely available, will lower their monthly bill from $300 to $90 without losing quality of service.

3.4 *Broadband-Enabled Telemedicine Enhances Healthcare for Children, Seniors, and People with Disabilities*

Broadband-enabled telemedicine services and applications hold much promise for those segments of the population that oftentimes are unable to obtain adequate healthcare on their own.

Children, particularly those living in low-income or rural areas of the country, stand to benefit greatly from enhanced telemedicine services. In particular:

- The number of pediatricians in rural parts of the United States remains low relative to the percentage of the population that lives in these areas. A 2001 study found that only 8 percent of pediatricians are located in rural parts of the country.[68] Telemedicine allows specialists and other medical professionals to establish a local presence via broadband without having to physically relocate their practice.
- Nationwide, nearly 14 percent of children have a "special healthcare need," which means they are at risk of developing a wide range of conditions and require healthcare above and beyond that of other children their age.[69] Telemedicine increases the availability of quality healthcare for these children.[70]
- Additional broadband-enabled telemedicine services available to children include remote dental exams,[71] vision screening,[72] and mental health tracking.[73]

Senior citizens and people with disabilities also stand to benefit greatly from broadband-enabled healthcare services. Seniors currently account for 12 percent of the population.[74] The total number of seniors is poised to double by 2050.[75] Moreover, there are currently over 50 million people with disabilities living in the United States, many of whom are older.[76] Healthcare costs for seniors and people with disabilities are expected to increase dramatically in the coming years. Broadband-enabled telemedicine applications will help to contain costs while improving care. For example:

- It has been estimated that broadband-based health resources can save approximately $927 billion in healthcare costs for seniors and people with disabilities over the 25-year period between 2005 and 2030.[77]
- In-home monitoring systems will allow seniors to receive critical services at home, which will greatly decrease reliance on nursing homes and other caregivers.[78] In addition, such systems enable more effective and individualized care for people with a variety of disabilities.

- Increased use of broadband among seniors and people with disabilities allows them to access health websites and other critical tools that will enable them to stay abreast of current treatments, options, drugs, and other pertinent information.[79]
- Broadband facilitates efforts by seniors and people with disabilities to stay in touch with family, friends, and community, and to participate in an array of activities, all of which may decrease debilitating symptoms of depression and sustain mental acuity.[80]

3.5 Conclusions

The reach and efficacy of telemedicine was enhanced by digital technologies like the Internet and HIT, and has thrived in the broadband era. Broadband-enabled telemedicine holds much promise and has already had a profound impact on rural patients, children, and seniors, among others.

The full potential of telemedicine will not be realized without wider broadband deployment and adoption. As such, government must continue to implement policies that encourage further investment in and innovation of broadband networks and broadband-enabled telemedicine applications. To this end, policies that facilitate and support various public and private telemedicine efforts by, among other things, funding pilot projects and otherwise creating incentives for the deployment of these services to rural and unserved parts of the country are essential to fostering a robust telemedicine sector and to continuing the transformation of the U.S. healthcare sector.

4. THE ROLE OF BROADBAND IN THE CURRENT TELEMEDICINE SECTOR: A SURVEY OF PUBLIC & PRIVATE APPROACHES

Broadband has become an essential feature of innovation in the telemedicine sector by facilitating the development and deployment of a growing number of cutting-edge tools and services. Innovators across the sector have ready access to a robust broadband infrastructure that is characterized by rapidly expanding bandwidth and consistently lower access prices. As a result, broadband-enabled telemedicine services and applications have led to healthcare cost savings, more expansive medical services, and efficiencies in the management of critical healthcare data.

Yet, despite these many advances, the telemedicine sector remains, in many respects, a niche industry with a primarily rural focus. As this section details, a significant portion of federal and state telemedicine funding supports programs, pilot projects, and other initiatives that are deployed to remote parts of the country. In particular, funding is being used to encourage the build out of advanced broadband architecture across states,

creating large networks of telemedicine providers and users that link rural patients with urban facilities and doctors. However, as these networks become more robust, the telemedicine services provided over them will become more attractive, affordable, and useful to non-rural users. Similarly, as more individuals adopt broadband[81] and understand its role in enabling the delivery of advanced telemedicine services, demand for these services will increase across all demographics and geographies.

This section provides a survey of the broad range of telemedicine efforts that are being pursued across the country, at every level of government, and by both public and private sector entities. In particular, this section focuses on:

- Federal telemedicine grant initiatives;
- State-level telemedicine programs that leverage statewide broadband networks;
- Public-private and hybrid approaches that combine public resources with private sector innovation; and
- Private-sector entities that are developing and deploying broadband-enabled telemedicine services in a variety of ways in order gather key data regarding efficacy and value.

4.1 Federal Efforts

The federal government has consistently played an active role in spurring innovation and use of telemedicine services. Over the past few decades, the federal government has allotted hundreds of millions of dollars to a variety of agencies and programs that support state and local telemedicine initiatives.[82] Three of these efforts are examined:

- The FCC Rural Healthcare Pilot Program;
- The Office of Health IT Adoption, based in the U.S. Department of Health & Human Services; and
- The Department of Agriculture's Rural Development Telecommunications Program.

Each of these programs recognizes the critical role that broadband plays in the delivery of advanced telemedicine services and actively encourages the deployment and use of high-speed networks in order to expand their reach.

4.1.1 FCC Rural Healthcare Pilot Program

Launched in November 2007, the FCC's Rural Healthcare Pilot Program is designed to facilitate the creation of a nationwide broadband network dedicated to "healthcare, connecting public and private non-profit healthcare providers in rural and urban locations."[83] Under this pilot project, "selected participants [are] eligible for universal service funding to support up to 85 percent of the costs associated with the construction of state or regional broadband healthcare networks and with the advanced telecommunications and information services provided over those networks."[84] The goal of this program is to "bring the benefits of telehealth and telemedicine to areas where the need for these benefits is most acute; allow patients to access critically needed specialists in a variety of practices; and enhance the healthcare community's ability to provide a rapid and coordinated response in the event of a national healthcare crisis."[85] Total funding for the program is approximately $417 million over three years.[86]

This initiative will have two immediate effects. First, it will spur the development and deployment of statewide broadband networks dedicated to facilitating the delivery of broadband-enabled telemedicine applications.[87] *These systems can also be used to create a robust healthcare network among hospitals, clinics, and other care providers within the state and among different states in a region* (see Case Study 4).

CASE STUDY 4
The Illinois Rural Health Network

The Illinois Rural HealthNet ("IRHN") (www.niu.edu/irhn) is a high-speed, fiber-optic broadband network connecting rural Illinois hospitals with specialists at larger facilities throughout the state and nation. The IRHN will receive $21 million over three years from the FCC's Rural Healthcare Pilot Program to build and maintain this network.

A unique feature of IRHN is that it is also part of the Regional Development Institute ("RDI") at Northern Illinois University. RDI seeks to improve regional economic development and develop best practices across a wide array of issues, including energy, education, and healthcare. In its first phase, the RDI will help to connect 88 rural communities to the IRHN network by 2010. Currently, the IRHN supports over 200 hospitals, including 80 located in rural areas and 52 Critical Access Hospitals. IRHN is also exploring the feasibility of using point-to-point wireless systems to expand its footprint.

According to Alan Kraus, Executive Director of the Broadband Development Group at the RDI, broadband is a "game changer." "What we're doing is a state-wide effort," says Kraus. "We looked at being able to put broadband at the center of healthcare development because we see it as an enabler, changing how people do things."

Second, *quality healthcare will be increasingly available to patients regardless of geographic location or socioeconomic background*. Services initially aimed at rural users will eventually be used by non-rural users as the convenience, effectiveness, and value of these services become more well-known.

The FCC's pilot program will increase the availability and use of broadband-enabled telemedicine services, spur further innovation and demand among patients across entire states, and drive the telemedicine sector towards becoming accepted as a mainstream healthcare alternative.

4.1.2 Office of Health IT Adoption

Housed within the U.S. Department of Health and Human Services, the Office of Health IT Adoption promotes the adoption and implementation of interoperable information technologies that seek to streamline the administrative functions of healthcare providers and make health information more widely available and accessible to patients, doctors, and other healthcare providers.[88] These efforts stem, in part, from a Presidential Executive Order issued in 2004 that created the position of National Coordinator for Health IT in order to "provide leadership for the development and nationwide implementation of an interoperable HIT infrastructure to improve the quality and efficiency of healthcare."[89]

Broadband plays a key role in facilitating the flow of medical information over HIT systems (see Snapshot 2). Indeed, according to HHS, "these connected systems are the future of safer, more affordable healthcare in America, and they depend on broadband access. By enabling rapid exchange of large amounts of data, broadband has become a critical component of robust health IT systems."[90] The implementation of a robust HIT policy will complement and enhance advanced telemedicine service by providing ready access to critical health information. A key component of this policy is the adoption of EHRs.[91]

SNAPSHOT 2
Broadband-Enabled Health IT Enhances Telemedicine

Dr. Karen Bell, Director of the Office of Health IT Adoption at HHS, sees the adoption of technologies like EHRs as an essential precursor to more robust innovation and deployment of telemedicine.

"In order to capture, store, and transmit critical health information, you need a broadband connection," says Bell. Her office foresees the entire infrastructure of health IT moving toward "virtual care," which allows for the real-time provision of lifesaving healthcare services. These and other advanced telemedicine applications are dependent on the wide availability and adoption of broadband by hospitals, doctors, and patients.

An EHR is an individual patient's digitized medical record. In 2006, 68 percent of hospitals reported at least limited implementation of EHRs, but only 11 percent reported full implementation.[92] Even fewer individual doctors have fully adopted EHRs. According to HHS, only four percent of physicians have adopted fully functional EHR systems.[93] However, the vast majority of doctors who use EHRs say they have helped improve the quality and timeliness of care.[94] Another study among radiologists found that "62 percent cite [lack of consistent] access to patient medical records as an impediment to their work and 96 percent agreed or strongly agreed that this problem creates medical risks for patients."[95]

Oftentimes, physicians are reluctant to adopt these types of advanced telemedicine applications because of the high fixed costs associated with them.[96] As discussed in more detail in Section 6, *there are a number of insurance and regulatory reforms that could be implemented in order to create incentives for using these services*. In addition, both the federal government and individual states are experimenting with ways to increase the adoption and use of EHRs. In June 2008, for example, the federal government announced a $150 million Medicare pilot program that will offer doctors in 12 cities and states (1,200 small practices in total) across the U.S. funding to move from paper to EHRs.[97] This program is part of a broader plan by HHS to reach the goal set forth in the Executive Order of providing U.S. residents with access to EHRs by 2014. In New York City, the local Department of Health recently launched a $60 million pilot that compensates participating doctors who adopt and use EHRs.[98] The city's goal is to aggregate patient data for the purposes of tracking disease and other macro-trends.[99]

4.1.3 U.S. Department of Agriculture Rural Development Telecommunications Program

The United States Department of Agriculture's ("USDA") Rural Development Telecommunications Program provides funding for a wide range of rural initiatives that seek to enhance rural life.[100] Since 2001, this program has invested more than $76 billion to spur growth in home ownership, encourage business development, and deploy critical community and technology infrastructure.[101] A key component of the Program is the grants it provides to telemedicine providers. In 2008, USDA Rural Development provided over $28 million in funding for distance learning and telemedicine organizations, many of which leverage high-speed broadband connections to provide enhanced services to the underserved across the country.[102]

4.2 State & University Programs

States and state-focused initiatives are also playing a key role in spurring the deployment and use of broadband-enabled telemedicine services by providing funding and other support for innovative initiatives. For example, in March 2008, New York

awarded $105 million in grants to 19 community-based HIT projects designed to promote the use of EHRs throughout the state.[103] These systems will "ensure that clinical information is in the hands of clinicians and their patients to help guide medical decisions and support the delivery of more coordinated, patient-centered care."[104] Similarly, in August 2008, Massachusetts enacted a law that will "promote cost containment, transparency and efficiency in the delivery of quality healthcare" by making available $25 million per year to assist in the transition to statewide electronic recordkeeping for health records by 2015. [105]

Similar efforts have been observed in nearly every state across the country. This section examines the efforts of four states—Alaska, California, Oklahoma, and Texas. Each state promotes the use of broadband-enabled telemedicine services by implementing a carefully tailored, state-specific strategy for the deployment of these services. The following discussion underscores the fact that the most effective strategies are those that leverage readily available academic, medical, and technological expertise.

4.2.1 Alaska

One of the most rural and sparsely populated states in the union, Alaska is by necessity home to an array of approaches that use broadband to deliver vital telemedicine services. Indeed, a number of unique programs have been developed over the past decade, providing much of the state with critical and effective healthcare.

For example, the Alaska Native Tribal Health Consortium ("ANTHC"), a "non-profit health organization owned and managed by Alaska Native tribal governments and their regional health organizations,"[106] was recently awarded over $9 million under the FCC's Rural Healthcare Pilot Program.[107] Broadband plays a key role in ANTHC's telemedicine program. For example, broadband enables videoconferencing, which allows for remote consultations in many parts of Alaska that are isolated or difficult to travel through. These types of services have been successful in the state. *According to ANTHC's 2007 Annual Report, 68 percent of its telehealth cases prevented unnecessary patient travel, while in eight percent of telehealth assessments doctors were able to diagnose serious ailments in their early stages, preventing further complications*.[108]

Another innovator in the state is the Yukon-Kuskokwim Health Corporation ("YKHC"). YKHC administers a "comprehensive healthcare delivery system for 50 rural communities in southwest Alaska."[109] According to recent testimony before the Senate Commerce Committee, YKHC's CEO Gene Peltola observed that "broadband deployment has transformed the delivery of healthcare services" throughout the southwest region of Alaska where YKHC operates.[110] YKHC uses a terrestrial microwave broadband network to transmit its telemedicine services.[111] Among many other services provided over this system, YKHC uses its broadband network to outsource radiological data to Dayton, Ohio for diagnosis.[112]

4.2.2 California

In 2006, California Governor Arnold Schwarzenegger signed two Executive Orders that sought to spur the deployment and use of broadband for telemedicine purposes. The first was the Health Information Technology Executive Order, which allocated up to $240 million for the "implementation of a mix of public/private financing alternatives to facilitate rapid adoption and sustainability of HIT for hospitals, physician groups, physicians, and other healthcare providers."[113] The second was the Broadband Executive Order, which established a statewide Broadband Task Force to examine best practices for bringing broadband to all residents and to determine which types of services could be offered via these networks.[114]

In January 2008, the Broadband Task Force released its findings regarding the availability of broadband in the state and made a number of recommendations for using broadband to deliver critical public services. One of the recommendations was to create a statewide e-health network that would provide "Californians with electronic access to health services and health-related information [to] assist in preventing disease, promoting health and wellness, simplifying access to health coverage, and reducing healthcare costs."[115] This program would supplement the California Telehealth Network, which recently received $22 million over three years from the FCC's Rural Healthcare Pilot Program.[116]

Universities located throughout the state also contribute to the deployment of broadband-enabled telemedicine services. For example, the University of California, Davis has established a program that uses broadband videoconferencing to provide rural hospitals with pediatric expertise. Over the past seven years, physicians have participated in over 200 remote consultations, many of which come during time-sensitive trauma situations.[117] But for a broadband connection, such efforts would not be possible.

4.2.3 Oklahoma

Many of the telemedicine services in Oklahoma originate from or flow through its universities, particularly Oklahoma State University ("OSU"). Over the past several years, OSU has developed a robust series of complementary telemedicine programs that provide advanced healthcare services to nearly every corner of the state. One of the primary centers of activity is the OSU Distance Learning & Telemedicine Center.[118]

OSU leverages the state's public broadband network—OneNet[119]—to deliver its telemedicine services. OneNet provides ample bandwidth (upwards of 100 megabits per second) to transport real-time medical services to rural healthcare facilities and to hospitals across the state. According to John Barnaby, Network Operations Manager for

the OSU Telemedicine Program, the wide availability of broadband has significantly decreased the cost of providing telemedicine services on OSU's end and the cost of using these services by physicians and patient.

Given the rural nature of the state, OSU has developed a number of hybrid approaches for using broadband in the delivery of telemedicine services. For example, OSU recently deployed a Mobile Telemedicine Clinic ("MTC") to cover remote parts of the state. The MTC is a state-of-the-art bus that has been outfitted with a variety of broadband-enabled telemedicine equipment, including a satellite dish to upload and down critical information.[120] This type of approach exemplifies the profound impact that broadband can have on the delivery of life-enhancing and lifesaving telemedicine services (see Snapshot 3).

SNAPSHOT 3
The Economic Impact of Broadband on Telemedicine

Even though there have been enormous improvements and advances in the provision of telemedicine services to rural areas, a number of remote areas remain unconnected. In Paris, IL, for example, the director of radiology at the local community hospital reached out to the Illinois Rural Health Net for help in enhancing its radiology services. The director complained that it took upwards of three hours to upload one set of x-rays using a slow Internet connection, which costs the hospital $1,000 per month. If this small hospital were connected to the IRHN, such transmissions would take 15 seconds and cost much less. IRHN is working with its colleagues in Paris to develop a solution.

Source: IRHN

4.2.4 Texas

Texas has long been a leader in the field of telemedicine. Indeed, in 1989 it launched one of the first statewide telemedicine programs in the country.[121] Many of these initial efforts were based at the Texas Tech Health Sciences Center in Lubbock, which launched its Telemedicine Program that same year.[122] To date, the Telemedicine Program has established sixteen correctional facility telemedicine sites (see Case Study 5) and nine community-based sites across the southwest part of the state. Each site is connected to the program's proprietary broadband network via dedicated T1 lines. These lines are capable of transmitting real-time audio, video, and data. Because its broadband network is available in large swaths of the state, a number of innovative telemedicine programs have been launched.

CASE STUDY 5
Using Broadband-Enabled Telemedicine to Enhance Healthcare in Correctional Facilities

Providing telemedicine services to correctional facilities decreases the cost and risk of transporting prisoners to off-site medical facilities.

In 2001, medical spending on state prisoners totaled over $3 billion. Moreover, 21 percent of state inmates and 22 percent of federal inmates said they had a medical problem after being incarcerated. The cost savings associated with establishing a telemedicine program in a prison are substantial. A recent study by the National Institute of Justice observed that the costs of implementing a telemedicine system in a prison are usually offset by the resulting cost savings, which average $14,200 per month after the break-even point.

The Texas Tech Health Sciences University's Telemedicine program currently provides telemedicine services to 16 prisons across the state (totaling over 30,000 inmates). In addition to providing basic care, telemedicine enables ancillary health services that otherwise would not be available. These include more robust psychiatry, dermatology, orthopedic, and internal medical services.

Sources: American Telemedicine Association; Texas Tech

One example is a program that provides remote burn care. Burn care services are provided via broadband to areas in and around El Paso. Prior to this program, burn victims in the southwest part of the state had to drive upwards of six hours to reach burn specialists at Texas Tech in Lubbock. This program has decreased the amount of unnecessary travel and increased the effectiveness of burn care, which requires a number of follow-up visits.[123]

The Texas Tech Telemedicine Program has also launched two telepharmacy sites in Texas—one in Turkey (2002) and one in Earth (2006).[124] Telepharmacy uses broadband Internet connections to bring the expertise of a pharmacist to these areas by using Web cams and microphones to facilitate a virtual, broadband-enabled consultation between the pharmacist and patient.

Each of these programs has been well received, and Program Director Debbie Voyles predicts much more success in the future. "Everyone is very pleased to have telemedicine services available to them," she observes, "especially those in the most remote areas of Texas." Looking ahead, Voyles observes that "the baby boom generation is going to dictate the future of telemedicine because they're going to want access to their doctors at the drop of a hat. As the cost of technology is coming down, the cost of connectivity is coming down with it. And 10 years from now, [telemedicine] will likely be in many people's home."

4.3 Public-Private & Hybrid Approaches

In addition to the many federal and state-level efforts aimed at deploying and promoting the use of broadband-enabled telemedicine services, a number of public-private and hybrid partnerships have been forged to pursue the same goals. Indeed, such approaches have been particularly successful in niche areas of telemedicine, including the increased use and effectiveness of mental health tools, the development of more robust remote monitoring, diagnostic and treatment services, and the establishment of various vehicles for harmonizing standards and efforts in this area.

4.3.1 Mental Health

Videoconferencing technology first enabled telepsychiatry services beginning in the 1960s. However, broadband has had two major impacts on this particular telemedicine service. First, the wide availability of broadband, either via private or public networks, has increased the footprint of telepsychiatry. As a result, these types of services are increasingly available to rural patients and prison inmates, among other underserved groups.[125] Second, broadband has brought down the cost of telepsychiatry, which has made it more affordable for lower-income patients living in remote areas.

Telepsychiatry has begun to thrive due to unique public-private partnerships, which pair public funding with private expertise to increase the reach of effective mental healthcare.[126] Arizona has been a leader in providing telepsychiatry services via videoconferencing. Since its creation, the Arizona Regional Behavioral Health Authority ("RBHA") has provided telepsychiatry services to over 42,000 patients across the state.[127] Launched in 1995, the RBHA is supported by a combination of state and federal funding.[128] Similar public-private telepsychiatry programs have been launched in Washington[129], Missouri[130], and New York,[131] among many other states.

Studies indicate that broadband-enabled telepsychiatry services are effective and useful in many cases. The technology facilitates more consultations with a wider swath of the population and encourages multiple psychiatrists to work as a team in the treatment of extreme cases.[132] In addition, a study of telepsychiatry services in Britain concluded that "the greatest benefits [of telepsychiatry] are likely to lie in improving communications in the local service where it could reduce delays in discharging patients into the community, save travel costs, and potentially result in very significant savings in the amount of private care contracted. Links with the private hospitals who care for significant numbers of patient will improve the quality of life for patients."[133] Moreover, patients have responded positively.[134] The continued deployment of robust broadband networks will continue to spur innovation in and use of these types of services across the country.

4.3.2 *Remote Monitoring, Diagnostics & Treatment*

A promising extension of traditional telemedicine services is the use of broadband-enabled sensors to remotely monitor the health of a patient.[135] While mainstream adoption of these types of technologies may be a few years away, a number of public-private pilot programs are actively studying the impact of these services on patients.

One such program is the Oregon Center for Aging & Technology ("ORCAT"). Funded in part by the National Institute on Aging, ORCAT recently partnered with Intel's Home Health Research to study the use of in-home motion sensors as a way to track cognitive decline. Sensors collect real-time motion data to create a robust personal profile, against which data is analyzed over time to identify changes in behavior and potentially to diagnosis early onset Alzheimer's disease.[136] This in-home system relies on a wireless broadband connection to upload daily information from the patient to the ORCAT facilities.[137]

The use of broadband-enabled in-home monitoring technologies has many positive impacts on patients, particularly senior citizens. The cost savings associated with more widespread use of these systems could be significant. Consider that the average cost for a private room in a nursing home is $213 per day or $77,745 annually.[138] The average monthly cost of living in an assisted living facility is $2,969 or $35,628 annually.[139] And the average hourly rate for a certified home health aide is $32.37.[140] Medicare and Medicaid pay for the vast majority of long-term care.[141] Effective implementation of an in-home monitoring system could reduce or eliminate certain expenses for many seniors, and the concomitant burden on federal funds, at least for a period of time. From a wellbeing standpoint, aging in place offers many seniors a more comfortable and mentally rewarding lifestyle. Moreover, these innovative new technologies enable seniors to monitor their health in real-time and potentially preempt fatal or degenerative disease.

The Veterans Health Administration ("VHA"), which is housed within the U.S. Department of Veterans Affairs ("VA"), has been a leader in implementing telemedicine solutions, setting an example for the private sector. Recently, the VHA experimented with remote monitoring technologies. In 2002 the VHA introduced its Care Coordination/Home Telehealth ("CCHT") program, which sought to "provide routine [in-home] and chronic care management to veteran patients" with a number of chronic diseases, including diabetes, hypertension, depression, and post-traumatic stress disorder.[142] Over the course of five years, the CCHT program treated over 30,000 patients, 86 percent of which reported being satisfied with the program.[143] Perhaps most importantly, the annual per-patient cost of the CCHT program is $1,600, which is almost $12,000 per year less that the VHA's traditional home-based primary care services.[144] Given the success of this program, the VA plans to increase the number of CCHT patients to 50,000 by 2011.[145]

Monitoring technologies are also being used to link specialists with remote hospitals that lack access to such doctors. For example, in Massachusetts, two Harvard University training hospitals have launched a TeleStroke program that allows their neurologists to remotely diagnose and treat stroke patients.[146] This service has proven to be effective in saving lives and in decreasing costs associated with past attempts by remote hospitals to provide similar services. The main hospital on Martha's Vineyard, for instance, spends $10,000 per year to use this service and take advantage of the TeleStroke doctors' expertise, rather than spending hundreds of thousands, if not millions, to keep and maintain the equipment and staff on-site at all times.[147] The TeleStroke services rely on robust broadband connections to put specialists in touch with at-risk patients via real-time video and image transmission.

Over the next decade, these types of services likely will be commonplace in homes with access to reliable broadband connections.

4.3.3 Standards & Certification

Going forward, one of the most important advancements in the field of telemedicine will be the development and adoption of standards and certification criteria that will enable the interoperability of various services and technologies. The widespread availability and use of broadband has facilitated the creation of a number of software programs and applications that seek to enhance existing telemedicine services. However, if these new applications (e.g., various proprietary EHR programs) are unable to work with one another, then their value will be limited.

To prevent this from happening, a variety of standards-setting bodies have been established to ensure continued interoperability. HHS, for example, launched the Healthcare IT Standards Panel ("HITSP") in 2005. This panel "serve[s] as a cooperative partnership between the public and private sectors for the purpose of achieving a widely accepted and useful set of standards specifically to enable and support widespread interoperability among healthcare software applications, as they will interact in a local, regional, and national health information network for the United States."[148] As doctors and hospitals across the country migrate from paper-based medical records to EHRs, and as innovative new broadband-enabled telemedicine tools like Microsoft's HealthVault continue to be deployed (see Section 5.2), HITSP will ensure that these new innovations are interoperable and thus of value to all stakeholders.[149]

HHS also manages the development of the Nationwide Health Information Network ("NHIN"), which seeks to "provide a secure, nationwide, interoperable health information infrastructure that will connect providers, consumers, and others involved in supporting health and healthcare."[150] HHS is working with stakeholders to develop

"capabilities for standards-based, secure data exchange nationwide" in order to "promote a more effective marketplace, greater competition, and increased choice through accessibility to accurate information on healthcare costs, quality, and outcomes."[151] To date, HHS has provided over $22 million in funding to launch a pilot initiative that will test its prototype architecture for the NHIN before opening it up to the public.[152]

Another collaborator in this space is the National Institute for Standards & Technology ("NIST"), which is a "non-regulatory federal agency" based in the U.S. Department of Commerce that "works with industry, research, and government organizations to make information technology more usable, more secure, more scalable, and more interoperable than it is today."[153] NIST collaborates with the healthcare industry to promote the use of HIT. To this end, it was recently awarded $20 million under the American Recovery and Reinvestment Act of 2009 ("ARRA") to support its work in testing and analyzing standards for EHRs.[154]

A similar effort in the private-sector is the Certification Commission for Health IT (www.cchit.org) ("CCHIT"), which certifies a variety of EHR products. CCHIT is a voluntary initiative[155] that leverages its reputation as a leading certifier of EHRs to create incentives for doctors to adopt and use the efficient tools in order to bolster their quality of patient care and to protect against medical liabilities.[156]

Recently, HHS launched a public-private initiative—the National eHealth Collaborative ("NeHC") (www.nationalhealth.org)—that seeks to facilitate the development of a national, interoperable HIT infrastructure by harmonizing the efforts of bodies like HITSP and CCHIT. NeHC is a "voluntary consensus standards body to bring together consumers, the public health community, healthcare professionals, government, and industry to accelerate HIT adoption by providing a credible and transparent forum to help establish priorities and leverage the value of both the public and private sectors."[157] The successful coordination of these efforts will be crucial in light of the recently adopted economic stimulus bill that has allotted billions of dollars for the development of a robust HIT system.[158]

4.4 Private-Sector Initiatives

Many recent breakthroughs in telemedicine have originated in the private sector. A growing number of private companies are expanding their research and development departments to investigate cutting-edge telemedicine services and applications in the hope of finding commercially viable products. These efforts play an important role in spurring innovation across the telemedicine sector. Three examples are illustrative.

First, a variety of telecommunications companies are leveraging their networks to enable a wide range of telemedicine services. Wireless carriers, for example, have begun to use their next-generation networks and handsets to provide a series of broadband-enabled telemedicine services and applications. As a recent report to Congress noted, "when married with wireless technology, broadband enables the real-time, reliable transmission of bandwidth intensive information in a mobile environment."[159] With wireless penetration at 84 percent[160] and third-generation networks widely available across the United States,[161] wireless telemedicine services and applications are flourishing. For example:

- Verizon Wireless recently launched its "Pill Phone," which makes information from the "Pill Book" available on its mobile phones.[162] This application provides users with information on more than 1,800 common drugs and facilitates the scheduling and notification of taking or administering required dosage. The library contains information about what medications look like, dosing, contraindications, possible side effects and conflicts as well.[163]
- T-Mobile also makes available a number of personal healthcare applications for download and use on its Smartphones.[164] One such application is called Health Tracker, which allows users to store personal health information (e.g. weight, blood pressures, etc.) on their BlackBerry.[165]
- AT&T's iPhone is being used to deliver telemedicine applications. For example, the Mobile MIM Application for the iPhone "allows a referring physician or patient to view medical images remotely, without being tied to an imaging workstation."[166]

Additional innovations are likely as increasingly open wireless platforms invite developers to create multimedia applications that leverage 3G and 4G networks, more sophisticated handsets, and peripherals like built-in rotating digital cameras that will facilitate mobile health conferencing. This rotation technology is an example of how providers are contemplating the future uses of devices to meet needs.

Wireline broadband providers are also active participants in the telemedicine sector, both as participants in and supporters of the development of new services. Examples include:

- AT&T has partnered with a number of hospitals and other healthcare providers to enable a variety of telemedicine, telehealth, and HIT solutions. For example, AT&T has partnered with Baptist Health in Arkansas to provide patients in rural parts of the state with access to intensive care services via a 45 megabit per second broadband

connection.[167] AT&T is also developing its own set of in-home monitoring technologies and services.[168]

- Verizon, in 2008, provided funding and other support to hospitals and clinics around the country. For example, it recently awarded a sizeable grant to La Maestra Community Health Centers in San Diego, California to purchase new telemedicine tools and to upgrade its telehealth offerings.[169] Another innovative example is the Mobile Medical Monitor ("M3") Project that Verizon has helped to support at the New York & Presbyterian Hospital.[170] Now in its third phase, M3 provides a clinician with a portable, wireless technology that enables the collection, aggregation, and summarization of patient information in an accessible format regardless of location. It automatically inferences the data against similar cases, which enhances care decisions, and provides automated alerts when the patient status changes. M3 is an innovative, cost- and time-saving solution to fractured patient information resulting in medical errors and disruption in continuity of care.
- Cox Cable recently partnered with Oklahoma hospitals in the Integris Health network to upgrade data capabilities such that health providers are now able to "execute remote video consultations, real-time information exchange, imaging, and voice-over-Internet-protocol applications."[171]
- ConnectMD, a subsidiary of GCI cable, has established a large healthcare footprint in Alaska, providing 140 facilities with sufficient bandwidth to enable the transmission of health information and the use of a variety of HIT services.[172]

Second, the efforts of multinational conglomerates like General Electric ("GE") have had an enormous impact on technological innovation on the hardware side of telemedicine. GE Healthcare is a $17 billion unit of GE Worldwide and has created a series of cutting-edge new tools that enhance current-generation telemedicine services.[173] These include research and development focused on diagnostic imaging, surgery, clinical systems, life sciences, medical diagnostics, and HIT.[174] The quality of these technologies has been widely recognized and adopted by telemedicine providers across the country. For example, in 2002, NASA for the first time began using non-proprietary heart monitoring and information systems produced by GE to monitor the health of astronauts while they are outside their spacecraft.[175]

Third, Intel has long been active in the telemedicine arena. Intel has partnered with educational institutions across the country to determine the effectiveness of in-home wireless sensors on tracking cognitive decline. An added advantage of a company like

Intel is that it can leverage its global footprint to launch a series of concurrent studies and trials. To this end, in 2007, Intel announced a joint venture with a number of programs in Ireland to establish a Technology Research for Independent Living Centre in the country.[176] Similarly, Intel has the flexibility and capital to partner with other companies that are focused on telemedicine to speed innovation and deployment. For example, Intel recently partnered with GE Healthcare and Motion Computing to develop a mobile medical device that will accelerate the collection of a patient's vital health information.[177] This device creates synergies between data collection and storage and represents another step towards more fully converged, broadband-enabled telemedicine devices.

4.5 Conclusions

To date, the combined efforts of stakeholders in the federal, state, local, nonprofit, and private arenas have produced a vibrant telemedicine industry that continues to develop and deploy lifesaving services and applications to patients and healthcare providers across the country. Broadband networks enable these services with a reliable and fast medium through which they can be made available to even the most rural users. As discussed in the next section, broadband will continue to play a key role in enabling future telemedicine innovations and in transforming the healthcare paradigm.

5. THE IMPACT OF GREATER BROADBAND AVAILABILITY & TECHNOLOGICAL ADVANCES ON TELEMEDICINE

Greater broadband availability and continued technological advances will result in a number of positive impacts on telemedicine in the coming years.

5.1 Innovation at the Network Level

Innovation at the network level will enable a number of near-term advancements by providing more robust infrastructure, faster speeds, and more reliability.

Over the next several years, network owners will continue investing in their networks in order to provide all users with better broadband connections. Traditional telco and cable companies, for example, will continue to deploy fiber-optic systems, which have the potential to transmit data at speeds above 100 megabits per second. Recent fiber deployments by Verizon,[178] AT&T,[179] and Comcast,[180] among others, signal a dedication to providing end-users with faster, more reliable and more versatile next-generation connections. Similarly, wireless carriers will leverage their advanced spectrum licenses and more effective spectrum management techniques to build out third- and fourth-generation networks. Moreover, public-private endeavors, like the Illinois Rural Health

Network, will continue to build out and bolster proprietary broadband networks, connect more users, and enable the delivery of next-generation telemedicine services and applications.

In addition to faster speeds and wider availability, *network managers will deploy more sophisticated protocols and methods for ensuring the secure transmission of high-priority data associated with telemedicine services to doctors, caregivers, family members, and, when necessary, emergency medical personnel*. The ability to reliably and instantaneously transmit time-sensitive data is essential to many emerging telemedicine services.[181] Networks that can guarantee this level of service will likely see robust telemedicine innovation at its edges. Thus, network managers will design and implement the techniques necessary to optimize the user experience and to decongest network traffic that could degrade the transmission of potentially lifesaving telemedicine services.

Innovation at the network level and at its edges will continue to develop under a regulatory framework that promotes competition, innovation, and experimentation. In view of the nation's current financial crisis and credit crunch, policies at every level of government should strive to promote investment and job creation. The build-out, maintenance, and management of advanced networks, along with the development of broadband-enabled telemedicine services and applications, cost billions of dollars. Thus, legislative and regulatory policies should be shaped that continue to encourage these advances.

5.2 Near-Term Outlook

In the near-term, three trends in the field of telemedicine will continue to drive innovation and adoption of these critical services.

First, broadband will continue to be incorporated into most telemedicine services, allowing these technologies to have a more national footprint. To this end, public and private efforts regarding the build out of broadband networks will be crucial. Over the next three years, the FCC's Rural Healthcare Pilot will provide support to programs in nearly every state for the development of robust broadband network infrastructure that is dedicated to the transmission of telemedicine services. Although this pilot project was only recently launched, successes are already evident. The Illinois Rural Health Net, for example, has successfully deployed a statewide broadband network and connected a variety of hospitals, clinics, and other healthcare institutions to it.

Moreover, public and private actors will also begin to leverage the existing broadband infrastructure to deliver emergency medical services. For example, recent natural disasters like Hurricanes Katrina and Ike have highlighted the need for robust emergency services that can be provided over broadband networks. To this end, in February 2008, the Joint Advisory Committee on Communications Capabilities of

Emergency Medical and Public Healthcare Facilities ("JAC") released a report that recommended using broadband as the basis for developing a "systematic, coordinated, and comprehensive strategy to improve emergency communications throughout the ranks of first responders and public health facilities."[182] The JAC recommended using advanced broadband technologies to improve immediate emergency responses and to link families, patients, and doctors in order to enhance emergency medical treatments. The JAC also acknowledged that efforts made in the emergency response arena must be supported by a wider recognition of the potentially lifesaving impacts of telemedicine, remote monitoring, and similar broadband-enabled medical services.[183]

Second, the rising popularity and effectiveness of remote care services will increase, first among senior citizens and eventually among the general public. Due to the emergence of broadband, telemedicine has become much more interactive, facilitating more robust transfers of time-sensitive information. Rising healthcare costs, along with a large increase in the senior population, have spurred the development of broadband-enabled telemedicine services that facilitate "aging in place." The efforts of organizations like Intel and ORCAT are pushing healthcare into homes via remote monitoring technologies like in-home sensors and other broadband-enabled devices.

Cisco is also experimenting with a remote care technology called HealthPresence. Using Cisco's telepresence technology, this device leverages the "[broadband] network as a platform" and combines "state-of-the-art video, audio, and medical information to create an environment similar to what most people experience when they visit their doctor or health specialist."[184] In practice, it operates like a kiosk. A patient enters a private area and is able to communicate with her doctor via telepresence. Trials are currently underway in Scotland and New Zealand.[185]

Another initiative focused on providing remote care to the general public via broadband is American Well (www.americanwell.com). American Well is a "new healthcare marketplace where consumers and physicians can come together online, to acquire and provide convenient and immediate healthcare services. Using the latest technologies in Web communications and digital telephony, [American Well] extends traditional healthcare services to the home setting."[186] American Well provides patients with the opportunity to have scheduled and unscheduled teleconsultations with doctors. An e-nurse application "triages" a patient and recommends a doctor.[187] Once the patient speaks remotely with a doctor via Web-cam, the patient has the ability to forward the results of the consultation—notes, preliminary diagnoses, recommendations, etc.—to her primary care physician.[188] A small but growing handful of insurance companies allow subscribers to use American Well as part of their health plan and the program provides affordable services to the uninsured.[189]

The increasing popularity of remote care is helping to shift many perceptions associated with traditional healthcare. *In-home monitoring, consultations, and other broadband-enabled*

services that facilitate the real-time collection of critical health data are moving the healthcare paradigm away from disease treatment and towards disease prevention.[190] IBM Global Business Services predicts that by 2015 "the emphasis of healthcare systems around the world will expand from acute care services to include prevention and chronic condition management."[191] The near-term success of various in-home monitoring trials of senior citizens will determine whether these types of broadband-enabled monitoring devices are a niche service for the elderly or whether they are useful to the general population.

Third, and related, broadband will empower individuals with the knowledge and tools necessary to become informed of and engaged in the management of their healthcare. In addition to enabling more personalized, in-home care, broadband is also being used to facilitate the wider availability of personal medical information for use by individuals. Providing individuals with ready access to their medical history and other pertinent health information in an EHR would allow them to make more informed choices about which treatments to pursue, which doctors to go to, and which health plans to purchase. IBM has observed that "as consumers become more directly accountable for their health and healthcare choices, they can also become wiser, more value-based purchasers, improve their health through better choices, and at the same, exert pressure to keep system costs in line."[192]

Use of these services is currently growing and individual companies and organizations are taking the lead to promote the value and convenience of EHRs. For example, in 2007 Verizon became an early adopter when it partnered with WebMD to make available to its employees their individual EHRs.[193] A number of more widely available personal health management tools have been deployed, including Microsoft's Health Vault (see Case Study 6), Google Health,[194] and Dossia.[195] Each of these applications relies on a robust broadband connection to enable the full universe of services available through these portals.

President Obama has emphasized the use of HIT, especially EHRs, as a key tool in changing the healthcare paradigm, cutting costs, and improving care. To this end, the ARRA included some $19 billion for the continued deployment and adoption of EHRs by providers across the country.[196] In particular, some of these funds will be used to incentivize the adoption of and penalize the failure to use EHRs via a variety of Medicare and Medicaid reimbursement mechanisms.[197] It is hoped that these funds will spur "meaningful" adoption of EHRs by large and small healthcare providers over the next few years.[198] Thus, it is likely that a significant number of doctors and patients will adopt and use these key healthcare tools in the near future.

CASE STUDY 6
Microsoft HealthVault

Launched in October 2007, HealthVault (www.healthvault.com) is a free online portal that allows individuals and their families to collect, store, and share valuable healthcare information. Data that can be stored in the HealthVault includes EHRs from doctors, test results, real-time monitoring information collected and uploaded via one of the many HealthVault compatible medical devices, prescription information, and an entire universe of other health data.

Microsoft views this innovation as a way to combat the vast fragmentation of personal health data that currently floats around between doctors, hospitals, and insurance companies. George Scriban, a Senior Product Manager for HealthVault, describes this tool as creating an "ecosystem" of personal healthcare tools. "Pervasive broadband is important to put rich tools in front of people," Scriban says. Broadband enables users to leverage the full potential of HealthVault, which along with similar programs will continue to transform the U.S. healthcare paradigm.

* * * * * *

These three trends, along with many other innovations facilitated by broadband, will continue to transform the telemedicine industry over the next decade. Also over this period of time, lawmakers, healthcare providers, and a larger portion of the population will learn about and begin to experience the cost saving and lifesaving aspects of telemedicine. In the long-term, telemedicine could very well replace many traditional medical methods and fundamentally alter present-day notions of healthcare.

5.3 Long-Term Outlook

The future of telemedicine is very bright, provided policymakers adhere to policies that promote investment in broadband infrastructure and certainty for innovators.

Current pilot programs and cutting-edge telemedicine applications could become mainstream techniques in a decade or two. For example, wider acceptance and tolerance for the outsourcing of radiology data could lead to continued outsourcing of additional medical services, leading to more efficiencies and cost savings. High-speed broadband applications could also supplant the current phenomenon of "medical tourism,"[199] which requires physical travel, with broadband-enabled teleconsultations,[200] e-prescriptions, and cybersurgery.[201] Indeed, remote cybersurgery, enabled by high-speed broadband networks and devices, holds much promise and is often referred to as "the ultimate advance in telemedicine."[202] Cybersurgery will be further enhanced by innovations like telepresence,[203] which increases the human element during the surgery. Such advances could help to ensure that every American

has access to quality surgeons regardless of geographic location. Moreover, cybersurgery could also represent a new market for U.S.-based doctors who wish to export their expertise abroad.[204]

These types of advanced services will be supplemented with telemedicine services and applications that are deployed in a patient's home, worn on the body, and incorporated into everyday objects. For example, the cell phone is seen as a logical and convenient vehicle for telemedicine.[205] As previously discussed, wireless providers are currently bolstering their networks to provide faster broadband service, which allows for the development of telemedicine applications for the current generation of handsets (e.g., Smartphones). In the near-term, basic services like text messaging are being leveraged to provide a primitive platform for patients to transmit personal health data like blood sugar to a doctor for monitoring purposes.[206] In the long-term, however, wireless devices are poised to play a critical role in telemedicine innovation.

OfCom, the British regulator of communications, recently released a report predicting that wireless telemedicine technologies will play a large role in enhancing more individualized healthcare.[207] In particular, OfCom predicts that innovators will leverage the ubiquity of mobile handsets and the decreasing costs of wireless sensors to produce services that can monitor personal information in real-time and send emergency alerts when a person gets into an accident or suffers a sudden health event like a heart attack.[208] These and other products, like in-home "smart" devices, rely on fast broadband connections to deliver real-time services that can save lives or detect the early onset of chronic diseases.

The amount of data collected from these types of devices, along with the wider availability and increased use of next-generation EHRs, will enhance online portals like HealthVault and Google Health, and further empower individuals to more effectively manage personal health decisions. Moreover, healthcare providers will increasingly outsource back-office operations like customer service and claims-processing, which could save upwards of $75 billion per year in the United States.[209] These types of efficiencies, both on the patient's end and the provider's end, have the potential to drastically decrease healthcare costs across the board.

5.4 Conclusions

With annual healthcare spending in the United States expected to balloon to nearly $4 trillion by 2016, and with the imminent retirement of millions of baby boomers, broadband-enabled telemedicine services hold much promise for pushing healthcare services into the home, driving down costs, and increasing the quality of care available to all Americans in both the near- and long-term. Technology and innovation will help to shift the healthcare paradigm away from institutionalized disease treatment and

towards personal wellness and preventative care, which in turn will have enormous impacts on individual economic wellbeing and the broader U.S. economy.

6. Government, Telemedicine & Broadband: Recommendations for Meaningful Policymaking

In order to realize the full potential of telemedicine, policymakers must grapple with a number of legal and regulatory issues in the near-term. Policymakers can facilitate continued innovation and adoption of broadband-enabled telemedicine services by revising medical, insurance, and other laws to reflect the modern healthcare marketplace and to encourage continued investment in and innovation of broadband-enabled telemedicine services, applications, and devices.

Recommendations for meaningful policymaking include:

1. Insurance laws, particularly reimbursement mechanisms, should be updated to promote greater adoption and use of telemedicine services.
2. Modernize and harmonize privacy laws to ensure more robust adoption and use of telemedicine services by healthcare providers and patients.
3. Craft and implement security standards to ensure that telemedicine services are secure and confidential.
4. Create an efficient and uniform physician licensure system that allows and encourages doctors to use broadband-enabled telemedicine services in the treatment of patients regardless of geographic location.
5. Tort reform is needed to protect telemedicine practitioners from frivolous lawsuits and to encourage the continued adoption of broadband-enabled telemedicine devices and services.
6. A combination of targeted policymaking and public-private partnerships should be used to facilitate the deployment of broadband to unserved areas of the country and to educate consumers about the benefits of telemedicine.
7. Bolster the nation's pro-investment regulatory framework for broadband in order to encourage continued innovation of networks and telemedicine technologies.

6.1 RECOMMENDATION #1

Insurance laws, particularly reimbursement mechanisms, should be updated to promote greater adoption and use of telemedicine services.

A formidable barrier to the continued expansion of broadband-enabled telemedicine applications is an antiquated set of insurance laws that do not provide adequate economic incentives for healthcare providers to adopt and use these types of services.[210] *For example, most public and private health plans do not reimburse doctors for using telemedicine applications*. Without a reimbursement scheme that compensates a doctor for both "real" and "virtual" medical consultations and procedures, the healthcare paradigm in this country will continue to be rooted in traditional face-to-face encounters and will not sufficiently migrate towards more efficient, ubiquitous, and affordable healthcare via broadband-enabled telemedicine.

Healthcare in the United States is financed by two streams of funding: 1) the collection of money for healthcare (e.g. insurance premiums and taxes), and 2) the reimbursement of health service providers for healthcare (e.g., money to doctors from insurance carriers or the government).[211] Telemedicine cost issues are primarily concerned with the latter. The mechanics of most private health plans typically mirror those of government at both the state and federal level, especially on issues of reimbursement. *Thus, it is vital for state and federal governments to take the lead by updating their reimbursement schemes to include the full spectrum of telemedicine services*.

Government healthcare is largely disbursed via Medicare and Medicaid. Medicare is a single-payer program that covers some 42 million Americans—35.4 million senior citizens and 6.3 million people under age 65 with permanent disabilities.[212] It is financed by federal income taxes, a payroll tax shared by employers and employees, and individual enrollee premiums.[213] Medicaid, on the other hand, is operated at the state level and covers approximately 55 million low-income Americans.[214] Medicaid programs are financed jointly by the states and federal government through taxes so that every dollar spent by a state on Medicaid is matched by the federal government by at least 100 percent.[215]

Given the broad reach of these programs, Medicare and Medicaid account for substantial percentages of healthcare providers' revenues. However, under the current reimbursement structure for these programs, many advanced telemedicine services generally are not reimbursable. As a result, *healthcare providers often lack a financial incentive to adopt and use these types of services*. Recent reforms signal a growing recognition of the value of telemedicine services.

Over the past few years, Medicare has expanded to include certain types of telemedicine and telehealth services.[216] *However, the scope of the new reimbursement structure is still limited.* For example, Medicare will only pay for telemedicine services that are provided via video conference.[217] Medicare has a much narrower and less inclusive view of in-home telemedicine; it does not cover in-home medical service provided via a telecommunications service.[218] "Store and forward" services like teleradiology are covered but only certain certified healthcare facilities are eligible to provide Medicare-supported telemedicine services.[219] Recently, Medicare announced a pilot program in Arizona and Utah that allows beneficiaries to maintain and manage EHRs.[220] However, beneficiaries can only choose from among a limited list of participating EHR providers.[221]

Medicare and Medicaid reforms vis-à-vis telemedicine are encouraging, but more can be done. For example, most reimbursements are given to telemedicine providers who serve rural areas. While telemedicine was originally developed, and is still primarily used, for the provision of healthcare to remote patients, these types of services are increasingly used in urban and suburban settings. *Limiting reimbursement to rural telemedicine would slow the adoption and use of these services across the entire population*. As Debbie Voyles of Texas Tech observes: "There are a lot of patients in inner-cities that have difficulty getting in to see a physician, but they're excluded from reimbursement." Unfortunately, policymaking cannot keep pace with technological innovation, as evidenced by the antiquated notions included in many insurance plans.

Reimbursement mechanisms must evolve with the healthcare system. This includes recognizing the increased use and effectiveness of telemedicine services and providing reimbursement mechanisms for them regardless of where and to whom the services are administered. Reforms adopted and implemented by the federal government will likely prod state governments and private insurers to follow suit. Moreover, private insurers should be encouraged to experiment with telemedicine reimbursement independent of federal or state reforms. Indeed, a handful of states require private insurers to provide some form of telemedicine reimbursement.[222] Otherwise, the U.S. healthcare system will continue to bloat and will be unable to realize the potentially enormous cost savings associated with broadband-enabled telemedicine services.

6.2 RECOMMENDATION #2

Modernize and harmonize privacy laws to ensure more robust adoption and use of telemedicine services by healthcare providers and patients.

In addition to updating insurance laws, policymakers must also address a variety of legal issues that could potentially block wider adoption of lifesaving telemedicine services. Foremost among these is privacy.

The security of personal health information is paramount to doctors and patients as more advanced telemedicine services and devices collect and transmit an increasingly large volume of medical data over the Internet. Although transferring personal health information electronically via e-mail or an EHR may be efficient, it also raises important issues regarding the confidentiality of patient data and the possibility of private medical information being illegally viewed or stolen by a third-party.[223]

To date, many states have enacted laws of general applicability regarding the electronic transmission of health information. These laws were crafted in response to the mostly intrastate nature of many modern telemedicine services that have been launched. However, newer broadband-enabled telemedicine services allow for the transmission of health data in real-time manner across state lines and international borders. Thus, *the existence of a patchwork system of privacy standards forged to address intrastate services increases compliance costs in a borderless digital world and decreases the incentive for doctors to share data with healthcare providers in other states*.

In order to resolve these discrepancies, policymakers should consider adopting a national framework for ensuring the privacy of interstate electronic health communications in the United States. This would improve the efficiency and effectiveness of the nation's healthcare system by encouraging the widespread use of broadband-enabled telemedicine services and applications like EHRs and remote monitoring systems regardless of geographic location.[224] Unfortunately, the current set of health privacy policies is out of date, which risks slowing the deployment and adoption of critical telemedicine tools.

In 1996, Congress passed the Health Insurance Portability and Accountability Act ("HIPAA") to, among other things, streamline electronic medical record systems while protecting patients, improving healthcare efficiency, and reducing fraud and abuse.[225] HIPAA requires healthcare providers, health plans, and business associates to adopt security and privacy standards for electronic communications, medical records, and medical transactions.[226] Prior to HIPAA, a "comprehensive personal right to privacy in one's medical affairs did not exist."[227]

HIPAA, however, only addresses some of the privacy concerns related to the electronic transmission of health data. The HIPAA privacy component, which creates standards for maintaining the integrity of protected health information, is applied to information that is transmitted for healthcare operations, as well as financial or administrative purposes.[228] Covered entities, which include all health plans, healthcare clearinghouses, and healthcare providers who conduct electronic healthcare transactions, are

responsible for ensuring HIPAA compliance from their business associates who receive protected health information in the process of providing services to the covered entity.[229] Yet the advent of more advanced broadband-enabled telemedicine services raises several privacy issues that are not typically encountered during conventional medical practice.[230] These include:

- Telemedicine could reasonably be regarded as a healthcare operation and therefore fall under the "treatment, payment, or healthcare operations" categorization, which permits the use and disclosure of protected health information without patient consent.
- Teleconsultations may require additional non-clinical personnel (e.g., technicians, camera operators, etc.) who do not participate in traditional medical care but who nonetheless would be required to comply with all HIPAA regulations.
- In traditional medical care, providers typically have existing relationships with the medical specialists with whom they consult. However, when dealing with telemedicine, patients and their on-site medical providers often will not know which clinical and non-clinical personnel will be involved at the distant site. HIPAA does not directly address this situation.

Solutions to these privacy issues have been offered by a number of organizations. For example, Connecting for Health,[231] an initiative supported by the Markle Foundation,[232] recently issued a comprehensive Common Framework for Networked Personal Health Information[233] ("Framework"), which offers solutions for many of these concerns. The Framework, which addresses privacy issues from both the consumer perspective and the technical perspective,[234] defines a set of practices that can help protect personal information, enhance consumer participation in online personal health records, and is available free of charge on the Connecting for Health Website.[235] Ultimately, the Framework seeks to empower individual users with full access to and control over personal medical information while providing them with a sense of absolute privacy in the management of their health information. A diverse array of healthcare-related groups, including consumer and privacy organizations (e.g. AARP), health insurers, healthcare providers, and technology companies (e.g. Dossia, Google, Intuit, Microsoft, and WebMD) have endorsed this framework.[236]

Current telemedicine providers have used some of the strategies recommended by the Framework, such as the use of consent forms and patient releases. Lisa Gaudet of Northeast Health states that her programs requires "[all patients] to sign a release, which spells out the method that their data will be transmitted and viewed, the risks associated with that method, and the efforts we will take to protect their health related information." Thus far, Northeast Health has not experienced any legal issues with

data privacy or data security. Similarly, Oklahoma state law requires telemedicine providers like the Oklahoma State University Telemedicine Program to obtain the consent of every patient who is to receive telemedicine services by signing a Legal Consent Form. This allows patients to make informed decisions regarding the services that they are about to receive. Moreover, in order to further ensure that privacy is not compromised, the Oklahoma State University Telemedicine Program does not record any of their telemedicine sessions. All procedures are completed in real time, just as they are in a local physician's office.

Policymakers have the opportunity to update laws like HIPAA and harmonize conflicting state privacy laws in order to ensure the continued use of broadband-enabled telemedicine services.[237] Decreasing the amount of privacy-related compliance costs would increase the incentive to adopt these new services and would increase the availability of effective and affordable healthcare.

6.3 RECOMMENDATION #3

Craft and implement security standards to ensure that telemedicine services are secure and confidential.

As more and more healthcare services migrate online, questions regarding the security of sensitive health information being transmitted over the Internet have been raised. Many consumers worry about identity theft, spam, hacking, and other nefarious intrusions. Indeed, a recent study by Pew found that 75 percent of Internet users do not like giving out their credit card or personal information online.[238] In the realm of healthcare, trust and security are at the center of the traditional doctor-patient relationship. As digital healthcare continues to evolve, it is essential that network and data security are addressed by telemedicine developers, users, and patients.

At the network level, security includes the development and implementation of standards for the secure transmission of health information. To date, the development of such standards has been slow.[239] The continued prevalence of intrusive applications like spam frustrates users, decreases their enjoyment of the Web, and could delay further adoption of broadband-enabled telemedicine.[240] Similarly, the increased use of Wi-Fi networks for in-home monitoring raises additional security issues. These types of networks tend to be less secure than wire-based ones, but their relative affordability and ability to interact with other wireless technologies (e.g., wireless sensors) have made them very attractive to researchers and patients. However, given the rising prominence of telemedicine services and their importance to the future of healthcare, private sector innovators have begun working together to address security issues.

For example, in April 2005, SafetySend formed a partnership with the American Association for Medical Transcription to create a private system that securely transmits personal health information.[241] SafetySend's service (www.safetysend.com) includes solutions for organizations needing secure file transfers that comply with HIPAA privacy standards.[242] It also offers secure e-mail and fax components and is available for purchase by individuals for as little as $8 per month.[243]

In addition, more secure wireless technologies continue to be developed. A team at the Rochester Institute of Technology has been working on integrating radio frequency identification ("RFID") technology into cardiac sensor networks, which are used to remotely monitor a patient's heartbeat pattern and blood pressure.[244] This method will help transfer critical cardiologic information to doctors and hospitals, increasing the quality of diagnosis and reducing the need for medical supervision.[245]

Many network security issues, however, may be solved as the bandwidth available to telemedicine providers increases. For example, according to Doug Power, Senior Consultant and Research Associate at the Regional Development Institute Northern Illinois University, which supports the Illinois Rural Health Network, robust fiber-optic broadband networks will allow telemedicine users and providers to send "secure transmission packets, via their own Virtual Private Network riding over the IRHN." These types of dedicated networks will greatly enhance network security and increase consumer confidence in broadband-enabled telemedicine services.

6.4 RECOMMENDATION #4

Create an efficient and uniform physician licensure system that allows and encourages doctors to use broadband-enabled telemedicine services in the treatment of patients regardless of geographic location.

The interstate (and global) nature of broadband-enabled telemedicine services is also challenging traditional notions of physician licensure, which currently limit doctors to practicing only in the states where they are licensed. The historical basis for state regulation of the practice of medicine is rooted in the Tenth Amendment, which delegates to states the power to, among other things, preserve the public health, welfare and safety of their residents.[246] As a result, states have created licensing requirements and oversight boards to monitor health and medical practices across their territories. But in the modern healthcare marketplace, such laws are not reflective of the borderless nature of many telemedicine services. Thus, licensure laws that limit the practice of medicine to one state might unduly decrease the reach of telemedicine.

In 1997 and 2001, Telemedicine Reports to Congress identified licensure as a major barrier to the development and use of telemedicine services.[247] Additional reports also recommended a more consistent framework to encourage interstate telemedicine.[248] Thus far, incremental progress has been made as a number of alternative licensure models have been offered and considered. Many of these proposals are based on the notion of reciprocity, a system that permits one state to recognize a license in good standing that a practitioner holds in another jurisdiction.[249] These and other models limit the pool of doctors who are allowed to use telemedicine services in the treatment of patients regardless of geographic location. Having to comply with myriad licensure rules could delay treatment and deny a patient the services of a specialist who does not reside in an eligible state under the home state's reciprocity rules.

One recommendation is for the adoption of a national licensure system for telemedicine. Such a system would expand the market for telemedicine, promote both the use and development of new technologies, and eliminate many of the legal and regulatory ambiguities that plague and constrain the present system.[250] A national system would involve the issuance of a license based on a standard set of criteria for the practice of telemedicine throughout the United States. Disciplinary actions resulting from malpractice or other negligence would continue to be carried out at the state level subject to the national standards.[251]

Outdated licensure systems represent a major obstacle to the expansion of telemedicine services. While telemedicine originated primarily as an intrastate service, broadband has removed physical state barriers and has the power to connect doctors and patients located anywhere in the world. As such, licensure models must be revised to provide for interstate (and eventually international) telemedicine services.

6.5 RECOMMENDATION #5

Tort reform is needed to protect telemedicine practitioners from frivolous lawsuits and to encourage the continued adoption of broadband-enabled telemedicine devices and services.

The number of medical malpractice suits and settlements continues to increase each year. Indeed, the cost of medical malpractice torts had the largest growth among U.S. tort costs, totaling $28.7 billion in 2004, having increased an average of 11.7 percent annually since 1975.[252] Telemedicine, by its nature an emerging and cutting-edge medical service, expands the reach of healthcare and thus increases the possibility of medical malpractice suits.[253] As a result, many physicians are hesitant to adopt broadband-enabled telemedicine applications for fear of exposing themselves to greater liability. While doctors who use telemedicine services and tools negligently should certainly not be immune from lawsuits, policymakers should consider reforms that

encourage the use of these services by updating tort laws to include telemedicine and telehealth.

As with licensure, tort laws are largely state-specific. Traditionally in tort cases, an important jurisdictional determination is where a tort occurred.[254] Telemedicine complicates this determination because the doctor and patient are physically separated, which muddies the traditional perception of the doctor-patient relationship.[255] While federal tort law generally holds that the law of the patient's home state controls, telemedicine injects some uncertainty because doctor and patient are connected only by a broadband connection.[256] The possibility exists that a telemedicine provider could be exposed to a number of different tort laws should negligence occur.

The current uncertainty regarding tort law and telemedicine may discourage healthcare providers from adopting broadband-enabled telemedicine devices and services and using them to provide interstate care. Policymakers must recognize that broadband-enabled telemedicine has the potential to radically transform the U.S healthcare paradigm and that antiquated tort laws may potentially discourage physicians and other healthcare providers from using these tools to provide medical care to patients regardless of geographic location.

6.6 RECOMMENDATION #6

A combination of targeted policymaking and public-private partnerships should be used to facilitate the deployment of broadband to unserved areas of the country and to educate consumers about the benefits of telemedicine.

The availability of robust broadband infrastructure is vitally important to the future of telemedicine. Devices and applications will become increasingly more bandwidth-intensive as they provide more sophisticated real-time monitoring, emergency alert, and other time-sensitive services. Thus, for telemedicine to be most effective, broadband must be made available to and adopted by users in every corner of the United States.

To date, broadband network owners have responded to growing demand for more bandwidth by investing billions of dollars in next-generation networks.[257] Yet, for a wide variety of reasons, parts of the country remain unserved.[258] Indeed, even though the FCC has found that "more than 99 percent of the country's population lives in 99 percent of zip codes" in which there is at least one broadband provider, broadband remains relatively scare in those zip codes with the lowest population density.[259] As a result, the public and private sectors must work together on a solution for deploying advanced network infrastructure to unserved parts of the country and to educate the public about the profound impact that broadband services generally, and broadband-

enabled telemedicine services specifically, can have on personal wellbeing. A number of tools are available.

First, as mentioned in Section 4, the federal government should continue to strategically use universal service funding to create unique programs and incentives for deploying advanced telemedicine infrastructure to unserved parts of the country. The FCC's Rural Healthcare Pilot, which, among other things, promotes the creation of proprietary broadband networks dedicated to the transmission of health-related services, has already been successful in spurring innovation and deployment of broadband across the country. Unique approaches like the Illinois Rural Health Net, the University of Virginia's Southwest Virginia Alliance for Telemedicine, and various efforts in Alaska should be looked to as models for crafting solutions that fit specific local or state needs.

Second, local, state, and federal government should promote the use of public-private partnerships to bring broadband and broadband-enabled telemedicine services to rural, low-income, and other unserved consumers. The Connected Nation model, for example, has succeeded in spurring broadband availability and adoption in Kentucky[260] and has been adopted in Minnesota, Ohio, Tennessee, and West Virginia.[261] Additional efforts have succeeded in facilitating the deployment of robust telemedicine services to those most in need. University-based programs that are funded in part by federal grants have been especially successful to date. Similar approaches have led to breakthroughs in the fields of telepsychiatry and remote monitoring, and have helped to harmonize efforts by instituting a public-private standards-setting body for the HIT and telemedicine device sectors.

Third, these efforts must be coupled with efforts to raise awareness regarding the life-enhancing impacts of broadband-enabled telemedicine among a wider swath of patients and care givers. A number of organizations that specialize in bringing broadband to specific segments of the population (e.g., Older Adults Technology Services for senior citizens[262] and One Economy for low-income users[263]) should be used as models to spur demand for and use of these critical tools.

In the near term, special efforts should be made to bolster demand and use of broadband among senior citizens, as this large segment of the population stands to benefit the most from adopting broadband. A high-speed connection facilitates a wide range of social, economic, and health-related benefits for seniors,[264] including a number of previously discussed telemedicine tools and services. Additional efforts might include education campaigns that target seniors, ensuring that online tools are designed in a senior-friendly way, and supporting local initiatives aimed at training seniors to use computers and the Internet.[265]

Overall, a national commitment to incorporating telemedicine into a new healthcare paradigm is critical to transforming how medical care is provided in this country.[266]

6.7 RECOMMENDATION #7

Bolster the nation's pro-investment regulatory framework for broadband in order to encourage continued innovation of networks and telemedicine technologies.

An essential prerequisite for cutting-edge innovation in the telemedicine industry is the wide availability of advanced broadband infrastructure. Indeed, many current telemedicine services rely on robust broadband connections to be effective. Over the next few years, most of the next-generation telemedicine applications and devices developed will be increasingly intertwined with broadband as the network becomes an ecosystem for more individualized medical care. Policymakers should thus bolster the pro-investment policies that have fostered an innovative broadband marketplace over the last decade in order to ensure that the telemedicine sector continues to thrive.

Investment in broadband network infrastructure, robust management and security protocols, and research and development are essential to ensuring continued innovation by developers of telemedicine services and applications. To this end, current economic conditions require careful policymaking that provides investors and innovators with certainty that their efforts will not be made in vain. Federal funding for the deployment of broadband via the recently adopted economic stimulus package will supplement USF funding in the short-term to support further network build-out to unserved parts of the country.[267] In addition, funding that is allocated for expanding and promoting the use of EHRs and other health IT could also be used to bolster the adoption of broadband-enabled telemedicine services in hospitals, care centers, and other medical facilities across the country.[268]

Additional vehicles for strategically targeting these funds to support the deployment of broadband networks to unserved areas and to spur further innovation in the telemedicine sector could include tax breaks to network owners, grants to support telemedicine-focused university programs and public-private initiatives, and innovative incentives for private entities to devote resources to the research and development of cutting-edge services.[269]

7. Conclusion

Healthcare in the United States is an overloaded system that is poised to be furthered burdened as the baby boomers begin to retire.[270] Moreover, a number of reports have questioned the quality of healthcare in the United States by highlighting the high number of avoidable deaths and internal inefficiencies that serve only to raise costs.[271] However, as detailed at length in this paper, broadband-enabled telemedicine has the potential to transform U.S. healthcare.

Broadband is driving innovation across the telemedicine industry. It is increasing the efficacy of HIT by connecting more institutions and allowing for the faster transmission of vital information; it is pushing healthcare into homes and will eventually decrease reliance on hospitals and nursing homes; and it is empowering individual patients by providing them with access to personal health and medical information. As a result, healthcare costs have generally decreased where telemedicine services have been implemented.

In its most recent report to Congress, the Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Healthcare Facilities noted that "[e]nsuring that every American has access to broadband service throughout the country is… an essential healthcare communications imperative. Broadband access can mean access to telemedicine applications, health information, and the ability of healthcare workers to work remotely in an emergency."[272] The future of healthcare is tied to the continued development of broadband-enabled telemedicine applications. Further, the development of these tools is dependent on the continued deployment of advanced broadband networks.

Without a robust, efficiently managed broadband infrastructure that can provide telemedicine users with large amounts of bandwidth, innovation will slow and adoption of these tools will stall. Policymakers should thus continue to implement policies that support investment and encourage innovation while also reforming and updating a variety of healthcare-related laws in order to spur the adoption and use of telemedicine services. By doing so, policymakers will transform the U.S. healthcare system by increasing its reach, enhancing its effectiveness, and decreasing its costs.

ENDNOTES

[1] *See* Dept. of Health & Human Services, Centers for Medicare & Medicaid Services, National Health Expenditure (NHE) Fact Sheet, http://www.cms.hhs.gov/NationalHealthExpendData/25_NHE_Fact_Sheet.asp#TopOfPage.

[2] *See* Carmen DeNavas-Walt, Bernadette D. Proctor, and Jessica C. Smith, *Current Population Reports*: *Income, Poverty, and Health Insurance Coverage in the United States: 2007*, at p. 21, U.S. Census Bureau (2008), *available at* http://www.census.gov/prod/2008pubs/p60-235.pdf.

[3] *Id*. at 19.

[4] According to the Agency for Healthcare Research and Quality's 2007 *National Healthcare Quality Report* ("*NHQR*"): "The average annual rate of improvement reported across the core measures included in this year's fifth annual NHQR is 2.3%, based on data spanning 1994 to 2005. An analysis of selected core measures, which cover data from 2000 to 2005, shows that quality has slowed to an annual rate of 1.5%," at p. iv. This report, released in February 2008, is *available at* http://www.ahrq.gov/qual/nhqr07/nhqr07.pdf.

[5] *Id.* at pp. 3-5.

[6] *See* Jeffrey S. Passel and D'Vera Cohn, *U.S. Population Projections: 2005-2050*, at p. 20, Pew Research Center (Feb. 2008), *available at* http://pewhispanic.org/files/reports/85.pdf.

[7] *See, e.g.,* Cara Buckley, *For Uninsured Young Adults, Do-It-Yourself Healthcare*, Feb. 17, 2009, N.Y. TIMES, *available at* http://www.nytimes.com/2009/02/18/nyregion/18insure.html?_r=1&hp (noting that in 2007 there were over 13 million young adults without health insurance in the United States).

[8] For example, a key component of the recently enacted economic stimulus plan is the allocation of $19 billion for the universal implementation and use of electronic health records. *See* Nancy Ferris, *$19 Billion is Health IT Total in Final Stimulus Bill*, Feb. 12, 2009, GOV. HEALTH IT, *available at* http://govhealthit.com/articles/2009/02/12/19-billion-is-health-it-total-in-final-stimulus-bill.aspx ("*Health IT Stimulus*").

[9] *See* Issue Paper, *Telemedicine, Telehealth, and Health Information Technology*, at p. 3, AMERICAN TELEMEDICINE ASSOCIATION (May 2006), *available at* http://www.americantelemed.org/files/public/policy/HIT_Paper.pdf ("*ATA HIT Paper*").

[10] *Id.*

[11] *Id.*

[12] *Id*. at 2.

[13] *Id.* at 4.

[14] *See, e.g.,* Eric Dishman, *Inventing Wellness Systems for Aging in Place,* at p. 35, COMPUTER MAGAZINE (May 2004) ("*Inventing Wellness*").

[15] See Richard Hillestad et al., *Can Electronic Medical Record Systems Transform Healthcare? Potential Health Benefits, Savings, and Costs*, at p. 1103, HEALTH AFFAIRS, Vol. 24, No. 5 (2005). It is estimated, however, that implementing EHRs across the entire U.S. healthcare system could cost upwards of $100 billion. *See* David Goldman, *Obama's Healthcare Challenge*, Jan. 12, 2008, CNN MONEY, *available at* http://money.cnn.com/2009/01/12/technology/stimulus_health_care/index.htm.

[16] For example, it has been argued that the adoption of Computerized Physician Order Entry systems, which allow doctors to prescribe medicine electronically, can "substantially decrease the overuse, under use, and misuse of healthcare services." *See* Gilad J. Kuperman & Richard F. Gibson, *Computer Physician Order Entry: Benefits, Costs, and Issues*, at p. 31, ANNALS OF INTERNAL MEDICINE, Vol. 139, No.1 (2003),

available at http://www.annals.org/cgi/reprint/139/1/31.pdf. Moreover, studies have found that this type of technology enables cost savings for patients by "allowing doctors to check, with a patient's consent, the relative cost of co-payments for generic, formulary, and non-formulary drugs in a patient's health plan." *See* Laura Landro, *Incentives to Push More Doctors to e-Prescribe*, Jan. 21, 2009, WALL ST. J.

[17] *See* Robert D. Atkinson, Daniel Castro & Stephen J. Ezell, *The Digital Road to Recovery: A Stimulus Plan to Create Jobs, Boost Productivity and Revitalize America*, at p. 1, Info. Tech. & Innov. Found. (Jan. 2009), *available at* http://www.itif.org/files/roadtorecovery.pdf.

[18] *See* Report to Congressional Requesters, *Telemedicine: Federal Strategy is Needed to Guide Investments,* at p. 17, U.S. General Accounting Office (Feb. 1997), *available at* http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=gao&docid=f:n397067.pdf ("*GAO Report on Telemedicine*").

[19] *See, e.g.,* California Telemedicine and e-Health Center, History of Telemedicine, http://www.cteconline.org/telemedicine_history.html (describing "experiments using radio telecardiology (from the 1910s), telephone-mediated telestethoscopy (from the 1920s), and radiology image transfer and videophone experiments (from the early 1950s).").

[20] *GAO Report on Telemedicine* at p. 16.

[21] *Id.*

[22] *See Telemedicine for the Medicare Population: Update*, Agency for Healthcare Research & Quality, U.S. Dept. of Health & Human Services, No. 131 (Feb. 2006), *available at* http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat1b.section.28721 ("In store-and-forward telemedicine, clinical data are collected, stored, and then forwarded to be interpreted later. A store-and-forward system eliminates the need for the patient and the clinician to be available at either the same time or place.").

[23] *GAO Report on Telemedicine* at p. 17 (observing that, by the 1980s, telemedicine began to become prohibitively expensive and that, but for public funding, many innovations and advancements might have ceased altogether.).

[24] According to a 1997 government report, "Telemedicine can be described in many different ways, depending on the level of technology used, main purpose of its use, and transmission timing. At the lowest level, telemedicine could be the exchange of health or medical information via the telephone or facsimile (fax) machine. At the next level, telemedicine could be the exchange of data and image information on a delayed basis. A third level could involve interactive audio-visual consultations between medical provider and patient using high-resolution monitors, cameras, and electronic stethoscopes. This level is currently receiving much attention in literature and demonstrations." *GAO Report on Telemedicine at p. 16.*

[25] *See, e.g.,* Alexander H. Vo, *The Telehealth Promise: Better Healthcare and Cost Savings for the 21st Century*, at p. 1, Univ. Texas Medical Branch, *available at* http://attcenter.utmb.edu/presentations/The%20Telehealth%20Promise-Better%20Health%20Care%20and%20Cost%20Savings%20for%20the%2021st%20Century.pdf ("*21st-Century Telehealth*").

[26] *See* ConnectMD, News & Events, Technology, Telemedicine & Telebabies, http://www.connectmd.com/news_cs_technology.htm.

[27] *See, e.g.,* Elizabeth Olson, *High-Tech Offers Elderly the Chance to "Age in Place,"* May 25, 2008, NY TIMES.

[28] *See* Susannah Fox & Lee Rainie, *The Online Healthcare Revolution: How the Web Helps Americans Take Better Care of Themselves,* at p. 3, Pew Internet & American Life Project (Nov. 2000), *available at* http://www.pewinternet.org/pdfs/PIP_Health_Report.pdf.

[29] *See* Susannah Fox, *The Engaged e-Patient Population*, at p. 1, Pew Internet & American Life Project (Aug. 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Health_Aug08.pdf.

[30] *See, e.g.,* Press Release, *National Survey of Radiologists Reveals Systemic Problems Hurting Industry and Patient Care,* Dec. 3, 2008, Compressus, *available at* http://www.compressus.com/publicwww4/PDF_Press%20Releases/FH%20Compressus%20Survey%20Release%20Final-120208.pdf (reporting the results of a survey that found, among things, that ""Ninety-four percent [of surveyed radiologists] connected the inability of medical imaging systems to communicate with information systems of physicians and hospitals with missed or delayed diagnosis" and "[71] percent of radiologists consider this failure to share data with other physicians and hospitals as a growing crisis for the industry.") ("*Radiologists Survey*").

[31] *See* Report to the Ranking Minority Member, Committee on Health, Education, Labor, and Pensions, U.S. Senate, *Information Technology: Benefits Realized for Selected Healthcare Functions,* at 24, U.S. General Accounting Office (Oct. 2003), *available at* http://www.gao.gov/new.items/d04224.pdf.

[32] http://www.hhs.gov/healthit/community/background/; see also http://www.hhs.gov/healthit/ahiccharter.pdf.

[33] *See Continued Progress: Hospital Use of Health Information Technology,* at p. 1, American Hospital Association (2007), *available at* http://www.aha.org/aha/issues/HIT/resources.html ("*Continued Progress*").

[34] For example, the Marshfield Clinic in Wisconsin has successfully adopted a wide range of health IT tools. "Marshfield's 790 doctors and their support staff at 43 locations in Wisconsin all use the tablet PCs. At the end of last year, the group eliminated paper charts for the more than 365,000 patients its doctors see each year, freeing up storage space the size of a football field at the main clinic in Marshfield." Tablet PCs route patient data to EHRs, which are continuously updated and "include [a patient's] health history, medications, lab tests, treatment guidelines and doctors' and nurses' notes." *See* Steve Lohr, *Healthcare That Puts a Computer on the Team*, Dec. 26, 2008, N.Y. TIMES, *available at* http://www.nytimes.com/2008/12/27/business/27record.html?_r=2&ref=business.

[35] *Continued Progress.*

[36] In October 2008, then-Senator and presidential candidate Barack Obama penned an article for the New England Journal of Medicine that outlined his vision for healthcare reform. Obama focused on the need for modernizing the U.S. healthcare system by, among other things, investing heavily in health IT in order to realize cost savings and reduce medical errors. *See* Barack Obama, *Modern Healthcare for All Americans*, NEW ENG. J. OF MED., Vol. 359, No. 15, pp. 1537-1541 (Oct. 9, 2008), *available at* http://content.nejm.org/cgi/content/full/359/15/1537.

[37] *See In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, First Report, CC Docket No. 98-146, para. 2 (rel. Feb. 2, 1999).

[38] *Id.* at para. 35.

[39] *See High-Speed Services for Internet Access: Status as of December 31, 2007,* FCC Wireline Competition Bureau Report (Jan. 2009), Table 10, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-287962A1.pdf ("*FCC Broadband Stats - Jan. 2009*").

[40] *See High-Speed Services for Internet Access: Status as of December 31, 2006,* FCC Wireline Competition Bureau Report (Oct. 2007), Table 10, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-277784A1.pdf.

[41] *See* U.S. Department of Health and Human Services, HHS Broadband Fact Sheet, http://www.hhs.gov/news/facts/broadbandaccess_.html.

[42] *Id.*

[43] *See, e.g.,* Jim Baller & Casey Lide, *Capturing the Promise of Broadband for the Future of North Carolina & America,* at p. 21, E-NC (June 2008), *available at* http://www.e-nc.org/2008/pdf/Broadband_report_composite.pdf.

[44] *State of Connectivity* at p. 15.

[45] *See, e.g.,* Andrew Pollack, *Who's Reading Your X-Ray?*, Nov. 16, 2003, N.Y. TIMES.

[46] *See* Archie A. Alexander, III, *American Diagnostic Radiology Moves Offshore: Is This Field Riding the "Internet" Wave Into a Regulatory Abyss?* 20 J.L. & Health 199 (2007) (explaining the controversy surrounding outsourcing in general and arguing in favor of teleradiology as beneficial to patients and doctors.) ("*Radiology Moves Offshore*").

[47] *See* Myrle Crosdale, *Admissions Process Aims to Boost Rural Doctors*, Feb. 7, 2005, AMERICAN MEDICAL ASSOCIATION AMEDNEWS.COM, *available at* http://www.ama-assn.org/amednews/2005/02/07/prsb0207.htm.

[48] *See* Texas Tech Health Sciences Center, Telemedicine Training & Consulting, http://www.ttuhsc.edu/telemedicine/institute.aspx.

[49] *See* Joint Advisory Committee on Communications Capabilities of Emergency Medical and Public Healthcare Facilities, *Report to Congress*, at p. 41 (Feb., 2008), *available at* http://energycommerce.house.gov/Press_110/JAC.Report_FINAL%20Jan.3.2008.pdf ("*Joint Advisory Committee Report to Congress*").

[50] MedApps, for example, has released an FDA-approved product that allows for information gleaned from its glucose measuring to be sent via Bluetooth to a patient's cell phone and transmits the information to a central server in near real-time. *See MedApps D-PAL Remote Patient Monitoring System for Diabetes,* July 12, 2007, MEDGADGET.COM, *available at* http://medgadget.com/archives/2007/07/medapps_dpal_remote_patient_monitoring_system_for_diabetes.html.

[51] *See* Robert Litan, *Vital Signs via Broadband: Remote Health Monitoring Transmit Savings, Enhances Lives,* at p. 2, White Paper of Better Healthcare Together (Oct. 2008), *available at* http://betterhealthcaretogether.org/SitesResources/bhctv2/Resources/Documents/VITAL%20SIGNS%20via%20BROADBAND%20FINAL%20with%20FOREWORD%20and%20TITLE%20pp%2010%2022.pdf ("*Vital Signs*").

[52] *See Senior Citizens to See High Tech Sensors in Homes, on Bodies to Monitor Health*, Dec. 6, 2007, SENIOR JOURNAL, *available at* http://www.seniorjournal.com/NEWS/Features/2007/7-12-06-SenCit2See.htm.

[53] *Id.*

[54] *See* Marlis Meyer, Rita Kobb & Patricia Ryan, *Virtually Healthy: Chronic Disease Management in the Home*, at p. 1, *Disease Management* Vol. 5, No. 2 (June 2002), *available at* www1.va.gov/visn8/v8/clinical/cccs/articles/virtually.doc.

[55] *See* Mark Terry, *Three Modalities of Cardiovascular Telemedicine*, 14 J. TELEMED. & E-HEALTH 1031, 1032 (Dec. 2008).

[56] *See* Press Release, *Viterion Telehealthcare Announces Agreement with the Visiting Nurse Service of New York to Provide Telehealth to Home Health Patients at Risk for Re-Hospitalization*, July 12, 2007, VITERION.COM,

available at http://www.viterion.com/web_docs/Viterion-VNSNY%20Press%20Release%2007-12-2007%20rev.pdf.

[57] *See, e.g.,* American Telemedicine Association, Telemedicine Cost Efficiency, http://www.atmeda.org/news/mediaguide/costefficiency.htm.

[58] *Id.* (citing a study of 1,000 patients in Tennessee who were spared having to drive a combined 62,000 miles thanks to various telemedicine services.).

[59] According to the California Broadband Task Force's Final Report, "83 percent of parents of children with special healthcare needs report driving more than an hour to see a specialist. For many of these families, this driving time results in lost work and missing wages. By allowing families the opportunity to be served at local clinics through telemedicine applications that enable remote screening, diagnosis, treatment, and monitoring, families can receive quality care in the communities in which they work and live." *See* California Broadband Task Force*, The State of Connectivity: Building Innovation through Broadband*, at p. 15 (Jan. 2008), *available at* http://www.calink.ca.gov/pdf/CBTF_FINAL_Report.pdf ("*State of Connectivity*").

[60] *21st-Century Telehealth* at p. 8.

[61] *See* Stacie Huie, *Facilitating Telemedicine: Reconciling National Access with State Licensing Laws,* 18 Hastings Comm. & Ent. L.J. 377, 389 (1996).

[62] *Id.*

[63] The Oregon Center for Aging & Technology ("ORCAT") is one institution that has launched a pilot program that uses in-home wireless sensors to monitor cognitive decline among older adults. For more information, *see* ORCAT, Current Research, http://www.orcatech.org/research.php#etac.

[64] *See* International Conference on Alzheimer's disease, *Highlights of Research Findings*, at p. 1, Alzheimer's Association, *available at* http://www.alz.org/icad/downloads/2008_ICADhighlights.pdf.

[65] *See* Press Release, *Alzheimer's disease to Quadruple Worldwide by 2050*, June 10, 2007, Johns Hopkins University Bloomberg School of Public Health, *available at* http://www.jhsph.edu/publichealthnews/press_releases/2007/brookmeyer_alzheimers_2050.html (announcing a study by Ron Brookmeyer et al. entitled *Forecasting the Global Burden of Alzheimer's Disease*).

[66] *See* Sarah Born, *Telemedicine in Massachusetts: A Better Way to Regulate*, 42 New Eng. L. Rev. 195, 202 (2007).

[67] *See* Glen Effertz, *Using a Business Case for Telehealth – A Model for Persuading Decision Makers*, Telemedicine Information Exchange (March/April 2004), *available at* http://tie.telemed.org/articles/article.asp?path=telemed101&article=businessCase_geffertz_tpr04.xml.

[68] *See* Greg Randolph, et al., *Trends in the Rural-Urban Distribution of General Pediatricians*, Pediatrics, Vol. 107, No. 2 (2001), *available at* http://pediatrics.aappublications.org/cgi/reprint/107/2/e18.pdf.

[69] *See* The Children's Partnership, *Meeting the Healthcare Needs of California's Children: The Role of Telemedicine*, at p. 5, Digital Opportunity for Youth Issue Brief, No. 3 (2nd Edition, Mar. 2008), *available at* http://www.childrenspartnership.org/AM/Template.cfm?Section=Home&Template=/CM/ContentDisplay.cfm&ContentID=11343 ("*Telemedicine & Children*").

[70] *Id.*

[71] The College of Dentistry at the University of Florida, for example, has a teledentistry program. *See* College of Dentistry, University of Florida, Overview, http://www.dental.ufl.edu/offices/teledentistry/.

[72] *Telemedicine & Children* at p. 6.

[73] *Id.*

[74] *See* U.S. Department of Health and Human Services, Administration on Aging, *A Statistical Profile o f Older Americans 65+* (June 2008), *available at* http://www.aoa.gov/press/prodsmats/fact/pdf/ss_stat_profile.pdf ("*Statistical Profile*").

[75] *See* Jeffrey S. Passel & D'Vera Cohn, *U.S. Population Projections: 2005-2050*, at p. 20, Pew Research Center (Feb. 2008), *available at* http://pewhispanic.org/files/reports/85.pdf.

[76] *See* Press Release*, Americans with Disabilities: July* 26, May29, 2007, U.S. Census Bureau, *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/010102.html

[77] *See* Robert E. Litan, *Great Expectations: Potential Economic Benefits to the Nation From Accelerated Broadband Deployment to Older Americans and Americans with Disabilities*, New Millennium Research Council (Dec. 2005), available at http://www.newmillenniumresearch.org/archive/Litan_FINAL_120805.pdf.

[78] *Vital Signs* at p. 34-37.

[79] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Senior Citizens*, U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.uschamber.com/assets/env/broadbandseniors.pdf ("*Broadband & Seniors*").

[80] *Id.*

[81] Fifty-five percent of U.S. households have adopted broadband. *See* John Horrigan, *Home Broadband Adoption 2008*, at p.2, Pew Internet & American Life Project (July 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Broadband_2008.pdf.

[82] For example, a 1997 GAO report estimated that "nine federal departments and independent agencies…invested at least $646 million in telemedicine projects from fiscal years 1994 to 1996."*GAO Report on Telemedicine* at p. 3.

[83] *See* FCC, Rural Healthcare Pilot Program, http://www.fcc.gov/cgb/rural/rhcp.html.

[84] *See In the Matter of Rural Healthcare Support Mechanism,* WC Docket No. 02-60 (rel. Nov. 19, 2007), at para. 2, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-279101A1.pdf ("*FCC Rural Health Pilot Order*").

[85] *Id.* at para. 39.

[86] *Id.*

[87] *See, e.g.,* Alan Joch, *Broadband Flows to Rural Clinics,* June 9, 2008, GOV. HEALTH IT, *available at* http://www.govhealthit.com/print/4_18/features/350394-1.html.

[88] For additional information, *please see* HHS: Heath Information Technology, http://www.hhs.gov/healthit/.

[89] *See* Executive Order 13335, issued April 27, 2004, *available at* http://www.whitehouse.gov/news/releases/2004/04/20040427-4.html.

[90] *See* Press Release, *HHS Broadband Fact Sheet*, Feb. 1, 2008, HHS, *available at* http://www.hhs.gov/news/facts/broadbandaccess_.html.

[91] *See* Office of the National Coordinator, *The ONC-Coordinated Federal Health IT Strategic Plan: 2008-2012*, at p.3, HHS (June 3, 2008), *available at* http://www.hhs.gov/healthit/resources/HITStrategicPlan.pdf ("*Federal IT Strategy*").

[92] *Continued Progress.*

[93] *See* Press Release, *Large Survey of Physicians Show Size and Setting Continue as Major Factors Influencing EHR Adoption Rates*, June 18, 2008, HHS, *available at* http://www.hitadoption.org/index.php?module=News&id=cntnt01&cntnt01action=detail&cntnt01articleid=4&cntnt01returnid=30.

[94] *See* Catheric M. DesRoches et al., *Electronic Health Records in Ambulatory Care – A National Survey of Physicians*, New England J. of Med., Vol. 359, No. 1 (2008), *available at* http://content.nejm.org/cgi/content/full/359/1/50 (finding that "Physicians reported positive effects of these systems on several dimensions of quality of care and high levels of satisfaction" and that "Physicians who use electronic health records believe such systems improve the quality of care and are generally satisfied with the systems."); *see also* Steve Lohr, *Most Doctors Aren't Using Electronic Health Records,* June 19, 2008, NY TIMES, *available at* http://www.nytimes.com/2008/06/19/technology/19patient.html ("*Doctors Aren't Using EHRs"*).

[95] *Radiologists Survey.*

[96] *Doctors Aren't Using EHRs* (estimating that implementing an EHR system could cost upwards of $20,000 per doctor). Moreover, it has been argued that the relative low usage rate of EHRs among physicians (as compared to adoption rates of other advanced technologies) is attributable to an inadequate value proposition. In other words, "For many physicians, writing with pen and paper still accomplishes [most] tasks better than electronic systems. And while [healthcare] providers are often expected to bear the cost of implementing an HER system, many of the benefits – such as improved patient safety, data security, care coordination, and disease prevention – accrue to patients, insurers, and payers, but not to providers." *See* Clayton M. Christensen, Jerome H. Grossman & Jason Hwang, THE INNOVATOR'S PRESCRIPTION: A DISRUPTIVE SOLUTION FOR HEALTHCARE 135 (McGraw-Hill 2009).

[97] *Id.*

[98] *See* Anemona Hartocollis, *City to Pay Doctors to Contribute to Database*, Dec. 29, 2008, N.Y. TIMES, *available at* http://www.nytimes.com/2008/12/30/nyregion/30records.html?_r=2&ref=nyregion ("The health department is providing subsidies for doctors to subscribe to the system and teams of trainers to support the transition; so far, more than 1 in 10 of the city's estimated 10,000 primary-care doctors have started using the system, and an additional 500 are in the pipeline.").

[99] *Id.*

[100] *See* USDA, Welcome to the Rural Development Telecommunications Program, *available at* http://www.usda.gov/rus/telecom/.

[101] *See* USDA home page, http://www.usda.gov/rus/telecom/commconnect.htm.

[102] *See* Press Release, *USDA Awards $28 Million for Distance Learning and Telemedicine Grants*, Sept. 18, 2008, USDA, *available at* http://www.rurdev.usda.gov/rd/newsroom/2008/20080918-DLTnewsrelease0908.pdf.

[103] *See* Press Release, *New York Awards $105 million in Health Information Technology Grants,* March 28, 2008, Office of the Governor of the State of New York, *available at* http://www.state.ny.us/governor/press/press_0328081.html.

[104] *Id.*

[105] *See* Massachusetts Senate, Bill No. 2863, *available at* http://www.mass.gov/legis/bills/senate/185/st02/st02863.htm.

[106] *See* Alaska Native Tribal Health Consortium, About, http://www.anthc.org/abt/.

[107] *FCC Rural Health Pilot Order* at Appendix B.

[108] *See Annual Report 2007,* at p. 14, Alaska Native Tribal Health Consortium, *available at* http://www.anthc.org/abt/annrept/upload/AnnMt_version_LoRez_Web.pdf.

[109] *See* Yukon-Kuskokwim Health Corporation, About, http://www.ykhc.org/682.cfm.

[110] *See Testimony of Gene Peltola before the Senate Commerce Committee*, at p. 1, Sept. 16, 2008, *available at* http://commerce.senate.gov/public/_files/GenePeltolaFullCommerceCommitteeTestimony91608FINAL.pdf.

[111] *Id*. at p. 2.

[112] *Id.*

[113] *See Executive Order S-12-06,* July 24, 2006, Office of the Governor of California, *available at* http://gov.ca.gov/executive-order/2616.

[114] *See Executive Order S-23-06,* November 28, 2006, Office of the Governor of California, *available at* http://gov.ca.gov/executive-order/4585.

[115] *State of Connectivity* at p. 71.

[116] *FCC Rural Health Pilot Order* at Appendix B.

[117] *See* Keith Easthouse, *Telemedicine Brings Faraway Patients, Physicians Together,* March 9, 2007, UC DAVIS DATELINE, *available at* http://www.dateline.ucdavis.edu/dl_detail.lasso?id=9358.

[118] For more information, *please see* http://www.healthsciences.okstate.edu/telemedicine/index.cfm.

[119] OneNet was launched in 1992 and has been funded primarily through taxpayer money. It currently serves over 1,600 clients across the state. For more information, *see* OneNet History, http://www.onenet.net/general/category1/sub1/history.htm.

[120] *See* OSU Mobile Telemedicine Clinic, http://www.healthsciences.okstate.edu/telemedicine/mtc/index.cfm.

[121] *See* Gilbert Eric DeLeon, *Telemedicine in Texas: Solving the Problems of Licensure, Privacy, and Reimbursement,* 34 St. Mary's L.J. 651, 661 (2003).

[122] *See* Texas Tech Health Sciences University, History, http://www.ttuhsc.edu/telemedicine/history.aspx.

[123] For more information, *please see* Texas Tech Health Sciences University, Other Projects, http://www.ttuhsc.edu/telemedicine/projects.aspx.

[124] *See* Michelle Cassady, *Telepharmacy System Comes to Earth,* April 6, 2006, DAILY TOREADOR, *available at* http://media.www.dailytoreador.com/media/storage/paper870/news/2006/04/06/News/Telepharmacy.System.Comes.To.Earth-1798047.shtml.

[125] *See, e.g.,* Kirk Johnson, *TV Screen, Not Couch, is Required for This Session,* June 8, 2006, N.Y. TIMES (noting that, as of 2006, "Psychiatry, especially in rural swaths of the nation that also often have deep social problems like poverty and drug abuse, is emerging as one of the most promising expressions of telemedicine. At least 18 states, up from only a handful a few years ago, now pay for some telemedicine care under their Medicaid programs, and at least eight specifically include psychiatry, according to the National Association of State Medicaid Directors. Six states, including California, require private insurers to reimburse patients for telepsychiatry, according to the National Conference of State Legislatures.").

[126] *See* Jamie Stengle, *Mental Health Treatment by Video Growing,* Oct. 9, 2006, USA TODAY, *available at* http://www.usatoday.com/tech/news/techinnovations/2006-10-09-telemedicine_x.htm?POE=TECISVA.

[127] *See* RBHA, Activity Data, http://www.rbha.net/data.html.

[128] *See* RBHA, History, http://www.rbha.net/overview_background.html.

[129] *See* Sharon Salyer, *3-D Video to Improve the Quality of Children's Psychiatric Services*, March 23, 2008, HERALDNET, available at http://www.heraldnet.com/article/20080323/NEWS01/4566228.

[130] *See* Alan Joch, *Broadband Flows to Rural Clinics*, June 9, 2008, GOV. HEALTH IT, *available at* http://www.govhealthit.com/print/4_18/features/350394-1.html.

[131] *See* Sara Foss, *Telepsychiatry Programs Aids Kids in Need,* May 18, 2008, DAILY GAZETTE, *available at* http://www.dailygazette.com/news/2008/may/18/0518_telepsych/.

[132] *See* American Psychiatry Association, Telepsychiatry, http://www.psych.org/Departments/HSF/UnderservedClearinghouse/Linkeddocuments/telepsychiatry.aspx.

[133] *See* Ian Jardine, Linda Kennedy & John Hunter, *A Feasibility Study of the Use of Videoconferencing to Improve Access to Mental Health Services for Mentally Disordered Offenders,* at p. 3, South London and Maudsley NHS Trust (Mar. 2003).

[134] *See* American Psychiatry Association, Telepsychiatry, http://www.psych.org/Departments/HSF/UnderservedClearinghouse/Linkeddocuments/telepsychiatry.aspx.

[135] *Inventing Wellness*.

[136] *See* ORCAT, Current Research, http://www.orcatech.org/research.php#etac.

[137] *See, e.g.,* Elizabeth Olson, *High-Tech Offers Elderly the Chance to "Age in Place,"* May 25, 2008, NY TIMES.

[138] *See* Aging Services: The Facts, *General Facts*, American Association of Homes and Services for the Aging ("AAHSA"), *available at* http://www.aahsa.org/aging_services/default.asp ("*AAHSA General Facts*").

[139] *Id.*

[140] *Id.*

[141] *Id.*

[142] *See* Adam Darkins et al., *Case Report – Care Coordination/Home Telehealth: The Systematic Implementation of Health Informatics, Home Telehealth, and Disease Management to Support the Care of Veteran Patients with Chronic Conditions*, 14 J. TELEMED. & E-HEALTH 1118, 1119-20 (Dec. 2008).

[143] *Id.* at 1122.

[144] *Id.* at 1123.

[145] *Id*. at 1124.

[146] *See* Massachusetts General Hospital, TeleStroke Services, http://www.massgeneral.org/stopstroke/telestroke.aspx.

[147] *See* Gina Kolata, *Cost Put a Stroke Treatment Out of Reach, Then Technology Made it Possible*, May 28, 2007, N.Y. TIMES.

[148] *See* Healthcare IT Standards Panel, About, http://hitsp.org/about_hitsp.aspx.

[149] *See Testimony of HITSP Program Director LeRoy Jones before the House Ways and Means Subcommittee on Health*, July 24, 2008, *available at* http://waysandmeans.house.gov/hearings.asp?formmode=view&id=7234.

[150] *See* HHS, NHIN – Background, http://www.hhs.gov/healthit/healthnetwork/background/.

[151] *Id.*

[152] *See* HHS, NHIN – Trial Implementations, http://www.hhs.gov/healthit/healthnetwork/trial/ (noting that "the NHIN trial implementations leveraged the ongoing work throughout HHS and its contractors and partners, including: the Healthcare Information Technology Standards Panel (HITSP), the Certification Commission for Healthcare Information Technology (CCHIT), the Health Information Security and Privacy Collaboration (HISPC) and the National Committee on Vital and Health Statistics (NCVHS)." Moreover, "once created, the NHIN Health Information Exchange (NHIE) Specifications, testing materials and trust agreements will be placed in the public domain to stimulate adoption.").

[153] *See* Press Release, *Certification Commission Announces Newly Certified EHR Products for Hospitals,* Jan. 22, 2008, CCHIT, *available at* http://www.cchit.org/about/news/releases/2008/Certification-Commission-Announces-Newly-Certified-EHR-Products-For-Hospitals.asp.

[154] *See* Joseph Conn, *Money to Boost EHR Initiatives Nationwide: Stimulus*, Feb. 23, 2009, MODERNHEALTHCARE.COM, *available at* http://www.modernhealthcare.com/article/20090223/REG/302239983 ("*Money to Boost EHR*").

[155] *See* CCHIT, About, http://www.cchit.org/about/index.asp.

[156] *See CCHIT Certified Electronic Health Records Reduce Malpractice Risk*, White Paper of CCHIT (2007), *available at* http://www.cchit.org/files/wpCCHITPhysicianBusinessCaseforCertEHR.pdf.

[157] *See* John Halamka, Mark Leavitt & John Tooker, *A Shared Roadmap and Vision for Health IT*, at p. 2, White Paper of NeHC (Feb. 2009), *available at* http://www.nationalehealth.org/uploadedFiles/Home/News/A%20Shared%20Roadmap%20and%20Vision%20for%20Health%20IT%20-%20Feb%2010%202009%20FINAL3.pdf.

[158] *See* Press Release, *NeHC Statement re American Recovery and Reinvestment Act of 2009*, Feb. 13, 2009, NeHC, *available at* http://www.nationalehealth.org/uploadedFiles/NeHC%20statement%20re%20American%20Recovery%20and%20Reinvestment%20Act%20conf%20report%20021309%20v2%20LM.pdf.

[159] *Joint Advisory Committee Report to Congress* at p. 2.

[160] *See* CTIA – The Wireless Association, Quick Facts, http://www.ctia.org/advocacy/research/index.cfm/AID/10323.

[161] *See* Tricia Duryee, *3G Adoption in the U.S. Exceeds Western Europe: Report*, Sept. 4, 2008, WASH. POST, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2008/09/04/AR2008090400776.html.

[162] *See* Press Release, *Verizon Wireless Customers Can Now Get Medication Information and Dosing Reminders with the Pill Phone Application on Their Phones*, April 16, 2008, Verizon Wireless, *available at* http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=109&STORY=/www/story/04-16-2008/0004793990&EDATE=.

[163] *See* The Pill Phone, https://www.pillphone.com/PillLogin.htm.

[164] A full listing of these applications can be found *at* https://t-mobile.handango.com/PlatformSoftwareSection.jsp?siteId=538&osId=592&topSectionId=6586&platformId=5&parentSectionId=6596&sectionId=6596&catalog=40&title=Personal+Healthcare.

[165] *See* T-Mobile, Production Information – Health Tracker for BlackBerry, https://t-mobile.handango.com/PlatformProductDetail.jsp?siteId=538&osId=592&jid=86583B652D35B5A17EC1C

X1227146F34&platformId=5&productType=2&productId=218317&sectionId=6596&catalog=40&topSectionId=6586.

[166] *See* MIM Vista, Mobile MIM for the iPhone, http://www.mimvista.com/iphone.

[167] *See Case Study: At Home or in Community Hospitals, Baptist Health Patients Get State-of-the-Art Care*, AT&T HEALTHCARE (2008), *available at* http://www.corp.att.com/healthcare/docs/cs_bh.pdf.

[168] *See* Time McKeough, *AT&T's Telehealth Wirelessly Monitors Patients' Health*, Jan. 15, 2009, FAST COMPANY, *available at* http://www.fastcompany.com/magazine/132/futurist-at-t-telehealth.html ("AT&T is developing a software tool and networking platform that will use wireless devices to record a patient's health measurements at home and send the data to the doctor. AT&T's system runs on both Wi-Fi – enabling videoconferencing -- and a second wireless technology named ZigBee, which receives data from medical sensors. ZigBee consumes considerably less power than Wi-Fi, so monitoring devices, including thermometers, pill dispensers, blood-pressure monitors, and pulse oximeters, can use small batteries to transmit data over long periods of time").

[169] *See* Press Release, *La Maestra Community Health Centers Expands Telemedicine Program*, Oct. 17, 2008, VERIZON MEDIA CENTER, *available at* http://newscenter.verizon.com/press-releases/verizon/2008/la-maestra-community-health.html.

[170] *See* Verizon Foundation, Healthcare & Accessibility Grants, http://foundation.verizon.com/core/health-featured_archive.shtml.

[171] *See* Linda Haugsted, *Cox Business Hooks Up Oklahoma Hospitals with Remote Data Tools*, Oct. 2, 2008, MULTICHANNEL NEWS, *available at* http://www.multichannel.com/article/134938-Cox_Business_Hooks_Up_Oklahoma_Hospitals_with_Remote_Data_Tools.php.

[172] *See* ConnectMD, News & Events, Technology, Telemedicine & Telebabies, http://www.connectmd.com/news_cs_technology.htm.

[173] *See* GE Healthcare, Fact Sheet, http://www.gehealthcare.com/usen/about/ge_factsheet.html.

[174] *Id.*

[175] *See* Press Release, *GE Medical Systems Provides NASA Important Heart Monitoring Systems for Space Mission; Advances Use of Telemedicine*, Mar. 1, 2002, GE, *available at* http://findarticles.com/p/articles/mi_m0EIN/is_2002_March_1/ai_83381142.

[176] *See* Press Release, *Intel Announced Digital Health Research Center for Ireland,* Jan. 2007, Ireland Dept. of Enterprise, Trade and Employment, *available at* http://www.entemp.ie/press/2007/20070130b.htm.

[177] *See* Press Release, *GE Healthcare Brings Mobile Computing to Point-of-Care for Enhanced Vital Sign Collection at UCSF*, Feb. 28, 2008, GE Healthcare, *available at* http://pressroom.gehealthcare.com/proom/internet/NewsandEvents.jsp?release_id=14025.

[178] Verizon will invest at least $23 billion dollars on its new FiOS system, *See* Peter Grant & Dionne Searcey, *Verizon's FiOS Challenges Cable's Clout*, WALL. ST. J., Oct. 24, 2007.

[179] AT&T invested upwards of $5 billion by the end of 2008 in its own fiber-optic network, *See* Todd Spangler, *AT&T Ups U-verse Spending Estimates by $500 Million,* MULTICHANNEL NEWS, Nov. 6, 2007.

[180] Comcast is currently deploying a new technology – DOCSIS 3.0 – which will boost broadband speeds that are comparable to fiber-optic speeds *See* Bob Wallace, *Comcast Details its First DOCSIS 3.0 Deployment*, XCHANGE, April 4, 2008, *available at* http://www.xchangemag.com/hotnews/comcast-details-its-first-docsis-3-0-deployme.html.

[181] *See, e.g.,* Charles M. Davidson & Michael J. Santorelli, *Network Effects: An Introduction to Broadband Technology & Regulation*, at p. 12-15, U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.uschamber.com/assets/env/introbroadband.pdf.

[182] *Joint Advisory Committee Report to Congress* at p. 2.

[183] *Id.* at p. 3.

[184] *See* Cisco, HealthPresence, http://www.cisco.com/web/about/ac79/health/hp/index.html.

[185] *Id.*

[186] *See* American Well, About Us, http://www.americanwell.com/aboutus.html.

[187] *See* American Well, How it Works, http://www.americanwell.com/how_american_well_works.html.

[188] *Id.*

[189] *See* Claire Cain Miller, *The Doctor Will See You Now – Online*, Nov. 19, 2008, N.Y. TIMES BITS BLOG, *available at* http://bits.blogs.nytimes.com/2008/11/19/the-doctor-will-see-you-now-online/?scp=58&sq=telemedicine&st=cse (noting that "The first plan to sign on is Blue Cross Blue Shield of Hawaii, which starting in January will offer patients virtual visits with its doctors. Other states and health plans, yet to be announced, will also activate it in 2009…Patients who are members of the health plan pay a co-pay, just like at the doctor's office. Doctors hold 10-minute appointments, which can be extended for an optional fee, and can file prescriptions through the system. Uninsured patients can also use it, for a fee that the health plans choose but which will be less than $50, much less than a visit to the emergency room, which is where the uninsured often end up. Health plans pay American Well a license fee per member to use the software, as well as a transaction fee of about $2 a patient each time a patient sees a doctor.").

[190] *Inventing Wellness*.

[191] *See Healthcare 2015: Win-Win or Lose-Lose? A Portrait and a Path to Successful Transformation*, at p. 30, IBM Institute for Business Value (2006).

[192] *Id.* at p. 26.

[193] *See* Press Release, *Verizon CEO Announces Implementation of New Online Personal Health Records Program for Company Employees*, May 9, 2007, VERIZON NEWS CENTER, *available at* http://newscenter.verizon.com/press-releases/verizon/2007/verizon-ceo-announces.html.

[194] *See* Google Health, FAQ, https://www.google.com/health/html/faq.html.

[195] *See* Dossia, About, http://www.dossia.org/founders/index.html.

[196] *Money to Boost EHR.*

[197] *Id.*

[198] *Id.*

[199] *See, e.g., Operating Profit*, Aug. 14, 2008, THE ECONOMIST (noting that "A report published last month by Deloitte, a consultancy, predicts that the number of Americans traveling abroad for treatment will soar from 750,000 last year to 6m by 2010 and reach 10m by 2012. Its authors reckon that this exodus will be worth $21 billion a year to developing countries in four years' time.") ("*Operating Profit")*.

[200] It has been observed that a doctor-patient relationship forged online can be as effective and beneficial as traditional face-to-face meetings. *See* John D. Blum, *Internet Medicine and the Evolving Legal Status of the Physician-Patient Relationship*, 24 J. Legal Med. 413, 455 (2003) (concluding that "A physician-patient relationship can be forged online, independent of a physical encounter. The potential benefits raised by

cybermedicine can only be realized in a meaningful way if this medium is drawn into the legitimate realm of medical practice, but such development clearly sparks challenges and fears that go beyond basic questions of legality."); *see also* Ronald F. Dixon & James E. Stahl, *Virtual Visits in a General Medicine Practice: A Pilot Study*, 14 J. TELEMED. & E-HEALTH 525, 528 (July / Aug. 2008).

[201] *See* R. Stephen Smith, *Telemedicine and Trauma Care,* 94 South. Med. J. 825-829 (2001), *available at* http://www.medscape.com/viewarticle/410822_print.

[202] *Id.*

[203] SRI International is one of a handful of companies experimenting with this new technology. For more information, *please see* http://www.sri.com/esd/med_devel/telepresence.html.

[204] *See* Meghan Hamilton-Piercy, *Cybersurgery: Why the United States Should Embrace this Emerging Technology*, 7 J. High Tech. L. 203 (2007) (arguing that "The international market for cybersurgeries performed by United States surgeons may be an incentive for the United States to encourage the growth of cybersurgery.").

[205] *See* Bill Crounse, *How the Internet and Wireless Devices Can Revolutionize Medicine,* Mar. 10, 2006, Microsoft, *available at* http://www.microsoft.com/industry/healthcare/providers/businessvalue/housecalls/telemedicine.mspx (observing that "wireless devices promise to make it feasible and less expensive to keep an eye on people who require more frequent attention. So patients who need a gentle reminder to exercise or check their blood sugar can get that reminder without an expensive office visit. Patients in need of rapid intervention can be summoned to a hospital or doctor's office in a timely fashion. The technology makes better use of healthcare resources.").

[206] *See* Mark Terry, *Text Messaging in Healthcare,* 14 J. TELEMED. & E-HEALTH 520, 521 (July / Aug. 2008).

[207] *See Tomorrow's Wireless World,* OfCom (rel. May 7, 2008), *available at* http://www.ofcom.org.uk/research/technology/overview/randd0708/randd0708.pdf.

[208] *Id.* at p. 12; *see also* Adam Sherwin, *New Wi-Fi Devices Warn Doctors of Heart Attacks,* May 7, 2008, THE TIMES, *available at* http://technology.timesonline.co.uk/tol/news/tech_and_web/article3883082.ece.

[209] *Operating Profit.*

[210] *See Innovation, Demand, and Investment in Telehealth*, at p. 70-71, Office of Tech. Policy, U.S. Dept. of Commerce, *available at* https://www.ncsbn.org/2004Report.pdf.

[211] *See* Kao-Ping Chua, *Overview of the U.S. Healthcare System*, at p. 3, American Medical Student Association (Feb. 2006), *available at* http://www.amsa.org/uhc/HealthCareSystemOverview.pdf.

[212] *See Medicare at a Glance,* KAISER FAMILY FOUNDATION (April 2005), *available at* http://www.kff.org/medicare/upload/Medicare-at-a-Glance-Fact-Sheet.pdf.

[213] *Id.*

[214] *See Medicaid: A Primer,* KAISER FAMILY FOUNDATION (Mar. 2007), *available at* http://www.kff.org/medicaid/upload/Medicaid-A-Primer-pdf.pdf.

[215] *Id.*

[216] *See, e.g., Medicare Payment of Telemedicine & Telehealth Services*, American Telemedicine Association (Jan. 2007), *available at* http://www.americantelemed.org/news/Medicare%20Payment%20Of%20Services.pdf.

[217] *Id.*

[218] *Id.*

[219] *Id.*

[220] *See Medicare Pilot to Maintain PHRs,* Aug. 13, 2008, FEDERAL TELEMEDICINE NEWS, *available at* http://telemedicinenews.blogspot.com/2008/08/medicare-pilot-to-maintain-phrs.html.

[221] *Id.*

[222] As of 2006, these included California, Louisiana, Texas, Oklahoma, and Kentucky. *See* Pamela Whitten & Laurie Buis, *Private Payer Reimbursement for Telemedicine Services in the United States*, at p. 2, White Paper, American Telemedicine Association (2006), *available at* http://www.atmeda.org/news/Whitepapers/2006%20Private%20Payer%20Report.pdf.

[223] *See* Robert Pear, *Privacy Issue Complicates Push to Link Medical Data*, Jan. 17, 2009, N.Y. TIMES, *available at* http://www.nytimes.com/2009/01/18/us/politics/18health.html?_r=2&ref=health (describing recent discussions regarding the need for more robust privacy safeguards in the use of EHRs and other electronic transmissions of medical data.").

[224] *See* Sharon R. Klein & William L. Manning, *Telemedicine and the Law*, http://www.netreach.net/~wmanning/telmedar.htm.

[225] *See* Glenn W. Wachter, *HIPAA's Privacy Rule Summarized: What Does It Mean For Telemedicine?*, Feb. 23, 2001, TELEMEDICINE INFORMATION EXCHANGE, *available at* http://tie.telemed.org/articles/article.asp?path=legal&article=h ipaaSummary_gw_tie01.xml.

[226] *Id.*

[227] *See* Jonathan Bick, *Emerging Internet Telemedicine Issues*, N.J. LAW J. (December 24, 2007), *available at* http://www.bicklaw.com/Telemed.htm.

[228] *Id.*

[229] *Id.*

[230] *Id.*

[231] *See* Connecting for Health, Home, http://www.connectingforhealth.org.

[232] *See* The Markle Foundation, Home, http://www.markle.org/.

[233] For an interactive version of the Framework, *see* Connecting for Heath, Connecting Consumers, http://www.connectingforhealth.org/phti/#guide.

[234] The Consumer Policy Brief can bet found *at* http://www.connectingforhealth.org/resources/CCPolicyBrief.pdf. The Technology Policy Brief can be found *at* http://www.connectingforhealth.org/resources/CCTechBrief.pdf.

[235] *See* Connecting for Health, Home, http://www.connectingforhealth.org.

[236] *Id.*

[237] Immediate past HHS Secretary Michael Leavitt recently articulated a set of guiding principles to bolster consumer privacy vis-à-vis digital health information. These included individual access to personal health information, openness and transparency, data integrity, and accountability. In addition, Secretary Leavitt also proposed the use of a label, modeled after the nutritional labels on food packaging, which would allow consumers to quickly compare personal health record products. *See* Press Release, *Secretary Leavitt Announces New Principles, Tools to Protect Privacy, Encourage More Effective Use of Patient Information to Improve Care*, Dec. 15, 2008, HHS, *available at* http://www.hhs.gov/news/press/2008pres/12/20081215a.html.

[238] *See* John Horrigan, *Online Shopping*, at p. 10, Pew Internet & American Life Project (Feb. 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Online%20Shopping.pdf.

[239] *See Overcoming the Psychological Barriers to Telemedicine: Empowering Older Americans to Use Remote Health Monitoring Services,* at p. 6, New Millennium Research Council (Feb. 2007), *available at* http://www.newmillenniumresearch.org/archive/Telemedicine_Report_022607.pdf (noting that as of Feb. 2007, such standards had yet to be developed).

[240] Pew has found that "Spam continues to plague the internet as more Americans than ever say they are getting more spam than in the past." However, users are increasingly adept at adopting tools to manage spam and similar applications. Indeed, Pew found that 71 percent of Internet users use spam filters on their emails accounts. *See* Deborah Fallows, *Data Memo: The Volume of Spam is Growing in Americans' Personal and Workplace Email Accounts, but Email Users are Less Bothered By It*, at p. 1, Pew Internet & American Life Project (May 2007).

[241] *See* Devon M. Herrick, *Telemedicine Provides Benefits, but Security and Privacy Risks Abound,* EMAXHEALTH (2006), *available at* http://www.emaxhealth.com/34/6028.html.

[242] *Id.*

[243] *Id.*

[244] *See Enhancing Quality and Security of Wireless Telemedicine*, Sept. 9, 2007, Rochester Institute of Technology*, available at* http://www.sciencedaily.com/releases/2007/09/070917124408.htm.

[245] *Id.*

[246] *See* Glenn W. Wachter, *Interstate Licensure of Telemedicine Practitioners*, March 10, 2000, TELEMEDICINE INFORMATION EXCHANGE (Mar. 2000), *available at* http://tie.telemed.org/articles/article.asp?path=telemed101&article=interstate Licensure_gw_tie00.xml ("*Interstate Licesnsure*").

[247] *See Telemedicine Report to the Congress*, HHS, GPO No: 0126-E-04 (MF) (1997); *Telemedicine Report to Congress*, HHS, GPO No: 619-261/65410 (2001).

[248] *See, e.g., Telemedicine Licensure Report*, The Center for Telemedicine Law & The Office for the Advancement of Telehealth (June 2003), *available at* ftp://ftp.hrsa.gov/telehealth/licensure.pdf (citing two examples: In 2002, when the House Commerce Committee inserted language in the Safety Net Legislation that expressed the Congressional interest in collaboration among regulatory boards to facilitate elimination of barriers to telehealth practice. (Healthcare Safety Net Amendments of 2002, Pub. L. No. 107-251, 116 Stat. 1621). This legislation was ultimately signed by the President. Similar language was included in the Senate version of the prescription drug legislation pending on Capitol Hill. (See S. 1, 108th Cong., 1st Sess. § 450H, 2003).

[249] *Interstate Licesnsure*.

[250] *See* Peter D. Jacobson & Elizabeth Selvin, *Licensing Telemedicine: The Need for a National System*, 6 J. TELEMED. & E-HEALTH429-439 (Dec. 2000).

[251] *See Telemedicine Report to Congress, Legal Issues—Licensure and Telemedicine*, NTIA (1997), *available at* http://www.ntia.doc.gov/reports/telemed/legal.htm.

[252] *See* U.S. Chamber Institute for Legal Reform, *available at* http://www.instituteforlegalreform.com/issues/issue.cfm?issue=HLD.

[253] *See* Jeffery L. Rensberger, *Choice of Law, Medical Malpractice, and Telemedicine: The Present Diagnosis with a Prescription for the Future*, 55 U. MIAMI L. REV. 31 (2000).

[254] *See Regulatory Jurisdiction*, Mar. 12, 2008, Action for Health, *available at* http://ir.lib.sfu.ca/bitstream/1892/4094/1/Regulatory%20Jurisdiction.pdf.

[255] *See* Patricia C. Kuszler, *Telemedicine and Integrated Healthcare Delivery: Compounding Malpractice Liability*, 25 AM. J.L. & MED. 297 (1999).

[256] *See* Jonathan Bick, *Emerging Internet Telemedicine Issues*, Dec. 24, 2007, N.J. LAW J., *available at* http://www.bicklaw.com/Telemed.htm.

[257] It is estimated that companies will have invested upwards of $60 billion in communications infrastructure in 2008. *See Statement of Jonathan Banks to the Subcommittee on Telecommunications and the Internet, Committee on Energy and Commerce, U.S. House of Representatives*, p. 2, July 22, 2008, *available at* http://energycommerce.house.gov/images/stories/Documents/Hearings/PDF/Testimony/TI/110-ti-hrg.072208.Banks-testimony.pdf (quoting a projection made by Yankee Group).

[258] This gap, however, continues to narrow each year. According to the National Telecommunications Cooperative Association's 2008 Annual Broadband/Internet Availability Survey Report, 91 percent of customers in its 2008 Survey area had access to broadband, *NTCA 2008 Broadband/Internet Availability Survey Report*, p. 8, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2008ntcabroadbandsurveyreport.pdf, up from 70 percent in 2007, *NTCA 2007 Broadband/Internet Availability Survey Report*, p. 7, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2007ntcabroadbandsurveyreport.pdf.

[259] *FCC Broadband Stats - Jan. 2009* at p. 4 and Table 18 (noting that "High population density has a positive association with reports that high-speed subscribers are present, and low population density has an inverse association. For example, high-speed subscribers were reported to be present in more than 99% of the most densely populated Zip Codes and in 90% of Zip Codes with the lowest population densities.").

[260] Connected Kentucky, the predecessor to Connected Nation, helped increase broadband adoption in the state by 83 percent between 2005 and 2007. *See The Economic Impact of Stimulating Broadband Nationally*, at p. 15, A Report from Connected Nation (Feb. 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf ("*Connected Nation Report*"); *see also* Arik Hesseldahl, *Bringing Broadband to Rural America,* Sept. 18, 2008, BUSINESS WEEK, *available at* http://www.businessweek.com/technology/content/sep2008/tc20080917_797892.htm.

[261] *See* Connected Nation, State Programs, http://www.connectednation.com/state_programs/.

[262] *See* OATS, About, http://www.oatsny.org/about_us.htm.

[263] *See* One Economy, Our Work: Broadband/Hardware, http://www.one-economy.com/ourwork/broadband.

[264] *Broadband & Seniors.*

[265] *Id*. at 32-34 (discussing a number of ways to stimulate broadband demand among seniors).

[266] *See* Neal Neuberger, *Advancing Healthcare Through Broadband: Opening Up a World of Possibilities,* at p. 3, Internet Innovation Alliance White Paper (Oct. 2007), *available at* http://www.internetinnovation.org/DesktopModules/iBN%20News%20Articles/Download.aspx?AttachmentID=6.

[267] The final stimulus bill includes $7.2 billion for broadband deployment to unserved and under-served areas of the country. However, mechanisms for identifying these areas and structuring disbursement of

the funds were not included in the bill and will be developed by NTIA and the FCC. *See* Stephanie Condon, *Stimulus Bill Includes $7.2 Billion for Broadband,* Feb. 17, 2009, CNET NEWS.COM, *available at* http://news.cnet.com/8301-13578_3-10165726-38.html.

[268] *Health IT Stimulus.* However, some experts have suggested that these funds should be spent elsewhere, as the current generation of EHRs are unlikely to lead to promised welfare gains. *See* Lisa Wangsness, *Letter Highlights Hurdles in Digitizing Health Records*, Jan. 1, 2009, BOSTON GLOBE.

[269] For example, a number of executives working in the high-tech sector have recommended that any federal stimulus include tax credits for the investment in IT in order to promote continued innovation. *See* Janet Rae-Dupree, *Innovation Should Mean More Jobs, Not Less*, Jan. 4, 2009, N.Y. TIMES (noting that the plan "calls for a tax credit for companies that spend more than 80 percent of what they had been spending annually on information technology like computers and software.").

[270] *See The State of Aging and Health in America 2007,* at p. 2, Centers for Disease Control and Prevention and The Merck Company Foundation (2007), *available at* http://www.cdc.gov/aging/pdf/saha_2007.pdf.

[271] The Institute of Medicine in 2000 found that medical errors in hospitals cause upwards of 98,000 avoidable deaths each year. *See* Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson, TO ERR IS HUMAN: BUILDING A SAFER HEALTH SYSTEM (National Academic Press 2000).

[272] *Joint Advisory Committee Report to Congress* at p. 40.

Attachment #10

THE IMPACT OF BROADBAND ON SENIOR CITIZENS

A Study Commissioned by the U.S. Chamber of Commerce

DECEMBER 2008

A REPORT TO THE U.S. CHAMBER OF COMMERCE

THE IMPACT OF BROADBAND ON SENIOR CITIZENS

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The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School thanks the U.S. Chamber of Commerce for commissioning this report. The ACLP thanks New York Law School Dean Richard Matasar for his continued and unwavering support of the study of those law and policy issues impacting all Americans. And the ACLP is indebted to Senior Fellow Lesley O'Neill and Research Fellow Ann Turner for their invaluable assistance.

Throughout the preparation of this report, the ACLP consulted with a wide variety of organizations, experts, and practitioners that are focused on seniors and technology. The ACLP thanks Tom Kamber, Renee Martinez, and Tracey Halls of OATS for providing access to their training classes and to their vast knowledge and experience with training seniors to use the Internet. In addition, the ACLP thanks: Joy Howell at Broadband Changed my Life!; Lydia Lundberg at Elite Care; Sheila Parkins at Computers4Seniors; Ken Walker at Per Scholas; and Tracy Zitzelberger at ORCAT.

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The views expressed herein are those of the authors and do not represent those of New York Law School.

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The Advanced Communications Law & Policy Institute (ACLP) at New York Law School is a public policy program that focuses on identifying and analyzing key legal, policy, and regulatory issues facing the advanced communications sector. ACLP's mission is to promote robust and solution-focused dialogues amongst state and federal policy makers, industry, academe, the financial community, and consumers concerning changes to the state and federal regulatory regimes governing wireline, wireless, broadband, and IP platforms.

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1. EXECUTIVE SUMMARY

Broadband is changing the way people live their lives. It enables all users to enjoy an array of economic, social, and health-related benefits. Broadband brings people closer together, facilitates small business and job creation, lowers transaction costs for consumers, and otherwise provides users with a gateway to the global digital marketplace.

Broadband is widely available throughout much of the United States.[1] Over 100 million broadband lines are currently in service across the nation.[2] And broadband is being adopted at a healthy clip by consumers. Consider that it took nearly 15 years for wireless phones to reach a 50 percent penetration rate in the U.S.; for broadband, it has taken only nine.[3]

As a result of widespread use and robust innovation across the entire sector, broadband is changing the collective perception of the Internet from primarily a medium for entertainment to a vehicle for the delivery and transmission of life-enhancing and lifesaving data and services. Today, Internet surfers using a broadband connection can make phone calls, maintain a blog, launch a business, and buy and sell goods at the click of a button. Users can also access accurate health information, manage finances, pay bills, and keep in regular contact with a healthcare provider.

This paper, the first in a series that will study the practical impact of broadband on select groups of users and applications, focuses on how broadband is impacting the lives of senior citizens and on how government should approach policy making in order to ensure that seniors (and all consumers) continue to enjoy the fruits of competition, innovation, and investment in the broadband market.

1.1 Broadband and Seniors

This paper assesses the myriad impacts that broadband has had and will continue to have on senior citizens. Until recently, many traditional assumptions associated with aging and elder care often cast seniors in a more passive role, not a proactive one. For a variety of economic, sociological, and technological reasons, this paradigm is now shifting. Broadband-enabled technologies are providing seniors with an interactive lifeline to the world, empowering them to live more robust, healthful, and independent lives.

With the senior population set to double in the coming decades, broadband and broadband-enabled technologies are poised to play an invaluable role in transforming senior life and the senior care paradigm. Continued competition, innovation, and

investment in the broadband market will allow current and future generations of seniors to age in place, stay relevant and connected to their communities, and take advantage of lifesaving applications.

1.2 Overview of the Paper

Section II provides a brief overview of current senior demographics and emerging growth trends for this segment, including information on the coming wave of baby boomer retirees. This section then analyzes the wide variety of senior perceptions regarding the Internet and broadband, focusing on four key topics:

- Availability of broadband
- Awareness & Demand for broadband
- Adoption of broadband
- Use of broadband

As an overview, broadband is widely available and seniors are increasingly aware of and demanding it. However, despite increasing adoption, there is a discernible gap between younger seniors who are enthusiastic adopters and older seniors who remain wary of the technology. Section II will also highlight unique approaches to bringing broadband to seniors and spurring demand.

Section III discusses the current roles and impacts of broadband on seniors. Three broad areas are examined:

- The social impacts of broadband on the daily lives of seniors across the country;
- The economic impacts of seniors using broadband, including personal and economy-wide welfare gains; and
- The effects of broadband on senior healthcare and wellbeing.

To assess the real impacts that broadband is having on seniors, this section includes testimonials and case studies of seniors, service providers, and organizations specializing in the field. These real world stories illustrate the practical impacts of broadband and highlight the types of challenges that remain for increasing adoption among a wider swath of seniors.

Section IV discusses the importance of greater broadband availability and technological advances on seniors. Even though broadband is widely available, actual adoption among seniors remains low relative to other age groups. However, as more robust networks are deployed, and as the technology is adopted by an increasing number of

seniors, a tipping point will be reached, spurring even more innovation in senior-specific applications and content.

In the near term, current pilot projects for training seniors and monitoring the efficacy of a variety of senior-specific health services will yield invaluable data regarding the impact of broadband and broadband-enabled technologies on seniors. Moreover, additional technological innovation will produce a rapidly expanding universe of broadband-enabled senior services. More often than not, such programs and inventions will come from the grassroots level with varying amounts of government involvement.

Successes in the near term will enable robust innovation in the long term, producing ever more useful services, devices, and applications, many of which will rely on broadband. Increased availability, demand, adoption, and use of broadband by seniors over the coming decades will transform the senior care paradigm, promote independence, and extend lives.

Section V discusses best practices for individual actors, collaborations, and government actors to encourage adoption and utilization of broadband and broadband-enabled applications among seniors via targeted education programs, to facilitate continued innovation by service and applications providers, and to incorporate broadband technologies into senior care. There are a number of areas where government can and should play a key role in enabling further adoption of broadband, which include a focus on broadband infrastructure, investment, technological innovation, and the advancement of broadband applications and services that are beneficial to seniors.

1.3 Foundational Principles

As discussed more thoroughly below, a number of ***foundational principles*** should drive public policy:

- Broadband is enabling seniors to live better, longer, and more healthful lives by connecting them to their families and the world around them.
- Broadband provides seniors with an interactive lifeline that enables a wide range of economic welfare gains and lifesaving medical services.
- Those seniors who have already adopted broadband are enthusiastic users and are increasingly incorporating it into their daily lives in a number of ways.
- Awareness, adoption, and use of broadband, however, remain fragmented among various generations of seniors. A number of obstacles stand in the way of realizing the full impact of broadband for all seniors.

- Opportunities exist to spur demand among seniors. These include educating seniors on the usefulness of broadband and providing them with options for getting online, be it at home, in a senior center, in a nursing home, the hospital, or the library.
- Opportunities also exist where local, state, and federal government can act to facilitate the continued development and deployment of advanced broadband networks to seniors living in every corner of the United States.
- Substantial investments in next-generation networks will be essential to realize the full range of broadband benefits for seniors.

2. An Overview of Broadband & Senior Citizens

According to a recent report by the Pew Internet & American Life project ("Pew"), 55 percent of homes had adopted broadband by April 2008, up from just 42 percent in March 2006.[4] However, a significant portion of the population remains offline altogether or continues to rely on slower dial-up connections. Pew has found that among those who continue to use dial-up modems to access the Internet, 62 percent have no desire to switch to broadband.[5] Fully 27 percent of adult Americans are non-Internet users.[6] While identifying the reasons for not embracing broadband is challenging, a recent Consumer Electronics report found that *one of the main reasons among consumers for not subscribing to broadband is the lack of a home computer, not lack of available broadband*.[7] Price remains a sticking point for some while a lack of understanding of what broadband is and what it can do also remains a large obstacle.[8]

Snapshot 1
The U.S. Broadband Market

- 100+ million broadband lines in service
- 1,360 different service providers
- 55 percent home adoption, and rising
- Voice, video, and data provided via broadband
- Prices are down four percent since 2005

Sources: FCC; Pew Internet & American Life Project

While broadband use among seniors has increased significantly over the last five years, a large number of seniors, especially those over 70, remain offline. As more senior-oriented services and applications migrate online, and as new tools aimed at enabling seniors to live healthier and more convenient lives are deployed, it is critical that older adults continue to adopt broadband and use it to enhance their lives.

This section will provide an overview of the current senior population and an analysis of the four key features of broadband use: availability, awareness and demand, adoption, and levels of usage.

2.1 The Senior Population: Demographics and Trends

Understanding the senior demographic, analyzing population growth trends, and assessing economic well-being provides context for identifying areas where broadband is having or could have a beneficial impact on the lives of older adults.

There are currently 37 million Americans over the age of 65, representing just over 12 percent of the population.[9] The number of seniors grew by 10 percent between 1996 and 2006[10] and is poised to double by 2050, at which time seniors will make up nearly 20 percent of the population.[11] The senior population will also grow significantly as "baby boomers" begin to retire in 2011.[12] According to the U.S. Census Bureau, there are over 78 million boomers in America, making it the largest generation in history.[13] Boomers are also among the most prosperous Americans in the country and, compared to those just over 65, are better off financially in terms of retirement savings.[14] However, this prosperity is tenuous due to a shrinking Social Security fund[15] and other economic worries.[16] These concerns, along with improvements in medicine and healthcare, are changing senior lifestyles in many ways.

For example, more and more seniors, especially older boomers, are working past retirement. The proportion of those aged 55 to 64 in the work force rose to nearly 65 percent in early 2008, up 1.5 percent from the year before.[17] The percentage of those over 65 who are still working recently climbed to 16.2 percent.[18] Many jobs require computer skills and seniors are increasingly enrolling in programs to obtain basic computing skills and Internet training. Along with applications to sharpen mental acuity during aging,[19] training seniors to use computers and the Internet are a boon to employers who often struggle to replace experienced and productive senior managers.[20]

These facts bode well for bringing more seniors to broadband. Many older seniors, however, remain skeptical of the need to use the Internet. But, as the following discussion of broadband use among older adults indicates, there are effective ways and methods of bringing seniors of all ages to broadband. Notably, once connected via broadband, most become enthusiastic users and incorporate it into their lives. The challenge is bridging the gap between awareness and adoption of broadband.

2.2 An Analysis of Broadband Use Among Senior Citizens

"Broadband makes my life easier."
~ Alice, 72, Springfield, OH

Alice represents a typical senior broadband user. A relative newcomer to the Internet, she uses her broadband connection to keep in touch with her grandchildren and friends, research topics of interest, and, via email, help produce the weekly bulletin for

her church. For Alice, broadband is *a cheaper and more convenient and affordable option for staying in touch with loved ones and has allowed her to pursue a number of personal interests.* This type of story is increasingly prevalent among seniors who use broadband.

In analyzing the conditions under which a senior begins to use broadband, four discrete issues play a role. ***Availability*** of broadband is the first and perhaps most important factor. If broadband is not available in a given area, then seniors will not have the option of using it. ***Awareness and demand*** is the second factor. If broadband is available, are seniors aware of it? If so, are they demanding it? The analysis will discuss approaches to stimulating demand among seniors. ***Adoption*** of broadband is arguably the most challenging issue. A number of factors (e.g., access to a computer, cost, etc.) contribute to a relatively low adoption rate among seniors even though awareness of and demand for broadband might be higher. However, adoption rates continue to rise due to innovative approaches and programs aimed at educating seniors about broadband. Finally, the amount and types of ***Usage*** will be discussed. (See Snapshot 2 for an overview.)

SNAPSHOT 2
An Overview of the Availability, Awareness/Demand, Adoption, and Use of Broadband by Senior Citizens

Availability	*Awareness & Demand*	*Adoption*	*Usage*
▪ Physical access to broadband for seniors tracks that of the general population ▪ Broadband is widely available ▪ Seniors living in rural areas likely have less access to broadband than other seniors.	▪ Awareness of and demand for broadband is increasing among seniors ▪ There is a gap between younger and older seniors regarding both awareness and demand.	▪ 19% of seniors have adopted broadband at home (Pew). ▪ 65% of seniors remain offline (Pew). ▪ Unique local approaches are effective in increasing adoption of broadband by seniors.	▪ Top uses include searching for health information and keeping in touch with loved ones. ▪ A variety of broadband-enabled tools and services enhance mental acuity among seniors.

2.2.1 Availability of Broadband

Broadband is widely available throughout the United States. Indeed, it is unavailable in only 0.1 percent of zip codes nationwide.[21] The number of broadband lines in service, the types of platforms over which broadband is provided, and the number of different service providers have all increased over the last several years. Nonetheless, some concerns exist that broadband is not sufficiently ubiquitous.[22]

Rural access to advanced communications services has long been a primary concern of policy makers. Broadband penetration is expectedly lower in some sparsely populated areas of the country but, according to the FCC, *competition for customers has driven deployment to most parts of the country.*[23] The U.S. Internet Industry Association ("USIIA") has also found that "the deployment gap between metropolitan and rural areas is closing."[24] Similarly, the National Telecommunications Cooperative Association ("NTCA"), the "voice" of rural telecommunications,[25] recently announced that 91 percent of customers in its 2008 Broadband Availability Survey area had access to broadband.[26] And as the FCC recently observed, "[t]he percentage of the lowest density zip codes with at least one high-speed subscriber increased from 73.5 percent in December 2003 to 90.5 percent as of June 2007."[27]

Seniors are somewhat more likely than the average U.S. resident to live in a rural part of the country. According to the United States Department of Agriculture ("USDA") some 15 percent of seniors live in rural areas, compared with just 12 percent of the general population.[28] In addition, the USDA has observed that, compared to their more urban counterparts, rural seniors "generally have less income, lower educational attainment, and a higher dependence on social security income."[29] Thus, adoption of broadband by rural seniors is especially important because of the many social, economic, and healthcare-related benefits it can deliver. Yet the USIIA has concluded that *lack of demand and adoption, rather than lack of availability, is the chief issue of concern regarding rural broadband efforts.*[30] As a result, it is essential that education and outreach efforts be targeted at rural seniors in order to spur adoption.

Availability of broadband for seniors does not appear to be the primary issue of concern. Rather, as subsequent sections will detail, raising the awareness of and demand for broadband and increasing adoption rates is of paramount concern.

2.2.2 Awareness of and Demand for Broadband

Measuring the awareness of and demand for broadband among seniors is more difficult than assessing its availability or adoption. Although a number of public and private organizations have been launched to assess and spur demand at the state and local levels,[31] many of these efforts, unfortunately, are not focused specifically on seniors. Their general conclusions and observations are helpful, nonetheless, in assessing awareness and demand among groups of people that, for many different reasons, remain unconnected.

Connect Kentucky, a public-private partnership focused on spurring broadband deployment and adoption across the mostly rural state of Kentucky, has noted that a key factor in its successes over the years has been the creation of local eCommunity Leadership Teams to educate consumers on the benefits associated with broadband.[32] More than half of the residents who eventually adopted broadband did so after learning

about the many benefits of broadband Internet access.[33] California's Broadband Taskforce has recommended a number of digital literacy programs and initiatives, including a statewide education campaign to notify all residents of the benefits of broadband.[34] Similarly, the FCC's Consumer & Governmental Affairs Bureau is home to a comprehensive broadband outreach campaign to help foster broadband development by increasing consumer awareness about the benefits and availability of broadband.[35] *Measuring the success of these and other endeavors is complex, but broadband subscriptions have consistently increased in each of the fifty states over the last few years.*[36] Local, community-based initiatives, supported by state and federal agencies, have been the most successful.

A number of trends are evident among older Americans. First, seniors generally are less likely than other adults to own a computer.[37] As the Consumer Electronics Association has observed, "[a]dults over the age of 65 are 21 percent less likely to own a home computer than adults under the age of 30."[38] Notably, *lack of a computer, and not lack of available broadband, is the primary reason for not having broadband at home across every age group and demographic*.[39]

SNAPSHOT 3
Varying Perspectives on the "Gray" Gap

"Broadband is opening a whole new world for me. It's not about what should be, it's about the real world. And broadband is the real world."
~ Hy, 69, Brooklyn, NY

"I felt like I was being left in the dust [without broadband]."
~ Barbara, 77, Averne, NY

"I tried it but it wasn't for me."
~ Bob, 78, Orlando, FL

"Why do I need it? I've gotten along without it."
~ Carmela, 85, Bronx, NY

Second, in general, seniors are becoming increasingly aware of the Internet. As a result, demand for it is similarly increasing. Awareness and demand can be measured by how many seniors have used the Internet. This measure includes those who have adopted broadband and those who have logged on but, for some reason, have yet to fully integrate it into their lives. According to a number of surveys, *senior awareness and demand for broadband has increased significantly over the last decade.* In 1996, only 2 percent of those over 65 went online.[40] By 2000, that number rose to 15 percent.[41] In 2004, 22 percent of seniors had gone online.[42] By 2006, that number was up to 34 percent.[43]

Third, older seniors are less likely to go online than younger seniors. In 2006 more than half of people in their 60s had gone online, compared to just 28 percent of those over 70.[44] Older seniors are more likely to either have a dial-up connection or be completely

offline.[45] Thus, a "gray" gap exists between older and younger seniors.[46] Fourth, anecdotal data suggests that there is wide variation among seniors vis-à-vis their awareness of and demand for broadband (see Snapshot 3).

In light of the above, outreach efforts should focus on increasing meaningful access to computers. Similarly, public and private sector efforts need to focus on educating all seniors about the benefits of broadband in order to spur demand and adoption. Local efforts, like Connect Kentucky, and national endeavors like the Alliance for Public Technology's "Broadband Changed my Life!" campaign,[47] are examples of successful approaches. Additional outreach efforts might be focused on older seniors in the short term in order to close the "gray" gap.

2.2.3 Adoption of Broadband

Adoption of broadband, which usually refers to the in-home installation of the service, is generally lower among seniors than among any other age group. Two main factors account for this. First, broadband demand is usually lower among seniors. Second, seniors are less likely to live in a traditional household than younger generations. Even though the vast majority of adults over 65 live at home, 4.4 percent live in nursing homes.[48] These numbers vary widely among seniors. Only 1.3 percent of seniors between 65 and 74 are in nursing homes; this number rises to 15. 4 percent for those over age 85.[49] Thirty percent of seniors live alone.[50]

Overall, there are three key conclusions regarding the adoption of broadband by seniors. First, the adoption rate among seniors is increasing. Indeed, Pew has observed a significant increase in home adoption of broadband among seniors over the last four years (see Chart 1).

CHART 1

Age Group	% Increase in Broadband Adoption 2005-2008
18-29	84.2
30-49	91.7
50-64	85.5
65+	137.5

Source: Pew[51]

Across all households, 55 percent have adopted broadband.[52] Over the next few years, it is estimated that an additional 20 percent of households, or forty-four million adults, will adopt broadband in their homes.[53]

Yet while broadband adoption among seniors is increasing, only 35 percent have actively adopted it.[54] Closing this gap remains the largest obstacle to unleashing the power of broadband for seniors.

> ***"I have broadband! I started out with dial-up and hated it! I changed over the first six months after owning my computer. I love my high-speed Internet, even though I don't like the monthly cost."***
>
> ~ Joan, 73, Valparaiso, IN

Second, a significant barrier to increased adoption is price. Even though broadband prices continue to decrease, *many seniors live on fixed incomes*. The median income for seniors in 2006 was $23,500 for males and $13,603 for females.[55] For households headed by someone over the age of 65, median income in 2007 was $28,305.[56] By way of comparison, the median income for households headed by someone under the age of 65 was $56,545 in 2007.[57] With the average price of broadband service around $38 per month,[58] compared to $11.99 per month for AOL dial-up,[59] many seniors are opting for the slower but cheaper alternative. Moreover, free dial-up is available in a number of cities like New York.[60] Thus, a key challenge is helping seniors understand that spending an additional $26-38 per month may be worthwhile and could potentially be offset by cost-savings enabled by their broadband connection (e.g., access to cheaper prescription drugs). Once seniors experience the difference between dial-up and broadband, many opt to pay more for the better, more reliable, feature-rich, and less frustrating service.

Third, educating seniors on the benefits of broadband is important to increasing adoption rates. The FCC has observed that "subscribership to broadband services continues to increase steadily as new broadband-dependent services and applications emerge in the marketplace, and that subscribership growth is important due to its relationship with deployment."[61] Demand stimulation and education efforts have positively impacted broadband adoption. In Kentucky, where Connect Kentucky has worked to create demand and tailor supply to bring broadband to unserved areas, availability increased from 60 percent in 2004 to 95 percent in 2007, while adoption increased 83 percent between 2005 and 2007.[62]

Local senior-specific efforts have been similarly successful (see Case Study 1). *These efforts appear to be the most effective means for initially bringing seniors to broadband and encouraging adoption, while national efforts provide critical ancillary support.*

CASE STUDY 1
Older Adults Technology Services ("OATS")

Based in Brooklyn, NY, OATS (www.oatsny.org) is a nonprofit organization that seeks to engage, train, and support older adults in using technology to improve their quality of life and enhance their social and civic engagement. Founded in 2004 by Tom Kamber, OATS employs a teaching model that is specifically tailored to seniors. Broadband, according to Kamber, has made his job easier. Increased Internet connection speeds have decreased the frustration of his students.

In its first two years, OATS taught 491 free classes and special seminars to over 1,170 seniors at nearly 20 locations across New York City. Over the last year, OATS has expanded and now trains upwards of 1,300 older adults per year. OATS works exclusively in senior and technology centers that are wired with broadband. OATS offers a variety of classes: a Basics class that introduces seniors to the computer and the Internet; Advanced class for seniors who want to continue honing their skills; and a Workforce Training program that prepares seniors to continue working or go back to work.

OATS has also partnered with Per Scholas (www.perscholas.org), a computer recycling company based in New York City, to provide free computers to seniors who complete a 10-week training course. After seniors graduate, Per Scholas delivers and installs a computer in the senior's home. The expectation is that seniors will subscribe to broadband after having experienced it in their class. However, Ken Walker, a Vice President at Per Scholas, notes that broadband remains too expensive for many seniors even after they receive a free computer.

Overall, OATS has been very successful in training seniors to access and use the Internet via a broadband connection. According to Kamber, most of OATS's students are in their 70s and half are below the poverty line. Based on direct student feedback, after their training seniors are much more confident in their ability to use the Internet, which in turn increases their confidence to live independently. The majority of students (75 percent) also say their new Internet skills have made them more connected with their family and friends.

2.2.4 Broadband Usage

Seniors who have adopted broadband use it for a wide array of purposes. In 2001, it was observed that the small percentage of seniors who used the Internet on a regular basis were enthusiastic participants in the burgeoning digital marketplace.[63] The most popular application was email, followed by personal research and reading the news.[64] By 2004, while email and personal searches remained the most popular applications for seniors, but looking for health information rose in prominence.[65] In 2006, Pew found that 68 percent of senior users searched for health information online, up from 60

percent in 2004.[66] The most popular health searches among seniors were for information on Medicare and Medicaid.[67]

Moreover, seniors use the Internet as a tool to improve their lives and to allay age-related fears. For example, in 2006 nearly 60 percent of seniors worried about staying "mentally sharp."[68] As a result of increased use and adoption, a number of senior-specific cognitive tools have been put online. Online resources like Crayons for Codgers (http://crayonsforcodgers.home.mindspring.com/) are specifically tailored to sharpen mental acuity. And, as seniors become more confident in their uses of broadband, they are more likely to become active contributors to the web by generating their own content. Senior-authored blogs, for example, are increasingly common. Senior Planet (www.seniorplanet.org) is an online resource where seniors can post blog entries, events, and other items of interest to the community.

> ***"I use the Internet everyday. My top use would be e-mail (for the two businesses in which I am involved). Second would be financial management (bank account, payments, investments), and third would be shopping (mainly organizing trips, buying books or Christmas presents). Broadband has greatly expanded the horizons of information to which I now have access."***
>
> ~ Nancy, 67, Yorktown, NY

The impacts that broadband is having on seniors will be discussed in detail in the next section. As an overview, broadband is enabling seniors to participate more fully in society. Broadband provides an interactive link with family, friends, and communities. Seniors are increasingly using their broadband connections to participate in an array of activities, from finding information on elections,[69] to making travel arrangements,[70] to managing their finances.[71] Increased adoption will serve to spur additional uses and encourage a closer integration of the technology into the lives of senior citizens.

2.3 Conclusions

The data cited and observations made in this section support a number of conclusions:

- Broadband is widely available to all U.S. residents including seniors. Rural access to broadband is also increasing, raising the need for more targeted education efforts to spur demand and awareness of the benefits of broadband among rural seniors and other rural residents.
- Seniors are aware of broadband, and senior demand for it is increasing. Moreover, once online, older adults are enthusiastic and capable users.

- Adoption of broadband among seniors continues to increase at a healthy rate each year. A number of obstacles, though, including the lack of computers among seniors and price, present challenges to more robust adoption. However, more aggressive education and outreach efforts could help to further spur demand, adoption, and use, particularly among lower-income seniors.
- Grassroots education efforts like Connect Kentucky and OATS have been very successful in bringing seniors to broadband. Public sector support, which includes both funding and the acknowledgement of the real power of broadband by policy makers, is an important complimentary measure to bringing more seniors to broadband.
- Enhanced public and private education and outreach efforts are likely required to spur awareness of and demand for broadband among senior citizens, especially older seniors.

3. THE CURRENT ROLE & IMPACT OF BROADBAND ON SENIORS

Broadband has emerged as a vehicle through which advanced services and applications can be delivered to seniors. This section will examine the impact of broadband on three core aspects of senior life.

First, the social impact of broadband on seniors will be discussed. Broadband is allowing a growing segment of the senior population to stay in touch with family and friends and to reconnect with their communities. These basic functions have had enormously positive effects on seniors.

Second, the economic impact of broadband on seniors will be examined. In addition to helping seniors save money on a wide array of items, broadband is also allowing older adults to manage retirement funds online, cut prescription drug costs, and work from home. Economic welfare gains have been observed for individual seniors and the wider economy. The impact of broadband is real and measurable and will continue to expand over the coming decades as more seniors adopt broadband and use it to extend their careers and facilitate a broad range of cost savings.

Third, this section will examine the impact that broadband has had on senior healthcare and wellbeing. Broadband is shifting the traditional elder care paradigm and has the potential to radically transform the senior healthcare system. With adoption rates continuing to increase among seniors, and with the rising tide of tech-savvy baby boomers on the verge of cresting into retirement, broadband is poised to be one of a handful of critical tools necessary for aging seniors in the 21st-century. (See Snapshot 4 for a summary of impacts.)

SNAPSHOT 4
The Social, Economic, and Health-related Impacts of Broadband on Senior Citizens

Social Impact	*Economic Impact*	*Impact on Healthcare & Well-Being*
▪ Broadband increases connectivity with family and friends. ▪ Broadband fosters feelings of relevance and provides seniors with an interactive outlet to the world. ▪ Enhancing personal communications can decrease feelings of depression and isolation.	▪ Individual economic gains include: e-commerce; managing personal finances online; savings on prescription drugs; and enhanced employment opportunities. ▪ Economy-wide gains include increases in: small business creation; seniors in the workforce; senior-oriented content and applications; and healthcare savings.	▪ Broadband is enhancing senior wellness and preventive care. ▪ Broadband is enabling lifesaving and life-enhancing telemedicine services like in-home monitoring. ▪ The potential for broadband-enabled healthcare services and applications is tremendous.

3.1 The Social Impact of Broadband on Seniors

> ***"The Internet is my lifeline to the world!!!"***
> ~ Joan, 73, Valparaiso, IN

Joan's enthusiasm for the Internet has been enhanced by her broadband connection. She subscribes to newsletters on Alzheimer's, pharmaceuticals, and one from the Mayo Clinic, and recently joined Facebook. She also regularly keeps in touch with family and friends via email and looks forward to the day when her youngest grandchildren can email her back. "It won't be long," she says.

Hy, 69, of Brooklyn, New York, agrees that broadband is "opening up a whole new world." He uses his broadband connection and new computer to stay in touch with family and friends and to meet new people. Sandy, 70, of New York, New York is also an enthusiastic subscriber who uses broadband to make business and personal contacts and "keep in better touch."

Similar stories are common among seniors who have adopted broadband.

Broadband is empowering seniors to remain connected – and feel connected. Feelings of isolation are pervasive among many older adults. With some 30 percent (nearly 11 million) of non-institutionalized seniors living alone, feeling disconnected and remote from family, friends, and community is common and can lead to depression or a host of other debilitating diseases. Studies have found that seniors who master computer skills appear to have fewer depressive symptoms than those who remain technologically unconnected[72] and that increased integration through social support services can protect against some mortality risks and lead to better mental health.[73] Anecdotal evidence also supports this. For example, broadband-enabled web-cams are an increasingly popular (and affordable) way for seniors to stay in touch with children and grandchildren who live far away.[74]

Broadband is enabling an array of senior interactions with people and the community via email, chat rooms, blogs, and news sites and has enabled them to participate in a host of activities that might otherwise be out of reach. Tom Kamber of OATS has found that *increased social integration and interaction via broadband increases feelings of relevance among seniors*. This, in turn, empowers seniors and provides them with confidence to live more independently.

Seniors are also empowered to make better informed life decisions by the availability of online content specifically tailored for them. AARP's website, for example, contains a universe of content, applications, and services for adults over the age of 50 (www.aarp.org). AARP also includes technology information like tips on buying a computer and basic web lessons.[75] Other senior-centric sites include Senior Journal (www.seniorjournal.com), Senior Net (www.seniornet.org), and Elder Web (www.elderweb.com).

Blogs are yet another tool for seniors to reconnect with the community[76] and stay mentally sharp.[77] The number of blogs either targeted at the senior population or authored by seniors continues to increase. One blog, tech4seniors.blogspot.com, is billed as "A place for Senior Citizens to learn and embrace Twenty-First Century technology." Another senior blog, Senior Planet (www.seniorplanet.org), provides a forum for seniors to interact and chat with each other.

Broadband also positively impacts seniors by bringing them together for training classes. Most classes are taught at local senior centers and offer seniors a more interactive, hands-on activity than more traditional programs. Small class sizes, like the six student cap imposed by Computers4Seniors in Cobb County, Georgia, fosters a sense of community among fellow students.[78] Computers4Seniors relies on volunteers to train seniors. Oftentimes, the volunteers, according to Program Director Sheila Parkins, are retirees of local technology companies like Lockheed Martin or IBM.

Conversely, OATS in New York has developed an intergenerational program that allows high school students to teach computer and Internet skills to seniors. The high school students are able to hone their communications and teaching skills while the seniors gain insight and share in their younger counterparts' enthusiasm for the web.[79] One of the program's participants said that "[t]he best part of the program is coming on Tuesday and Friday and being with friends and neighbors." [80]

Broadband holds much promise for keeping (or reconnecting) seniors to society and warding off feelings of isolation and depression. These benefits are especially relevant to older seniors as mental and physical health tends to decline at a much faster rate over the age of 80.[81] *With a large number of older adults remaining offline or tethered to slower dial-up connections, bridging the gap between wired and unwired seniors presents a challenge*.

3.2 The Economic Impact of Broadband on Seniors

The economic impact of broadband on individuals of all ages and on the entire U.S. economy is real, measurable, and well documented. Broadband impacts job creation, spurs small business creation, facilitates robust e-commerce, saves money, increases efficiency, and has quickly become the critical information backbone for our globalized world.[82] A recent study prepared for the Department of Commerce found a direct correlation between broadband availability and economic growth.[83] Similarly, Connected Nation, the parent organization of Connect Kentucky, estimates that a seven percentage point increase in broadband adoption "could result in $92 billion through an additional 2.4 million jobs per year created, $662 million saved per year in reduced healthcare costs…and $134 billion per year in total direct economic impact of accelerating broadband across the United States."[84]

As discussed below, broadband has positive economic impacts on seniors. Older adults are using broadband to facilitate personal economic gains, which have a cumulative impact on the wider economy. The economic impact has been profound for those seniors already online, presaging even more robust gains as more seniors adopt broadband.

3.2.1 Individual Economic Gains

The individual economic gains for seniors due to broadband range from discounts on items bought online to savings on prescription drugs to allowing a senior to telecommute to work, to reducing the transaction costs of even the smallest of tasks – e.g., food shopping.[85] This section will explore additional ways that broadband facilitates economic gains for seniors.

3.2.1.1 *E-Commerce*

One of the most popular economic applications of broadband across all demographics is participating in e-commerce, which allows for easy ordering and delivery of a nearly infinite array of goods and services online. In the second quarter of 2008, the Census Bureau found that e-commerce sales accounted for 3.3 percent of total retail sales in the United States, up from approximately one percent in 2000.[86] By 2008, two-thirds of American Internet users had purchased something online.[87]

Shopping online provides all consumers with access to discounted items, novel product information, and the ability to easily compare prices before purchasing. Thus, for those living on a fixed income, using a broadband connection to shop online could result in cost savings, which in turn could offset part or all of the monthly cost of a broadband connection. Seniors, however, represent the smallest segment of those who have made purchases online.[88] Older adults tend to be warier of providing personal information online and skeptical about whether shopping online saves time.[89] Moreover, Pew observes a correlation between connection speed and online shopping: "People with broadband at home are more likely than dial-up users to have bought something online, by a 74 percent to 59 percent margin."[90] Educating seniors on the potential cost-savings associated with shopping online and the many security apparatuses that have been implemented to ensure the safe transmission of personal information could spur additional use of broadband for these and other purposes.

3.2.1.2 *Drug Cost Savings*

Broadband facilitates the easy comparison of prices for many prescription drugs. For example, in 2004 *Checkbook* magazine found vast price differences among prescription drugs within the same metropolitan areas and concluded that online retailers often offered lower prices for certain drugs.[91] A wide array of online resources has been developed for seniors who are looking for affordable prescription drugs. *AARP, for example, has partnered with Walgreens to provide seniors with an online portal to purchase discounted drugs*.[92]

Another key area where broadband has had a real and practical impact on seniors is in *navigating the Medicare website to order prescription drugs and manage benefits.* Reforms implemented on January 1, 2006 created a new system that, while providing seniors with a number of new options, flooded participants with a deluge of information. Indeed, by 2008 there were some 1,824 different stand-alone plans available.[93] Unfortunately, the large number of choices and relatively poor customer service provided by the Medicare Helpline caused much confusion among seniors.[94] Participants in the plan were directed to the online portal to register and submit plan choices. This move assumed a certain level of facility with computers and the Internet. Fortunately, local organizations provided training to seniors to assist in the application

process. OATS of New York, for example, operated 28 clinics at six locations in Manhattan and the Bronx and helped lower-income seniors save a total of $19,000 on their drug costs.[95] Peer counselors were used to provide seniors with intra-generational support. As peer counselor Areatha, 77, of New York, observed: "With so few seniors using the Internet today, these peer counseling clinics are the best way for a lot of people to get the information they need."[96]

3.2.1.3 Managing Personal Finances

Broadband also appeals to older adults who wish to manage their personal finances. A wide range of broadband-enabled activities have been observed, ranging from checking bank account balances online to having bills paid automatically to managing retirement portfolios. Participation in these activities by seniors who have adopted broadband is robust and continues to increase.

AARP recently found that nearly three-quarters of retired workers received the majority of their retirement income from Social Security.[97] Forty percent received some form of pension from an employer and about 27 percent received income from an IRA or company-sponsored 401(k).[98] However, Merrill Lynch observed a shift in the traditional model of retirement among older boomers and younger seniors. In a 2005 report, Merrill found that "the majority of boomers relate that they plan to keep working and earning in retirement."[99] Yet these more affluent and younger seniors tend to worry about running out of money due to unforeseen illness or having to care for loved ones.[100] As a result of these worries and the opportunity to work past retirement, *many seniors are actively using their Internet connections to manage a growing variety of investments in order to assure a secure retirement.*

> ***"You can't trade stocks effectively with a dial-up connection, especially since most of these sites stream real-time market data."***
> ~ John, 65, Dallas, TX

John, 65, of Dallas, TX exemplifies the savvier segment of older adults who actively use their broadband connections to manage retirement savings and other investments. John first started using the Internet in the early 1990s. "At that time, my company was just beginning to go paperless. We got in a shipment of laptops and they slowly began giving them to us," he remembers. As a salesman who worked mostly from home, John was an early adopter of the Internet. John is currently semi-retired (he continues to freelance from home, which is facilitated by his broadband connection) and uses broadband to manage investments. John observes that his broadband connection has allowed him to seize control of his portfolio. He supplements prior financial knowledge with e-newsletters from providers like Investor's Business Daily, Morningstar, and Kiplinger's. John estimates that he saves quite a bit of money by being his own financial

planner. "There are no commissions or fees when you cut out the middle man. Only subscription fees for the newsletters and trading services."

Recent economic uncertainty has decreased optimism among many seniors for a comfortable retirement. Many are postponing retirement in order to continue working and adding to their savings.[101] Broadband-enabled personal financial services and applications are increasingly essential to seniors in this endeavor. *They empower older adults to take control of their portfolios and have a stake in the allocation of their funds.* Seniors can save money and quickly shift strategies, all from the comfort of their home.

3.2.1.4 Employment Opportunities Extended

Broadband is enabling seniors to extend their careers past retirement age or embark upon new careers via the Internet. This is important in light of workforce projections that predict a shortfall in experienced, management-level workers in the coming years.

The Bureau of Labor Statistics (BLS) has estimated that the U.S. economy will add 18.9 million jobs in the decade ending in 2014.[102] Yet, over the same period, nearly 36 million workers are expected to leave their jobs permanently and will need to be replaced.[103] According to AARP, older adults are poised and willing to work past retirement: "69 percent of workers [between the ages of] 45 to 74 plan to work during retirement years. Many want to work on different terms, with more flexibility and autonomy than during earlier careers. *Seventy percent of older workers say they are looking for ways to balance work and their personal lives, and 41 percent report that the ability to work from home is an absolutely essential part of their ideal job."*[104] A recent report issued by the Taskforce on the Aging of the American Workforce observed that the supply of seniors in the workforce will increase significantly over the next decade 2014, rising by 74 percent between 2004 and 2014.[105] *As AARP concluded, broadband will play a major role in extending the careers of seniors.*[106] A key component of such is telecommuting.

Broadband has facilitated the deployment of telecommuting programs in offices across the country. Indeed, some 42 percent of employers currently offer employees a telework option, up from 30 percent in 2007.[107] Gartner estimates that 12 million people telework more than eight hours per week, double the amount in 2000.[108] By 2009, Gartner expects this number to reach 14 million.[109] The Taskforce on the Aging of the American Workforce has recommended that employers promote telework and flexible retirement options for older workers in order to retain them[110] and continue benefiting from their managerial experience and expertise.[111]

3.2.2 Economy-Wide Welfare Gains

It is widely accepted that broadband will produce enormous consumer welfare gains across the entire economy. One study, from 2001, estimated that these gains would

amount to $400 billion annually.[112] Recent studies have projected lower annual gains, but estimates remain in the hundreds of billions of dollars.[113] The cumulative expected impact of individual welfare gains by seniors using broadband on the wider economy is similarly impressive. According to a 2005 study, *the aggregate cost savings due to the use of broadband by seniors and in the care of seniors was estimated to be between $532 billion and $847 billion by 2030*.[114] This estimate includes savings realized from increased efficiencies in health care and the economic impact of having more seniors in the workforce.

In addition, broadband stimulates small business creation and promotes entrepreneurship among seniors by lowering the costs of starting and running a business. For example, Barbara, 77, uses her broadband connection to support her career as a public speaker (www.barbarahillary.com). She uses her website to publicize her experience and to solicit speaking offers. Senior Net partnered with eBay in 2000 to provide computer and Internet training for seniors who wished to use eBay as a vehicle for selling possessions or hand-made goods.[115]

Moreover, the business of bringing seniors to broadband is thriving. A growing number of small businesses and nonprofit organizations have been established in response to increasing demand for broadband and computer skills by seniors. Similarly, senior-oriented services are thriving due in large part to the rapidly increasing demand for and adoption of broadband. It has been observed that seniors, unlike their younger counterparts, represent a "sticky" demographic from a marketing perspective, meaning that seniors are more likely to be more loyal users of certain services and not switch as rapidly or be as fickle as younger users.[116] This has spurred investment in senior-specific websites and online services.[117]

Recent economic uncertainty, however, threatens to slow the economic gains of seniors.[118] The number of seniors living in poverty[119] or who have declared bankruptcy[120] has increased in recent years, especially among older seniors. *These trends highlight the importance of broadband as an interactive tool that can be used to take control of one's financial well-being*. Broadband enables seniors to save money on a variety of items including prescription drugs, to continue working, and to put them in direct control of their finances. As such, educating seniors on the benefits of broadband for them is of critical importance.

3.3 The Impact of Broadband on Senior Wellbeing and Healthcare

Broadband and the universe of applications enabled by it are transforming the way technology is used in caring for aging adults. Indeed, broadband has sparked a reassessment of many of the perceptions associated with elder care. For example, personal wellness systems – services that use technology to promptly address the deleterious aspects of aging – are increasingly popular and are replacing older models

of senior healthcare that seemed to focus more on easing seniors into the last phases of their lives. Moreover, a wide range of broadband-enabled tools and services are being developed to augment the nation's approach to senior healthcare.

The transformation of senior healthcare is inextricably linked to a renewed focus on senior wellbeing. Senior wellbeing refers to the ways in which older adults prepare for and counteract the effects of aging. The traditional approach relies largely on passive techniques like "managing illness," which is reactive to health crises.[121] The new focus, however, is on "maintaining wellness," which represents a more holistic approach to the aging process.[122] From a healthcare perspective, broadband allows seniors and their caregivers to "personalize and 'consumerize' health and wellness technologies."[123] From a wellbeing standpoint, broadband empowers individuals by providing them with tools to maintain and improve mental and physical health.

This section will detail how broadband is becoming an indispensable tool for seniors who wish to increase their personal wellbeing and for the healthcare industry as it prepares to care for larger numbers of senior citizens. The interactive and real-time nature of broadband makes it one of the important innovations in U.S. healthcare.

3.3.1 Broadband & Senior Wellbeing

Broadband and broadband-enabled technologies are being used to enhance senior wellbeing in three important ways.

First, broadband Internet access provides seniors with a critical outlet for obtaining increasingly sophisticated medical and health information and allows them to be preemptive and interactive in their efforts to combat the harmful effects of aging.

In 2006, Pew estimated that nearly 70 percent of adults over the age of 65 and 80 percent of boomers used the Internet to find medical information.[124] A 2005 report issued by the Kaiser Family Foundation concluded that seniors have the most to gain from online health and medical resources because seniors "face a greater number of health conditions and use prescription drugs and health care services at a far higher rate than younger adults."[125] Seniors with broadband connections are more likely to go online for health information than those with dial-up connections.[126]

In response to increasing demand for online health and medical information among seniors and older baby boomers,[127] a number of broadband-enabled resources have been deployed. Sites like WebMD (www.webmd.com) and Family Doctor (www.familydoctor.org) provide general health information for all users and have solid reputations for providing accurate and up-to-date entries. Senior-specific health portals have also been deployed and have been well received. The Mayo Health Clinic, for example, has a dedicated Senior Health Center (www.mayoclinic.com/health/senior-

health/HA99999) that provides pertinent information on a wide range of common senior ailments and diseases. AARP recently launched four new online tools specifically tailored to enable seniors to "do everything from choose an excellent doctor or hospital, to better understand and evaluate their own health symptoms, conditions and medicines."[128] The National Institute of Health ("NIH") also has a web portal dedicated to senior health information (http://nihseniorhealth.gov/). These and a wide range of additional broadband-enabled tools are providing seniors with reliable, current, and lifesaving information.

Second, broadband and broadband-enabled applications are being used to help sharpen brain function among seniors. Many experts agree that since "older" brains retain a large amount of "semantic memory" (e.g., facts and figures) and "expert knowledge" (i.e. specialized information re a particular skill or hobby), mental functions can be kept sharp by targeted brain exercises.[129] As a result, broadband-enabled brain exercises are increasingly popular online destinations for seniors. These include tools created by Spry, Posit Science, and MindFit, among many others.[130] Other broadband-enabled activities include participating in online multiplayer games like Second Life[131] and fitness games on gaming consoles like the Nintendo Wii, which is extremely popular with seniors.[132]

Brain exercises in general have been found to delay cognitive decline and the onset of dementia and Alzheimer's.[133] It has been estimated that such diseases "cost the United States more than $148 billion annually in Medicaid and Medicare services and in indirect costs to businesses that employ [Alzheimer's] and dementia caregivers."[134] Intervening in the development of the disease can contribute to delaying the onset of Alzheimer's and other dementia. It was recently estimated that "interventions that could delay the onset of Alzheimer's disease by as little as one year would reduce prevalence of the disease by 12 million fewer cases in 2050."[135]

Third, broadband and broadband-enabled content empowers older adults with information, provides them with a vehicle for participating in their community, improves mental health, and enables them to live more independently. The result is a shift in the paradigm for elder care, one that supports more seniors aging in place and that decreases senior dependence on caregivers and on other aspects of the traditional healthcare model, all of which will have measurable social and economic impacts.

3.3.2 Broadband & Senior Healthcare

Approximately 60 percent of all health care spending in the United States is spent on seniors.[136] By one estimate, among people turning 65 today, 69 percent will need some form of long-term care.[137] With the population of seniors expected to double in the coming decades, senior health care will become more costly. Recent innovations, driven

by wider broadband availability, have the potential to radically transform the current senior healthcare paradigm.

It has been estimated that broadband-based health resources can save some $927 billion in health care costs for seniors and people with disabilities.[138] A large percentage of these cost-savings will be realized via the development and deployment of broadband-enabled telemedicine services, specifically in-home health monitoring technologies and other remote care services. These innovations, which largely rely on a reliable broadband connection to link doctor and patient, have the potential to transform elder care by lowering healthcare costs, increasing the efficient use of health care professionals, and freeing seniors from the strictures of traditional senior care.[139]

3.3.2.1 In-Home Monitoring Technologies

Many in-home monitoring systems use wireless sensors to track a senior's movements, record falls, and upload health information to a web-based interface that is accessible by caregivers and family members. *Broadband is being used to augment these systems by providing real-time data transmission capabilities*. For example, a series of pilot projects at the Oregon Center for Aging & Technology ("ORCAT") are using broadband-enabled real-time monitoring in order to gather critical cognitive and mobility data in an effort to detect mental decline at an early stage (see Case Study 2). As these technologies progress, more robust broadband networks will enable more intelligent software to analyze personal health data and send out alerts to caregivers.[140]

The falling prices of sensors and other technologies related to in-home monitoring, along with the convenience associated with these systems for seniors, caregivers, and family members, have spurred interest in and demand for such services.[141] *One study projects the market for monitoring services will become a $2 billion per year industry by 2010*.[142] The same study estimates that 3.4 million seniors will be using networked sensor applications to monitor and improve their health by 2012.[143] And even though seniors have expressed privacy concerns regarding the use of tracking devices, AARP found that a majority would consider subscribing to these services so long as they were affordable.[144]

The use of broadband-enabled in-home monitoring technologies has many positive impacts on seniors and the wider healthcare industry. From an economic standpoint, the cost savings associated with more widespread use could be significant. Consider that the average cost for a private room in a nursing home is $213 per day or $77,745 annually.[145] The average monthly cost of living in an assisted living facility is $2,969 or $35,628 annually.[146] And the average hourly rate for a certified home health aide is $32.37.[147] Medicare and Medicaid pay for the vast majority of long-term care.[148] Effective implementation of an in-home monitoring system could reduce or eliminate certain expenses for many seniors, and the concomitant burden on federal funds, at

least for a period of time. From a wellbeing standpoint, aging in place offers many seniors a more comfortable and mentally rewarding lifestyle. Moreover, these innovative new technologies enable seniors to monitor their health in real-time and potentially preempt fatal or degenerative disease.

CASE STUDY 2
Oregon Center for Aging & Technology ("ORCAT")

Over the last several years, ORCAT, which is based at the Oregon Health & Science University, has launched a number of pilot initiatives in the Portland area to test the effectiveness of in-home monitoring technologies for seniors. According to Tracy Zitzelberger, the Center's Administrator, ORCAT is trying to gather sufficient data to show the efficacy of these services while also creating a service that allows seniors to age in place. ORCAT uses radio frequency sensors to monitor mobility and cognitive functions. ORCAT sees a relationship between these two functions and has offered a number of studies that support their argument that gathering real-time data allows caregivers and family members to track the mental decline of a senior.

One of ORCAT's current pilots has participants in over 300 homes across the Portland area. Each of the study's participants is over 80 and has agreed to be monitored by a net of wireless sensors deployed throughout their homes. Mobility data is gathered by the sensors and sent wirelessly to a laptop computer, where the data is time-stamped and uploaded daily to the project center. They are required to provide email feedback via a broadband connection provided by ORCAT. Data is supplemented by regular email communications from the participants regarding their experience. The preliminary conclusion by researchers was that "it appears that the perceived benefit of ultimately understanding how such systems might extend or enable their independent living outweighed any concerns about disruptions to their daily activities." (Jeffrey Kaye et al., *Deploying Wide-Scale In-Home Assessment Technology*, available at www.orcatech.org/papers/FICCDAT_07_Kaye.pdf).

Zitzelberger observes that while broadband has been beneficial to ORCAT's research efforts, "It is too slow and too asymmetric." She feels that fiber-optic connections would be better for the delivery of real-time data. In the near-term, the program will continue with its pilot programs to see whether in-home systems are effective in tracking cognitive health and preventing dementia. It is hoped that in-home monitoring systems will shift the traditional paradigm associated with Alzheimer's and other dementias away from treatment and towards early detection and prevention.

3.3.2.2 *Additional Remote Care Technologies.*

A wide range of additional remote care technologies enable seniors to live more independent lives and to age in place. Examples of these technologies include a vibration-based fall detector[149] and wander management systems.[150] These and other "person-centric" technologies promote independence among seniors and a culture of personal responsibility by untethering seniors from caregivers and institutional care.[151] *As AARP recently found, the vast majority of seniors – 87 percent – prefer to have help provided to them in their home while a similar percentage of older adults said they are willing to sacrifice some of their privacy in order to remain at home during their later years*.[152] While many of these services currently do not use broadband, leveraging the ubiquity of high-speed networks will enhance the ability of these services to gather and transmit more data more quickly.

3.4 Conclusions

Broadband enables a universe of technologies, services, and applications that provide seniors with real social, economic, and health gains. In particular:

- Broadband connects seniors to family, friends, and community by providing them with an interactive lifeline to the growing universe of information and services available online.
- Connecting seniors promotes a more independent lifestyle. Older adults who are more consistently engaged are less depressed and more active.
- Broadband provides seniors with a medium through which they can realize significant economic gains via comparison shopping, lower drug costs, managing personal finances, telecommuting, and small business creation.
- Broadband is also spurring innovations within the senior healthcare industry, which promises to transform the traditional elder care paradigm and refocus efforts on senior well-being.
- The use of broadband and broadband-enabled tools by seniors and in the care of seniors has the potential to reduce healthcare costs by billions of dollars each year, to encourage the creation of small businesses and nonprofits focused on educating and training seniors to use broadband, and to foster an innovative marketplace for senior-oriented content and services.

Acknowledging and promoting these successes is essential to attracting more seniors to broadband. It has been found that "the usefulness perception of [information

technologies by] senior citizens can be driven by both tangible benefits such as resource savings and intangible benefits such as self-actualization."[153] In other words, the more that seniors are aware of the many benefits of broadband and experience the tangible benefits associated with it, the more they will demand and adopt it. *Thus, the coordinated efforts of local, state, and national organizations and broadband campaigns should focus on touting the practical uses and impacts of broadband for seniors.*

4. THE IMPACT OF GREATER BROADBAND AVAILABILITY & TECHNOLOGICAL ADVANCES ON SENIORS

Greater broadband availability and continued technological advanced will result in a number of positive impacts on seniors in the coming years.

4.1 Innovation at the Network Level

First, innovations at the network level will enable a number of near-term innovations by providing more robust infrastructure, faster speeds, and more reliability. Over the next several years, network owners are poised to continue investing in their networks in order to provide all users, including seniors, with better broadband connections. Telephone and cable companies, for example, will continue to deploy fiber-optic systems, which have the potential to transmit data at speeds above 100 megabits per second. Similarly, wireless carriers will leverage their advanced spectrum licenses and more effective spectrum management techniques to build out third- and fourth-generation networks.

In addition to faster speeds, network managers will deploy more sophisticated protocols and methods for ensuring the reliable and secure transmission of high-priority data from services like real-time health monitoring systems to doctors, caregivers, family members, and, when necessary, emergency medical personnel. Moreover, such techniques will be used to optimize the user experience for all subscribers by providing managers with latitude to decongest network traffic that could degrade the transmission of life-enhancing and lifesaving senior-oriented services.

The wider deployment of next-generation networks and optimal management techniques will further enable innovation by application and content developers. As more seniors adopt and use broadband, a wider array of senior-specific services will likely be developed for use in daily life. Moreover, competition among broadband providers will further push down prices, making the technology more affordable for all consumers, particularly seniors. In sum, the continued deployment of robust next-generation networks will spur continued experimentation, innovation, and adoption of helpful senior-oriented services and applications.

Especially in view of the nation's current financial crisis and credit crunch, policies at every level of government should strive to promote as much investment in broadband infrastructure as possible. The build-out, maintenance, and management of advanced networks, along with the development of broadband-enabled services and applications, cost billions of dollars. Policy actions which promote investment and innovation are in the best interests of seniors. To this end, government measures like the recent adoption of a law to enhance broadband data collection by the FCC will accelerate the deployment and adoption of this critical technology.[154]

4.2 Near-Term Outlook

Second, greater broadband adoption and use will have a number of near-term benefits. With the wider deployment of local demand stimulation programs and training courses, it is expected that more seniors will adopt broadband, and that additional older seniors will as well, thus narrowing the "gray" gap.

As more seniors adopt broadband, and as more robust networks are deployed across the country, the number and type of broadband-enabled services and applications that empower seniors will continue to proliferate. Providing seniors with more tailored products will allow a larger percentage of this segment to experience the tangible benefits of broadband, which in turn will spur adoption among even more seniors via a version of viral marketing among older adults. In addition, the proliferation of senior-specific broadband-enabled healthcare tools like in-home monitoring systems, along with the promotion of a new approach to elder care, will increase the demand for these types of services. As a result, having a larger number of senior using these technologies will provide more data on the efficacy of telemedicine services and should work to create a robust market for such services. Collecting additional data for these services in the near-term will prove crucial to their long-term viability.

The successes of today's pilot and other projects will inform the innovations of tomorrow. Data collected now will help determine whether current innovations are sustainable and of value to seniors. In addition, the next few years will be crucial to the future success of technological innovations in the field of senior telemedicine. Wider deployments and system refinements will help to assuage any fears held by seniors and to allay doubts of skeptical practitioners.[155] Thus, the near-term successes of unique efforts aimed at bringing broadband to seniors, like OATS, and organizations that use broadband to provide cutting-edge telemedicine and in-home, broadband-based monitoring services, like Elite Care (see Case Study 3), will be critical to the deployment of similar models across the country.

CASE STUDY 3
Elite Care

Elite Care (www.elitecare.com) operates two senior facilities in Oregon and employs a variety of innovative monitoring technologies. Through its "Creating an Autonomy-Risk Equilibrium" program, Elite Care deploys comprehensive "smart home" technology systems. Elite Care provides residents with the option of carrying a badge that contains a wireless sensor. This sensor interacts with other sensors in the home and around the premises to provide biofeedback to a centralized database. This system serves three primary audiences: residents who want biofeedback and cues to prolong their independence; staff members who want constant health information in order to identify health problems early and objective quality control measurements; and family members who wish to check up on their loved ones via Elite Care's Family Portal. Broadband connections enable real-time monitoring by family and caregivers. Lydia Lundberg, one of Elite Care's founders, says that the Family Portal "keeps families happy" by allowing them to monitor the health and status of a loved one (but only if the resident gives permission). Equally as important, staff also monitors the biofeedback.

Launched in 2000, Elite Care's two communities house almost 100 seniors. Lundberg feels as though her program is a trendsetter in the world of facilities-based senior care. She is particularly proud of the fact that much of the technological innovation that has resulted over the past few years is driven by residents providing constant feedback. While her program is open only to paying customers, Lundberg is confident that similar types of technologies will be common in the homes of many seniors once the costs of such services come down.

Also in the near-term, telemedicine and other senior service providers will continue to outreach to additional potential patients. For example, Lisa Gaudet, Director of Remote Care Technology for Northeast Health,[156] observes that in areas where broadband is not yet available, senior-specific telemedicine providers are using analog technologies (e.g., dial-up modems) to get into seniors' homes. However, Gaudet foresees a number of innovations centered on cellphones because of their relative ubiquity and the large number of applications available on them. Moreover, the increasing sophistication of cellphones, particularly 3G-enabled Smartphones, allows users to access the Internet at broadband-level speeds. The deployment of more robust wireless broadband networks will be a boon to rural providers like Northeast Health and others across the country and will provide yet another means of getting more seniors to use broadband-enabled services.

* * * * *

With the coming wave of retiring baby boomers on the horizon, policies and practices forged now will set an important precedent for addressing the demands and needs of a savvier generation of older adults.

4.3 Long-Term Outlook

Assuming that near-term demand stimulation and adoption efforts succeed at bringing a majority of seniors online, the long-term outlook is bright for older adults who use broadband. Niche uses currently evident among some seniors – e.g., actively managing finances online, using broadband for health purposes like brain exercises, comparison shopping for prescription drugs, etc. – will become the norm for many older adults. In-home monitoring technologies and other senior telemedicine services will become more widespread, promoting a more independent lifestyle among seniors. *Each of these trends presage a significant positive shift in perceptions associated with senior living, healthcare, and wellbeing*.

Driven by retiring baby boomers and younger seniors, the older population in the coming decades will be more independent, more willing and able to work from home, and savvier in how to incorporate broadband into their lives. Equally as important, this new senior lifestyle will have consequences far beyond just this older demographic. Economic welfare gains associated with medical savings, a potential decrease in reliance on public funding, a more interactive healthcare system, and other efficiencies stemming from broadband, for example, will likely be distributed across all demographics.

Cutting-edge research and experimentation currently underway predict positive lifestyle changes for seniors. For example, *broadband networks will increasingly be used as a medium through which critical information is sent in support of appliances and products designed to assist seniors*. These types of "smart" products will collect critical data in real-time and use broadband connections to analyze and transit the data the proper entity. For example, a researcher has developed a "smart" shoe that gathers data related to person's balance and, in theory, could alert the wearer, caregiver, or monitoring agency of an imminent fall.[157]

Combined with in-home monitoring technologies, seniors can benefits from a "smart" home that acts as a real-time, always-on receptacle for critical health information that can in turn be used to provide more real-time diagnoses to seniors via broadband.[158] Intel, among others, is experimenting with a Digital Home that would provide a "continuum of care" for seniors. The Home would leverage advanced broadband capabilities to provide remote services and to allow family members to stay abreast of their aging loved ones.[159] Remote consultations with physicians from one's home will likely become standard[160] as health records and other diagnostic technologies become portable over a broadband connection.[161] Much further down the line, "smart" robots

hold promise for providing seniors with a physical presence to deliver critical assistance in emergencies.[162]

Broadband will thus continue to be an invaluable tool for seniors in the long-term, both as a service they use to participate in a wide range of activities and as a compliment to "smart" products that will provide them with non-invasive real-time monitoring of their health and movements. In addition, broadband will continue to be used to enhance economic well-being, which will trickle down to the wider economy, and to bolster social interactions and community connectedness. Each of these uses will transform the traditional assumptions associated with aging as seniors live more independent lives with the help of broadband.

4.4 Conclusions

Near-term gains are critical to enabling long-term successes. Going forward, a multifaceted focus is necessary. First, connecting more seniors to broadband will help narrow the "gray" gap and provide seniors with access to a growing universe of life-enhancing and lifesaving applications and services.

Second, targeted education efforts regarding the real benefits of broadband will spur adoption and use in the short term. In addition to the previously discussed cost-savings enabled by broadband, educating seniors on the many ways that broadband can be used for personal social and healthcare gains is essential to stimulating demand and use by older adults.

Third, over the next few years it will be necessary to continue providing an environment that promises easy access to innovative broadband-enabled tools and services. The promotion of broadband as a key tool for enabling better health care and enhanced aging by public and private sector stakeholders will also spur adoption among seniors and encourage continued innovation.

5. GOVERNMENT, SENIORS & BROADBAND: BEST PRACTICES FOR MEANINGFUL POLICYMAKING

Broadband is having and will continue to have profound positive impacts on senior citizens, the economy, and the healthcare system. A variety of stakeholders in the public and private sectors will play a key role in facilitating the continued deployment of advanced networks and spurring innovation. Meaningful policies and approaches for empowering seniors via broadband will occur in many arenas.

Best practices for meaningful policy making include:

1. Comprehensive education and outreach efforts by individual actors and by public-private collaborations are critical components to raising senior awareness of the many benefits associated with broadband.
2. Foster a culture of applied technology and innovation across the country and at every level of government in order to educate seniors on the real world benefits of broadband.
3. Supporting local organizations that specialize in bringing seniors to broadband is essential to increasing adoption and use.
4. A spectrum of options exists, in lieu of outright subsidies, to make broadband more affordable and available to seniors while leaving ample room for competition to organically drive down the price of broadband for all consumers.
5. Core policy tools, combined with effective public-private partnerships, should be used to encourage broadband deployment to unserved areas of the country.
6. The lack of access to a computer by seniors should be addressed in ways similar to those that seek to stimulate demand for and adoption of broadband.
7. Continue adhering to the nation's pro-competition regulatory framework for broadband in order to encourage continued investment and innovation in broadband networks and technologies.

5.1 BEST PRACTICE #1

Comprehensive education and outreach efforts by individual actors and by public-private collaborations are critical components to raising senior awareness of the many benefits associated with broadband.

Even though broadband adoption and use are on the rise among senior citizens, a number of older adults remain unaware or are skeptical of the practical benefits associated with it. Indeed, the current "gray" gap is illustrative of the generational split among seniors: older seniors are generally wary of going online while younger seniors and baby boomers are more avid users. However, as previously discussed, *seniors of all ages are more likely to use broadband once they learn of its benefits and receive training on how to use it.*

To date, local and national organizations and initiatives have been successful in the education of and outreach to seniors regarding the many benefits of broadband. The successes of national actors like AARP and APT, along with more local efforts like OATS and public-private collaborations like Connect Kentucky, demonstrate how effective targeted education can be in spurring demand and use of broadband and broadband-enabled services. Thus, similar efforts should be encouraged and supported in order to promote education on:

- Prescription drug benefits and cost savings
- Information regarding state and federal insurance and medical benefits
- Cost-savings associated with e-commerce
- Applications and tools to sharpen mental acumen
- Staying connected with family and friends
- Healthcare information and tools (e.g., real-time health monitoring) designed to prolong independent living
- Websites, blogs, and other content tailored specifically for seniors

5.2 BEST PRACTICE #2

Foster a culture of applied technology and innovation across the country and at every level of government in order to educate seniors on the real world benefits of broadband.

The United States has been a world leader in the transition towards a more digital, interconnected global marketplace. The Internet was developed in the U.S. in the 1970s and 1980s; [163] the U.S. was one of the first countries to see the value in incorporating information technology into government and business in order to cut costs and make processes more efficient;[164] and the U.S. has arguably the most robust broadband infrastructure in the world, both wired and wireless.[165] Yet in spite of these successes, the United States has yet to fully embrace the life-altering implications of broadband. *More often than not, broadband discussions become bogged down in policy debates over esoteric issues when the focus should be on promoting a broadband-enabled digital culture*. There are a number of ways that government – local, state, and federal – businesses, nonprofits, and other stakeholders can work together to educate and empower seniors via broadband.

First, government should reassess the ways it uses technology vis-à-vis senior citizens to ensure that its services are inviting and inclusive of the senior point of view. In addition to posting information online, many government websites, especially those that provide senior services, could be redesigned to be more senior-friendly and interactive. The range of

senior-friendly design elements range widely, from making sure that text fonts are large enough to ensuring that information flows properly and guides seniors to the right place.[166] Also, in the appropriate instances, "open" applications could be implemented to provide seniors, caregivers, and others who are involved in elder care an outlet for suggesting best practices, correcting misleading information, and voicing opinions on issues. There is a large body of literature on the many virtues of a more robust e-government culture.[167] Given the high rates of senior voting relative to other age groups,[168] and a collective dedication to community, e-government may be a key lure for spurring more seniors to adopt broadband at home.

Second, an extension of making information more useful to senior users is creating a set of useful tools online for older adults to use – and educating seniors on these tools via outreach efforts. This would include partnering with organizations to leverage expertise and create synergies for seniors. For example, the Medicare administration could supplement its website with links to sites like BenefitsCheckup.org, a senior-friendly site that helps older adults identify benefits they qualify for and provides information on a wide range of government and private services.[169] On a more local level, New York City has developed a portal – Access NY – that "identifies and screens over thirty City, State, and Federal human service benefit programs" for seniors and other residents.[170] Other states provide similar services. Promoting these types of services could draw more seniors online provided that the value of using them is effectively communicated.

Third, policy makers could partner with local organizations to raise awareness of technology in general and broadband specifically. For example, in New York City, City Councilmember Gail Brewer worked with OATS to put on a "touch tank" for senior citizens. This event brought seniors together to experience new technologies, answer any questions, and allay any fears or intimidation they might have.[171] Similarly, national politicians could tout the positive impacts of broadband on seniors by commissioning studies or holding hearings. U.S. Senator Herb Kohl, for example, has convened numerous hearings of the Senate's Special Committee on Aging and has called for the preparation of various reports on a wide array of senior issues.[172]

Fourth, federal entities and elected officials could partner with national organizations like the Alliance for Public Technology ("APT") and leverage these groups' experience in drawing attention to broadband. Over the last several years, APT has sponsored a "Broadband Changed my Life!" campaign that aggregates success stories that describe how people have benefited from using broadband.[173] Similarly, senior-oriented advocacy groups like AARP and Senior Net could be viable partners in such ventures. A combination of local and national awareness campaigns would have a significant impact on seniors, many of whom remain offline altogether.[174]

Creating a national culture that more aggressively embraces technology and broadband would provide seniors with more awareness of the life-altering impacts of high-speed

Internet access and could potentially spur a large number to adopt it at home. Local efforts that specialize in the training of seniors to use computers and broadband are an essential part of this more national strategy.

5.3 BEST PRACTICE #3

Supporting local organizations that specialize in bringing seniors to broadband is essential to increasing adoption and use.

As previously discussed, many seniors are unaware of broadband, and, for those who are aware, there is a gap between awareness and adoption. Local efforts have been highly successful at bridging this divide by providing seniors with targeted training in basic computer and Internet skills. Local, state, and federal government can provide critical support to these organizations in a number of ways.

First, the lifeline for many of these local organizations is public funding. While some local nonprofits like OATS in New York are able to attract private support, many programs, like Computers4Seniors in Georgia, rely entirely on public funding. Thus, dedicating a reliable stream of funding and creating competitive grant programs to support these efforts would allow current service providers to focus on providing training to seniors and encourage additional organizations to be developed and launched.

Second, local governments should work with training programs and other senior-related projects to concentrate their efforts on geographic areas or segments of the population that are most in need. Many computer and Internet classes are provided only in modern facilities that are wired for broadband, thus limiting the reach of these efforts. By partnering with local government, training programs and other service providers could expand their offerings to areas outside their traditional purview. California, for example, has recognized the potential synergies available by coordinating statewide broadband education efforts and is actively pursuing a comprehensive approach to spurring broadband demand, adoption, and use.[175]

The economic and political support of local service providers by state and local government is essential to helping older adults overcome fears and skepticism associated with broadband. Although smaller in scale than national organizations, local groups like OATS have been successful because of their size, not in spite of it. Small classes allow for more interaction among students and promote a more congenial atmosphere. Moreover, intergenerational programs, used by organizations like Per Scholas and Mount Hope, add another personal touch to training efforts that larger entities cannot provide. Thus, local training programs, with the support of local and

state government, have the potential to further close the gap between those seniors who have embraced broadband and those who remain wary of it.

5.4 BEST PRACTICE #4

A spectrum of options exists, in lieu of outright subsidies, to make broadband more affordable and available to seniors while leaving ample room for competition to organically drive down the price of broadband for all consumers.

Cost continues to be a major obstacle for many seniors who might otherwise subscribe to broadband. As discussed above, many seniors live on a fixed income and oftentimes cannot justify spending additional money on a broadband connection. A number of options are available to policy makers to make broadband more affordable to seniors while also deferring to the organic market forces that continue to drive down the price of the service. Outright subsidies, however, might not be the most economically rational approach. It has been argued that subsidies would ultimately be socially sub-optimal because they would create inefficiencies that offset any benefits that might accrue.[176] In lieu of subsidies, policy makers have a number of options available to them.

First, insurance laws could be modified to reflect the realities of aging and technology in the twenty-first century. Clauses in the Medicare laws, for example, could potentially create unnecessary obstacles for seniors who wish to use broadband to enhance their lives. Medicare healthcare benefits, for instance, are suspended if a senior returns to work, even if it is only on a part-time basis. As mentioned above, telecommuting options and other broadband-enabled applications allow seniors and baby boomers to continue working past the age of retirement and earn additional income that could be used to support their broadband subscription. Last year, Senator Herb Kohl introduced two bills that would allow older workers to continue in their jobs or return to work, and offered employers incentives for retaining or hiring seniors.[177] These and similar reform efforts could be implemented to incorporate broadband into the Medicare and healthcare schemes for seniors and potentially allow for reimbursement.

Second, state and federal government should consider extending tax credits to the purchase of broadband by seniors in order to defer some of the cost. These types of credits have been offered to service providers to spur the deployment of broadband in states around the country.[178] Extending similar credits to individual seniors could be a viable approach to stimulating demand and adoption of broadband among seniors who would not be able to afford it otherwise.

Third, regardless of the approach adopted by state and federal government to assist seniors in affording broadband, these efforts should not impede the organic market forces that are driving down prices. The price of broadband access has steadily fallen over the years. Moreover, competition among different broadband providers for an increasingly shrinking pool of consumers has led to the development of a variety of pricing plans for users. For example, some companies are experimenting with different price tiers, which base monthly bills on how much bandwidth a person uses.[179] In the future, some companies may tailor special packages for seniors and other segments of the population in order to cater to their unique needs and uses. Thus, the market should be provided with wide latitude to compete and provide innovative service packages to seniors.

5.5 BEST PRACTICE #5

Core policy tools, combined with effective public-private partnerships, should be used to encourage broadband deployment to unserved areas of the country.

Investment and innovation in the broadband market have successfully spurred network deployment to nearly every part of the country and, *where there are pockets of unserved consumers, viable local and state solutions, supported by federal funding, currently exist to bring broadband to these areas*. In order to further these successes, three primary approaches should be considered: first, continued use of public-private partnerships at the state level; second, meaningful reform of the federal Universal Service Fund ("USF"); and third, the provision of additional funding and the creation of additional incentives for the deployment of advanced broadband infrastructure across the entire country. Each of these approaches effectively targets unserved areas and ensures the development of appropriate build-out strategies to spur the deployment of broadband to them.

First, public-private partnerships have thus far been successful in bringing broadband to unserved areas and stimulating demand among non-broadband users like seniors who live in these largely rural parts of the country. The Connected Nation model, which was first used in Kentucky, has since been adopted in Tennessee, Ohio, and West Virginia.[180] Its e-community strategies, which build on the best practices of the Connect Kentucky model, offer communities a way to "effectively and efficiently leverage technology" by promoting the value of broadband and broadband-enabled services.[181] This approach has successfully bridged the broadband and technology divide between urban and rural areas, and higher-income and lower-income users, and should be considered a model for other states around the country. Connected Nation estimates that adoption of its model by states across the country would result in a nationwide economic stimulus of over $134 billion per year.[182]

Second, careful and rational reform of the federal USF reform could be designed to target unserved areas and provide support to spur the adoption of broadband and other advanced communications services. The USF was originally created to subsidize the build out of basic telephone infrastructure to rural parts of the country. However, with telephone penetration near 100 percent, and with the number of traditional telephone lines decreasing every year since 2002,[183] reforms should center on containing the size of the fund, targeting truly unserved areas of the country, and designing economic incentives for providers to build out their networks to reach those who do not yet have access to broadband. Using this type of mechanism will ensure that funding is used as an incentive for innovation and not as a subsidy to support an unsustainable and ineffective business model.

Third, additional funding from the government, either via an economic stimulus package[184] or another source, could supplement USF funding and other grants to support local broadband education efforts and to create additional incentives for the deployment of broadband to unserved areas. The recent economic downturn and credit crunch has highlighted the need for public and private sector collaboration to create economic development opportunities in communities across the country. A number of organizations have called on the government to allot a portion of economic stimulus funding to the continued deployment of broadband infrastructure.[185] Funding of this sort should focus on spurring broadband build-out to unserved parts of the country and could also be used to support new and existing programs that bring seniors and other users to broadband (e.g., those described above in Best Practices 1-4). Vehicles for allotting such funding could include tax breaks for broadband providers, support grants for local nonprofits, and loans or other subsidies for the purchase of a computer.

Policy makers should consider these and other types of policy tools when implementing an approach to further spur broadband build-out, demand, and use. Government should act to address clear instances of market failure and work to make broadband available to seniors and all other residents living in remote parts of the country.

5.6 BEST PRACTICE #6

The lack of access to a computer by seniors should be addressed in ways similar to those that seek to stimulate demand for and adoption of broadband.

The primary reason among all age groups for not having broadband is the lack of a computer, not lack of available broadband. In addition, seniors are less likely than other age groups to own a computer. Owning or having access to a computer is a prerequisite to using wire-based broadband. However, in lieu of direct government involvement in providing

seniors with a computer, a number of innovative approaches are currently being employed across the country to make computers available to seniors.

Computer recycling programs like Per Scholas have been effective in refurbishing old computers and making them available to seniors and low-income consumers at discounted prices. In addition, Per Scholas has teamed with OATS in New York City to provide seniors with a free computer, installation, and a lifetime warranty upon completion of a training class (see Case Study 1 above). Similarly, One Economy (www.one-economy.com) has developed a viable model for bringing lower-income users to broadband and training them to use it for personal and economic gain. It has developed programs like its Digital Inclusion initiative and trained volunteers via its Digital Connectors program to connect the unconnected.[186]

These and similar types of grassroots initiatives have been very successful in spurring awareness, demand, and use of broadband among seniors and lower-income users. As mentioned above, government could expand its support of these types of programs in order to spur the use of broadband by older adults and other unconnected consumers.

5.7 BEST PRACTICE #7

Continue adhering to the nation's pro-competition regulatory framework for broadband in order to encourage continued investment and innovation in broadband networks and technologies.

A regulatory approach based on pro-investment policies has resulted in a tremendous amount of innovation that is inuring to the benefit of seniors. Congress, the FCC, and an array of other policy makers have, thus far, crafted broadband policies that are spurring the deployment of next-generation networks throughout the country – networks that will be able to support the data-rich senior-oriented services and applications that are on the horizon. All categories of providers (the traditional telcos, cable companies, wireless companies, and others) have responded to this regulatory environment with substantial investments. This, in turn, has spurred tremendous innovation of broadband-enabled applications, content and services, including specifically for seniors.

SNAPSHOT 5
Why Certainty & Reliability Are Important to Broadband Providers & Users

1. The current regulatory regime has spurred the development of senior-focused applications and services.
2. Seniors are more likely than other users to use emergency and life-saving applications. These services depend on a reliable broadband connection to be effective.
3. Network reliability depends upon a network owner having ample latitude to manage an increasing amount of data flowing over its infrastructure. Constraining this could decrease the reliability and efficiency of network.
4. In light of the recent economic downturn, it is important to craft policies that provide regulatory certainty and incentives to spur further investment and innovation.

Continuing this approach is in the best interest of seniors and of the nation as a whole. As the Federal Trade Commission ("FTC"), the nation's preeminent monitor of competition in a variety of markets, recently observed: "industry-wide regulatory schemes – particularly those imposing general, one-size-fits-all restraints on business conduct – may well have adverse effects on consumer welfare, despite the good intentions of their proponents. This is particularly true in terms of product and service innovation."[187] As a result, the FTC recommended a cautious approach to policy making in the broadband arena, one that proceeds carefully and balances the interests of all stakeholders in the market before acting.[188] (See Snapshot 5 for a discussion of the benefits of certainty and reliability in the broadband market.)

6. CONCLUSION

Broadband is empowering and enhancing the lives of all consumers, including the nation's senior citizens. Policies forged now will dictate whether these many positive gains are allowed to accrue of their own momentum.

Going forward, policymakers at all levels of government will inevitably have opportunities to pursue policies that could benefit the broadband market. Throughout the entire history of the advanced communications market, policies forged at the federal level have directly affected consumers. For example, after a deregulatory framework for wireless was adopted and implemented in the early 1990s, prices immediately decreased as piecemeal state-by-state regulation was replaced by a harmonized national approach. In the case of broadband, a hands-off approach has led to the development of a robust market and enormous leaps in innovation, all of which has profoundly changed the way seniors and other users live their lives. (Please see the introductory paper in this series for further discussion.)

Over the next few years, government and industry will have many similar opportunities to help ensure the continued development, deployment, and adoption of advanced broadband technologies. Collaboration among the public and private sector will spur demand for and use of broadband among seniors. Because broadband is the foundation upon which many future approaches to aging and senior care may be based, it is essential for policy makers to champion policies that create opportunities for continued investment, innovation, and technological advancement. Accordingly, policy makers should focus their efforts on ensuring that all seniors understand the importance of and have access to the growing universe of broadband-enabled services, applications, and technologies. Broadband is changing the aging paradigm and policy makers should not stand in the way.

ENDNOTES

[1] *See In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, Fifth Report, GN Docket No. 07-45, para. 76 (rel. June 12, 2008) (finding that broadband deployment has been "reasonable and timely") ("*5th 706 Report*").

[2] *See High-Speed Services for Internet Access: Status as of June 30, 2007,* FCC Wireless Competition Bureau Report, Table 10 ("*FCC Broadband Stats to June 2007*").

[3] *See* John Horrigan, *Commentary: U.S. Lags Behind*, at p. 1, Pew Internet & American Life Project (August 2007), *available at* http://www.pewinternet.org/pdfs/Broadband_Commentary.pdf.

[4] *See* John Horrigan, *Home Broadband Adoption 2008*, Pew Internet & American Life Project, at p. 2 (July 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Broadband_2008.pdf ("*Home Broadband Adoption 2008*").

[5] *Id.* at p. 10.

[6] *Id.* at p. 12.

[7] *See Broadband in America: Access, Use and Outlooks*, Consumer Electronics Association, at 6, July 2007, *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf.

[8] *See* William G. Korver, *Broadband Adoption and Not Availability is Key Challenge, Says One Economy*, July 31, 2008, BROADBANDCENSUS.COM, *available at* http://broadbandcensus.com/blog/?p=225; *Home Broadband Adoption 2008* at p. 12-14 (noting that "one-third (33%) of non-internet users say they are simply not interested in the internet" whereas "just 7% say it is too expensive.").

[9] U.S. Department of Health and Human Services, Administration on Aging, *A Statistical Profile o f Older Americans 65+* (June 2008), *available at* http://www.aoa.gov/press/prodsmats/fact/pdf/ss_stat_profile.pdf ("*Statistical Profile*").

[10] *Id.*

[11] Jeffrey S. Passel and D'Vera Cohn, *U.S. Population Projections: 2005-2050*, at p. 20, Pew Research Center (rel. Feb. 11, 2008), *available at* http://pewhispanic.org/files/reports/85.pdf.

[12] *See, e.g., Growing Older in America: The Health and Retirement Study,* at 4, Report of the National Institute on Aging, National Institutes of Health, U.S. Department of Health and Human Services (March 2007), *available at* http://www.nia.nih.gov/NR/rdonlyres/D164FE6C-C6E0-4E78-B27F-7E8D8C0FFEE5/0/HRS_Text_WEB.pdf ("*Growing Older*").

[13] *See* Press Release, *Oldest Baby Boomers Turn 60*, U.S. Census Bureau (rel. Jan. 3, 2006), *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/006105.html.

[14] *See* John Gist, *Comparing Boomers' and their Elders' Wealth at Midlife*, at 2, AARP Policy Institute (Sept. 2005), *available at* http://assets.aarp.org/rgcenter/econ/dd123_wealth.pdf.

[15] *See First Baby Boomer Receives First Social Security Payment*, Feb. 15, 2008, USA TODAY, *available at* http://www.usatoday.com/money/perfi/retirement/2008-02-12-boomer-social-security_N.htm.

[16] *See, e.g.,* Kara Rowland, *Retirement Plans Face Tough Times*, WASH. TIMES, Nov. 10, 2008, *available at* http://washingtontimes.com/news/2008/nov/10/dreams-deferred/ (chronicling the impact of the recent economic downturn on retirees).

[17] *See* Jennifer Levitz, *Americans Delay Retirement as Housing, Stocks Swoon*, WALL ST. JOURNAL, April 1, 2008 (describing the impact of lower house prices and other economic woes on older workers and those planning for retirement).

[18] *Id.*

[19] For example, a recent UCLA study found that "for computer-savvy middle-aged and older adults, searching the Internet triggers key centers in the brain that control decision-making and complex reasoning. The findings demonstrate that Web search activity may help stimulate and possibly improve brain function." *See* Rachel Champeua, *UCLA Study Finds that Searching the Internet Increases Brain Function,* UCLA Newsroom, Oct. 14, 2008, *available at* http://newsroom.ucla.edu/portal/ucla/ucla-study-finds-that-searching-64348.aspx.

[20] *See* Rob Salkowitz, Generation Blend, at p. 64 (Wiley 2008) (noting that "Extending the careers of productive workers beyond retirement age can offset some of the costs of training and recruitment, while keeping important knowledge and relationships in place.") ("*Generation Blend*").

[21] *706 5th Report* at para. 35.

[22] *See, e.g.,* Jonathan Adelstein, *Statement of FCC Commissioner Jonathan Adelstein, En Banc Hearing on Broadband and the Digital Future*, p. 2, July 21, 2008 ("Despite progress, the U.S. faces deficits of adoption, affordability, and capability when compared to the global broadband leaders. It is estimated that some 55 percent of adult Americans have broadband at home, but that still leaves almost half of all Americans without broadband access.").

[23] *5th 706 Report* at para. 36.

[24] *See* David P. McLure , *Deployment of Broadband to Rural America,* at p. 15, USIIA Report (rel. Mar. 4, 2008), *available at* http://www.usiia.org/pubs/Rural.pdf ("*Rural Broadband Deployment*").

[25] *See* NTCA, Home, http://www.ntca.org/.

[26] *See NTCA 2008 Broadband/Internet Availability Survey Report*, p. 3, NTCA, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2008ntcabroadbandsurveyreport.pdf.

[27] *5th 706 Report* at para. 36.

[28] *See* USDA Economic Research Service, Briefing, *Rural Population and Migration: Trend 6—Challenges From an Aging Population*, *available at* http://www.ers.usda.gov/Briefing/Population/Challenges.htm.

[29] *Id.*

[30] *Rural Broadband Deployment* at p. 5.

[31] *See, e.g., The Economic Impact of Stimulating Broadband Nationally*, at p. 16, A Report from Connected Nation (rel. Feb. 21, 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf ("*Connected Nation Report*").

[32] *Id.*

[33] *Id.*

[34] *See The State of Connectivity*: *Building Innovation Through Broadband*, at p. 65-66, Final Report of the California Broadband Taskforce (rel. Jan. 2008), *available at* http://www.calink.ca.gov/pdf/CBTF_FINAL_Report.pdf ("*California Broadband Task Force Report*").

[35] *5th 706 Report* at para. 58.

[36] *FCC Broadband Stats to June 2007* at Table 10 (providing data on the number of broadband subscribers in each state for the years 2001-2007).

[37] *Older Americans* at p. 3.

[38] *See Broadband in America: Access, Use and Outlooks*, at p. 6, Consumer Electronics Association (July 2007), *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf ("*CEA Report*").

[39] *Id.*

[40] *See* Pew Research Center for the People and the Press April 1996 Biennial Media Consumption Survey, *available at* http://people-press.org/reports/display.php3?ReportID=127.

[41] *See* Susannah Fox, *Wired Seniors*, at p. 4, Pew Internet & American Life Project (Sept. 2001), *available at* http://www.pewinternet.org/pdfs/PIP_Wired_Seniors_Report.pdf ("*Wired Seniors*").

[42] *See* Susannah Fox, *Older Americans and the Internet*, at p. 1, Pew Internet & American Life Project (Mar. 2005), *available at* http://www.pewinternet.org/pdfs/PIP_seniors_Online_2004.pdf ("*Older Americans*").

[43] *See* Susannah Fox, *Are Seniors Sitting Ducks?* at *p.*1, Pew Internet and American Life Project (April 2006), *available at* http://www.pewinternet.org/pdfs/PIP_Wired_Senior_2006_Memo.pdf.

[44] *Id.*

[45] *Home Broadband Adoption 2008* at p. 10-15.

[46] *See* Susannah Fox, *Digital Division*, at p. 6, Pew Internet & American Life Project (Oct. 2005), *available at* http://www.pewinternet.org/pdfs/PIP_Digital_Divisions_Oct_5_2005.pdf.

[47] *See* APT, Broadband Changed my Life!, http://www.apt.org/BB-changed-my-life/.

[48] *Statistical Profile.*

[49] *Id.*

[50] *Id.*

[51] *Home Broadband Adoption 2008* at p. 3.

[52] *Id.*

[53] *Id.* at p. 2.

[54] *Home Broadband Adoption 2008* at p. 12.

[55] *Statistical Profile.*

[56] *Id.*

[57] Carmen DeNavas-Walt, Bernadette D. Proctor, and Jessica C. Smith, *Current Population Reports*: *Income, Poverty, and Health Insurance Coverage in the United States: 2007*, at p. 15, U.S. Census Bureau (2008), *available at* http://www.census.gov/prod/2008pubs/p60-235.pdf.

[58] *See U.S. Consumer Eying 'High Speed' Broadband More Closely According to InStat Survey,* InStat, March 5, 2008, *available at* http://www.businesswire.com/portal/site/google/?ndmViewId=news_view&newsId=20080305005134&newsLang=en

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[61] *5th 706 Report,* at para. 59.

[62] *Connected Nation Report* at pp. 8-9.

[63] *Wired Seniors* at p. 2.

[64] *Id.*

[65] *Older Americans* at p. ii.

[66] *See* Susannah Fox, *Panel: Can the Health Informatician Help Seniors Cross the Digital Divide?* at p. 3, Pew Internet and American Life Project (Nov. 2006), *available at* http://www.pewinternet.org/ppt/fox_amia_nov_2006.pdf.

[67] *Id.*

[68] *See Senior Citizens Most Concerned about Health; Get News from Doctor, Internet*, June 8, 2006, SENIOR JOURNAL, *available at* http://seniorjournal.com/NEWS/SeniorStats/6-08-23-SeniorCitizensMost.htm.

[69] *See, e.g., Older Americans Lead Gain in Internet Use for Election 2004,* Nov. 12, 2004, SENIOR JOURNAL, *available at* http://www.seniorjournal.com/NEWS/Politics/4-11-12SeniorsOnNet.htm.

[70] OATS, for example, dedicates part of its Basics class to teaching seniors how to search for travel information (e.g., driving directions, airfares, etc.) and make airline reservations.

[71] *See, e.g., Affluent Seniors May be the New Online Financial Whizzes*, Jan. 15, 2008, Reuters, *available at* http://www.reuters.com/article/pressRelease/idUS136301+15-Jan-2008+PRN20080115 (noting that a recent report by the Spectrum Group found that "affluent senior citizens above the age of 70 are devoting a far higher percentage of their online time (32%) to financial pursuits than those age 70 and younger (13%).").

[72] *See Senior Citizens who Master Computers Have Less Depression*, Aug. 18, 2005, SENIOR JOURNAL, *available at* http://seniorjournal.com/NEWS/Aging/5-08-18MasterComputers.htm.

[73] *See generally* T.E. Seeman, *Social Ties and Health: The Benefits of Social Integration*, 6 Annals of Epidemiology 442-451 (1996).

[74] *See* Amy Harmon, *Grandma's on the Computer Screen*, Nov. 26, 2008, N.Y. TIMES.

[75] *See* AARP, Computer and Technology, http://www.aarp.org/learntech/computers/.

[76] *See, e.g.,* Carla K. Johnson, *Senior Citizen Bloggers Defy Stereotypes*, Nov. 6, 2005, USA TODAY, *available at* http://www.usatoday.com/tech/news/2005-11-06-geezer-blog_x.htm.

[77] *See, e.g.,* Sharon O'Brien, *Senior Blogs: Mental Exercise and Connection to the World*, About.com Senior Living, *available at* http://seniorliving.about.com/od/entertainmentrecreation/a/seniorblogs.htm.

[78] For more information on this program, *please see* http://www.computers4seniors.org/.

[79] Indeed, it has been found that the benefits of these types of programs are usually reciprocal and have lasting impacts on teens and on the computer skills learned by seniors. *See* Jane Kolodinsky, Michele Cranwell & Ellen Rowe, *Bridging the Generation Gap Across the Digital Divide: Teens Teaching Internet Skills to Senior Citizens*, J. of Extension, Vol. 40 No. 3 (June 2002), *available at* http://www.joe.org/joe/2002june/rb2.html.

[80] *See* OATS, Success Stories, *Intergenerational Program Builds Confidence for Young and Old, available at* http://www.oatsny.org/intergenerational.htm.

[81] *Id.*

[82] For a fuller exploration of the transition towards a more globalized economy and its various impacts, *please see* Robert J. Shapiro, *The Idea-Based Economy and Globalization: The Real Foundations of American Prosperity in the 21st Century*, NDN Globalization Initiative, Jan. 23, 2008, *available at* http://www.ndn.org/advocacy/globalization/the-idea-based-economy.pdf.

[83] *See* Sharon E. Gillett et al., *Measuring the Economic Impact of Broadband Deployment*, at p. 3-11 , Final Report, Prepared for the U.S. Department of Commerce, Economic Development Administration (Feb. 2006), *available at* http://www.eda.gov/ImageCache/EDAPublic/documents/pdfdocs2006/mitcmubbimpactreport_2epdf/v1/mitcmubbimpactreport.pdf.

[84] *Connected Nation Report* at p. 5.

[85] *See, e.g.,* Jonathan L. Willis, *What Impact will E-Commerce have on the U.S. Economy?* at p. 58, Economic Review, Second Quarter 2004, Federal Reserve Bank of Kansas City, *available at* http://www.kc.frb.org/publicat/Econrev/PDF/2q04will.pdf.

[86] *See* Press Release, *Quarterly Retail E-Commerce Sale: 2nd Quarter 2008*, U.S. Census Bureau (rel. Aug. 15, 2008), *available at* http://www.census.gov/mrts/www/data/html/08Q2.html.

[87] *See* John Horrigan, *Online Shopping*, at p. 2, Pew Internet & American Life Project (Feb. 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Online%20Shopping.pdf ("*Online Shopping*").

[88] *Online Shopping* at p. 8.

[89] *Id.* at p. 10.

[90] *Id.* at p. 12.

[91] *See Prescription Drugs: Smart Shopping Yields Big Savings*, CONSUMER CHECKBOOK.ORG (2004), *available at* http://www.checkbook.org/cgi-bin/free/drug.pdf.

[92] *See* https://www.walgreenshealth.com/whc/aarp/jsp/aarp_home.jsp.

[93] *See* Wikipedia: Medicare Part D, *available at* http://en.wikipedia.org/wiki/Medicare_Part_D.

[94] A 2005 GAO report found that inaccurate information was provided nearly 30 percent of the time by operators on the Helpline. In addition, the report found that operators were unable to provide any information 10 percent of the time. *See Medicare: Accuracy of Responses from the 1-800-MEDICARE Help Line Should Be Improved*, United States Government Accountability Office, Report to Congressional Committees (Dec. 2004), *available at* http://www.gao.gov/new.items/d05130.pdf.

[95] *See* OATS, *Medicare Peer Counseling Saves Bronx Seniors Thousands in Drug Costs, available at* http://www.oatsny.org/medicare.htm.

[96] *Id.*

[97] *See* Woelfel Research, *Consumer Payment Study*, at p. 2, AARP Knowledge Management (Feb. 2007), *available at* http://assets.aarp.org/rgcenter/consume/consumer_payment.pdf ("*Consumer Payment Study*").

[98] *Id.*

[99] *See* Press Release, *"The New Retirement Survey" from Merrill Lynch Reveals How Baby Boomers Will Transform Retirement*, Merrill Lynch, Feb. 22, 3005, *available at* http://www.ml.com/index.asp?id=7695_7696_8149_46028_46503_46635.

[100] *Id.*

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[103] *Id.*

[104] *See* AARP Policy Book, Ch. 10, Utilities: Telecommunications, Energy and Other Services, at p. 10-40, *available at* http://assets.aarp.org/www.aarp.org_/articles/legpolicy/10_utili07.pdf ("*AARP Policy Book*").

[105] *See* Report of the Taskforce on the Aging of the American Workforce (Feb. 2008), at p. 9, *available at* http://www.doleta.gov/reports/FINAL_Taskforce_Report_2-11-08.pdf ("*Aging Taskforce*").

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[107] *See* Carol Wilson, *Telecommuting Interest Soars*, Aug. 28, 2008, TELEPHONY ONLINE, *available* at http://telephonyonline.com/access/news/telecommuting-increases-0828/.

[108] *See* Eve Tahmincioglu, *The Quiet Revolution: Telecommuting*, Oct. 5, 2007, MSBC, *available at* http://www.msnbc.msn.com/id/20281475/.

[109] *Id.*

[110] *Aging Taskforce* at p. 3.

[111] *Generation Blend* at p. 67 (noting that "Workers in their sixties and seventies not only have the potential to remain productive, thanks to increasing life spans and health improvements, but are also the custodians of irreplaceable knowledge, relationships, and cultural lore.").

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[113] *Connected Nation Report* at p. 5.

[114] Robert E. Litan, *Great Expectations: Potential Economic Benefits to the Nation From Accelerated Broadband Deployment to Older Americans and Americans with Disabilities*, New Millennium Research Council (Dec. 2005), available at http://www.newmillenniumresearch.org/archive/Litan_FINAL_120805.pdf ("*Great Expectations*") (please note that this estimate includes cost savings associated with using broadband in the care for people with disabilities. It should also be noted that a large percentage (about a quarter) of older adults have disabilities, so there is some overlap.).

[115] *See* Senior Net, eBay for Seniors, http://www.seniornet.org/ebay/.

[116] *See* Matt Richtel, *Sticky Old People (Redux)*, Sept. 26, 2007, NY TIMES BITS BLOG, *available at* http://bits.blogs.nytimes.com/tag/senior-citizens/.

[117] *Id.* (reporting that "With so many Web sites aimed at the young, there are a growing number of venture capitalists investing in oldsters online. In the last year, there have been in particular a number of investments into social networking sites that are targeting people who have more of a need for Metamucil than MySpace.").

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[120] *See* Matt Sedensky, *Study: Bankruptcies Soar for Senior Citizens*, Aug. 31, 2008, USA TODAY, *available at* http://www.usatoday.com/money/economy/2008-08-31-bankrupt-seniors_N.htm (observing that "While the bankruptcy filing rate for those under 55 has fallen, it has soared for older Americans, according to a new analysis from the Consumer Bankruptcy Project, which examined a sampling of noncommercial bankruptcies filed between 1991 and 2007. The older the age group, the worse it got — people 65 and up became more than twice as likely to file during that period, and the filing rate for those 75 and older more than quadrupled.").

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[122] *Id.*

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[128] *See* News Release, *AARP Launches Four Online Health Tools to Empower Consumers To Make Informed Choices in Care*, Aug. 22, 2008, AARP, *available at*http://www.aarp.org/research/press-center/presscurrentnews/aarp_launches_four_online_health_tools_to_empower.html

[129] *See, e.g.,* Sharon Begley, *The Upside of Aging*, Feb. 16, 2007, WALL ST. J.

[130] For additional resources, *please see* Alzheimer's, Dementia and Mental Health, *Best Computer 'Brain Games' for Seniors to Delay Alzheimer's Disease,* June 21, 2007, SENIOR NET, *available at* http://seniorjournal.com/NEWS/Alzheimers/2007/7-06-21-BestComputer.htm.

[131] *See* Alex Cohen, *Video-Game Makers Discover a New, Older Market*, Dec. 7, 2006, NPR, *available at* http://www.npr.org/templates/story/story.php?storyId=6589941 (observing that "According to the Entertainment Software Association, 25 percent of all gamers are 50 years or older, and game makers are looking for ways to market to that age group.").

[132] The Wii, which provides users with an interactive gaming experience unlike any other gaming console, is increasingly popular among seniors and is being used as a way of getting older adults to participate in physical activities. *See, e.g.,* the Wii Olympics 2008, an event recently put on by NorthEast Health, http://www.nehealth.com/Retirement_Living/Wii_Olympics_2008/; *see also* Dave Wischnowsky, *Wii Bowling Knocks over Retirement Home*, Feb. 26, 2007, Chi. Trib., *available at* http://www.chicagotribune.com/news/local/chi-070216nintendo,0,2755896.story (reporting on a similar activity in Illinois).

[133] *See* Alzheimer's Research & Prevention Foundation, Exercise and Brain Aerobics, http://www.alzheimersprevention.org/pillar_3.htm (noting that "Mental exercise has been reported by neurologists to reduce your chance of developing Alzheimer's disease by 70 percent" and recommending that "Everyone should spend at least 20 minutes, 3 times a week, doing mental exercise.").

[134] *See* International Conference on Alzheimer's Disease, *Highlights of Research Findings*, at p. 1, Alzheimer's Association, *available at* http://www.alz.org/icad/downloads/2008_ICADhighlights.pdf.

[135] *See* Press Release, *Alzheimer's Disease to Quadruple Worldwide by 2050*, June 10, 2007, Johns Hopkins University Bloomberg School of Public Health, *available at* http://www.jhsph.edu/publichealthnews/press_releases/2007/brookmeyer_alzheimers_2050.html (announcing a study by Ron Brookmeyer et al. entitled *Forecasting the Global Burden of Alzheimer's Disease*).

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[138] *Great Expectations.*

[139] *See* Richard Adler, *Older Americans, Broadband, and the Future of the Internet*, at p. 2, Senior Net Report, *available at* http://www.seniornet.org/research/SeniorNetNNPaper060606.pdf.

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[143] *Id.*

[144] *See* Linda L. Barrett, *Healthy @ Home*, at p. 22, AARP, *available at* http://assets.aarp.org/rgcenter/il/healthy_home.pdf ("*Healthy @ Home*").

[145] *AAHSA General Facts*

[146] *Id.*

[147] *Id.*

[148] *Id.*

[149] *See* Medical Automation Research Center, University of Virginia, Gait Monitoring Device, http://marc.med.virginia.edu/projects_gaitmonitoring.html.

[150] *See, e.g.,* Wireless TelehomeCare Solutions, http://www.homefreesys.com/technology.htm, Home Free.

[151] *See Connected Personal Health in 2015: "Getting it Right!"* Continua Health Alliance, *available at* http://www.continuaalliance.org/news_events/white_papers/CHA_WP081408v07.pdf.

[152] *Healthy @ Home* at p. 8.

[153] *See* C.W. Phang et al., *Senior citizens' acceptance of information systems: A study in the context of e-Government services,* at p. 18, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, *available at* http://www.comp.nus.edu.sg/~atreyi/papers/senior-egov.pdf.

[154] The President signed the Broadband Data Act into law in October 2008. This law "requires Internet service providers to give the FCC more detailed reports so the FCC can identify the actual numbers of broadband connections by customer type and geographic area." *See* Stephanie Condon, *President Signs Broadband Data Collection Bill*, Oct. 10, 2008, CNET NEWS.COM, *available at* http://news.cnet.com/8301-13578_3-10063734-38.html.

[155] *See, e.g.,* Atiya Mahmood et al., *Perceptions and Use of Gerotechnology: Implications for Aging in Place*, at p. 105-106, J. of Housing for the Elderly, Vol. 22 (noting that "some researchers caution that [monitoring] technologies may actually impair quality of life.").

[156] *Please see* www.nehealth.com for more information.

[157] *See 'Smart Shoe' Could Prevent Elderly Falls*, July 31, 2008, AP, *available at* http://www.cnn.com/2008/TECH/ptech/07/31/smart.shoe.ap/index.html.

[158] *Inventing Wellness* at p. 36.

[159] *See* Health Research & Innovation, *Digital Home Technologies for Aging in Place,* Intel Corp, *available at* http://www.intel.com/research/exploratory/digital_home.htm.

[160] *See* Molly Merrill, *New Website Sends Virtual House Calls Knocking*, July 8, 2008, Health IT News, *available at* http://www.healthcareitnews.com/story.cms?id=9539 (reporting on the launch of TalktoaDoc.Org, a new website that allows patients to interact with their doctors in real time via the Internet.).

[161] Microsoft, for example, has developed HealthVault, a web-based repository for personal health information that is accessible wherever a user is able to get online. For more information, *please see* http://www.healthvault.com/WhatIsHealthVault.htm.

[162] *See* Dave Mosher, *Robot Dials 9-1-1*, April 16, 2008, LIVE SCIENCE, *available at* http://www.livescience.com/technology/080416-robot-calls-help.html (describing a prototype robot – the uBOT 5 - that is capable of picking up small objects, detecting when someone has fallen, using a stethoscope, and dialing 9-1-1.).

[163] *See generally* Lawrence Lessig, The Future of Ideas (2001) for a brief overview of the development of the Internet.

[164] *See, e.g.*, Martin Wolf, Why Globalization Works, at p. 120 (2004).

[165] *See, e.g.,* Jeffrey A. Eisenach, *Broadband Policy: Does the U.S. Have it Right After All?* Progress on Point Release 15.14, Progress and Freedom Foundation (Sept. 2008), *available at* http://www.pff.org/issues-pubs/pops/2008/pop15.14USbroadbandpolicy.pdf (arguing that "the relatively deregulatory American approach to broadband policy has produced highly desirable results, including high levels of investment and innovation, nearly ubiquitous broadband availability, high and increasing levels of penetration, falling prices, and high levels of consumer satisfaction.").

[166] *See* Emily Shartin, *Designing Websites with Senior Citizens in Mind*, April 3, 2005, Boston Globe, *available at* http://www.boston.com/business/technology/articles/2005/04/03/designing_websites_with_senior_citizens_in_mind/.

[167] *See, e.g.,* Beth Noveck, *Wiki Government: How Open-Source Technology Can Make Government Decision-Making More Expert and More Democratic*, Democracy Journal (Dec. 2007), *available at* http://www.democracyjournal.org/article.php?ID=6570 (arguing that "Ordinary people, regardless of

institutional affiliation or professional status, possess information–serious, expert, fact-based, scientific information–to enhance decision-making, information not otherwise available to isolated bureaucrats" and that "[p]artly as a result of the simple tools now available for collaboration and partly as a result of a highly mobile labor market of "knowledge workers," people are ready and willing to share that information across geographic, disciplinary, and institutional boundaries.").

[168] One analysis found that a higher percentage of adults over age 65 voted in the 2000 presidential than all adults under 65. *See* Tucker Sutherland, *Senior Vote Growing Much Faster Than That of Younger Voters, Oct. 29, 2004,* SENIOR JOURNAL, *available at* http://seniorjournal.com/NEWS/Politics/2004/4-10-29SeniorVoteGrowth.htm. The Census Bureau reported that adults over 65 comprised cast nearly 20 percent of the votes in the 2004 presidential election and that 71 percent of registered senior voters actually voted. *See* Press Release, *Older Americans Month: May 2008*, U.S. Census Bureau, *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/011603.html.

[169] For more information, *please see* www.benefitscheckup.org.

[170] For more information, *please see* https://a858-ihss.nyc.gov/ihss1/en_US/IHSS_languageSelectionPage.do.

[171] *See* Success Stories, *"Touch Tank" Puts Technology in the Hands of Seniors*, OATS, *available at* http://www.oatsny.org/touch_tank.htm.

[172] For more information, *please see* http://aging.senate.gov/.

[173] *See* http://www.apt.org/BB-changed-my-life/.

[174] Pew estimates that, as of May 2008, 43 percent of adults over the age of 65 remain offline. *Home Adoption 2008* at p. 13.

[175] *California Broadband Task Force Report* at p. 74-77.

[176] *See, e.g.*, Austan Goolsbee, *Subsidies, the Value of Broadband, and the Importance of Fixed Costs*, in BROADBAND: SHOULD WE REGULATE HIGH-SPEED INTERNET ACCESS? 278-294 (Crandall & Alleman, eds) (AEI- Brookings Joint Center for Regulatory Studies 2003).

[177] *See Number of Senior Citizens in Workforce Rapidly Climbing, Says New Report*, Feb. 15, 2008, SENIOR JOURNAL, *available at* http://seniorjournal.com/NEWS/Money/2008/8-02-15-NumberofSenCit.htm ("[In 2007], Kohl introduced two bills: the Older Worker Opportunity Act of 2007 (S.709) and the Health Care and Training for Older Workers Act (S.708), both of which would give older Americans the opportunity to work longer if they so choose and offer incentives to businesses for employing older workers.").

[178] This approach has been adopted in a number of states across the country. *See, e.g.,* Press Release, *New Commerce Program Encourages Broadband Availability,* Feb. 28, 2007, Wisconsin Dept. of Commerce, *available at* http://commerce.wi.gov/NEWS/releases/2007/034.html. It has also been endorsed by the National Telecommunications & Information Administration, which provides telecom advice to the President. *See* Report, *Networked Nation: Broadband in America*, at p. 3, National Telecommunications & Information Administration, U.S. Department of Commerce (Jan. 2008), *available at* http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf.

[179] Time Warner Cable is currently experimenting with this approach. *See, e.g., TWC Tees Up Metered Internet Trial,* June 3, 2008, LIGHTREADING, *available at* http://www.lightreading.com/document.asp?doc_id=155499&site=cdn.

[180] *See* Connected Nation, State Programs, http://www.connectednation.com/state_programs/.

[181] *See* Connected Nation, e-community Strategies, http://www.connectednation.com/state_programs/eCommunity_Strategies.php.

[182] *Connected Nation Report* at p. 4.

[183] *See* FCC, Wireline Competition Bureau, Industry Analysis and Technology Division, *Local Telephone Competition: Status as of June 30, 2007* (Jan. 2008).

[184] As of early December 2008, a large stimulus package was being negotiated for passage in early 2009. Preliminary discussions included the possibility of dedicating some of that funding for investment to increase access to broadband. *See, e.g.,* Corey Boles and Fawn Johnson, *Internet-Access Funds to be Included in U.S. Stimulus Plan*, Dec. 2, 2008, DOW JONES NEWSWIRE, *available at* http://telephonyonline.com/external.html?q=http://money.cnn.com/news/newsfeeds/articles/djf500/200812021616DOWJONESDJONLINE000620_FORTUNE5.htm.

[185] *See, e.g.,* Cecilia Kang, *New Coalition Drawing Up Nationwide Broadband Access Strategy*, Dec. 3, 2008, WASH. POST, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2008/12/02/AR2008120203164_pf.html (noting that "representatives from technology and telecommunications companies, labor unions and public interest groups frequently at odds with one another agreed to provide the next president with a roadmap for how to accomplish those goals…That map could include tax breaks, low-interest loans, subsidies and public-private partnerships to encourage more investments in upgrading and building out high-speed networks.").

[186] *See* One Economy, Broadband/Hardware, http://www.one-economy.com/ourwork/broadband.

[187] *See* FTC, *Broadband Connectivity Competition Policy*, at p. 11, Staff Report (June 2007) *available at* http://www.ftc.gov/reports/broadband/v070000report.pdf.

[188] *Id*. at p. 157-159.

Attachment #11

NETWORK EFFECTS:
AN INTRODUCTION TO BROADBAND TECHNOLOGY & REGULATION

A Study Commissioned by the U.S. Chamber of Commerce

DECEMBER 2008

A REPORT TO THE U.S. CHAMBER OF COMMERCE

NETWORK EFFECTS: AN INTRODUCTION TO BROADBAND TECHNOLOGY & REGULATION

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The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School thanks the U.S. Chamber of Commerce for commissioning this report. The ACLP thanks New York Law School Dean Richard Matasar for his continued and unwavering support of the study of those law and policy issues impacting all Americans. And the ACLP is indebted to Senior Fellow Lesley O'Neill and Research Fellow Ann Turner for their invaluable assistance.

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About The ACLP at New York Law School

The Advanced Communications Law & Policy Institute ("ACLP") at New York Law School is a public policy program that focuses on identifying and analyzing key legal, policy, and regulatory issues facing the advanced communications sector. ACLP's mission is to promote robust and solution-focused dialogues amongst state and federal policy makers, industry, academe, the financial community, and consumers concerning changes to the state and federal regulatory regimes governing wireline, wireless, broadband, and IP platforms.

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1. EXECUTIVE SUMMARY

Less than a decade ago, the dial-up modem was the primary means of getting online, enabling Internet connection speeds upwards of 56,000 bits per second, or 56 kilobits per second. Such speeds, slow by today's standards, were adequate for an Internet that was dominated by text-based sites, correspondences, and file transfers. However, the number of Internet users, the sophistication of content, and demand for advanced applications increased exponentially in the mid-1990s, highlighting the need for more high-capacity bandwidth to accommodate the rise in network traffic. This demand, along with cheaper network equipment, drove the development and deployment of broadband in the late 1990s.[1]

By 1999, broadband was being heralded as an economic and social catalyst, a technology that was poised to "increase our nation's productivity, create jobs…[and] meaningfully improve our educational, social, and health care services."[2] Over the last few years, broadband has replaced the dial-up modem as the primary Internet connection for the vast majority of consumers and businesses because it can deliver robust voice, video, and data services more quickly and reliably than its narrowband predecessor. Indeed, only 10 percent of American households still use a dial-up connection while over 55 percent have adopted broadband.[3]

As a result of such robust adoption and rapid innovation, broadband is fundamentally changing the way people live their lives. It is being used to spur technological innovations in the areas of health care, education, environmental sustainability, economic development, energy efficiency, personal wellbeing, and government. Broadband brings people closer together, helps consumers save money, makes government more accessible, and creates jobs. Broadband is currently a life-altering tool for many and should be viewed as an indispensable tool for all Americans as the technology is further integrated into daily life. Understanding exactly what broadband is, how it has evolved, and what the regulatory philosophy is that has allowed this vital new technology to flourish is critical to understanding how policy making can and will impact the evolution of networks and content.

Section II discusses two core aspects of broadband. First, it assesses the current broadband market and analyzes the policies that have enabled the market to grow and innovate at such a dramatic pace. Second, this section discusses the many facets of the broadband network and underscores the pivotal role that the network plays in facilitating innovation. Advanced, reliable, and efficient networks are essential to continued deployment and adoption of new technologies and services. Cutting-edge applications increasingly rely on stable broadband connections to deliver flawless and, in many cases, lifesaving services like telemedicine. *Being able to design, construct, and*

manage a network is crucial to creating the proper incentives for deploying physical broadband infrastructure and continuing to encourage and foster innovation.

Section III discusses the growing number of regulatory challenges facing the broadband market. The current regulatory environment, which focuses on promoting facilities-based investment and platform competition, has played a key role in enabling innovation at the network and application levels. The result has been a massive increase in network investment by communications providers. Indeed, it is estimated that companies will have invested upwards of $60 billion in communications infrastructure in 2008.[4] Moving away from a pro-investment model would halt this organic progress and would have a devastating effect on the U.S. economy, investment, and innovation as discussed at length below. Moreover, policies aimed at management practices are unnecessary and would serve only to chill innovation at the network level and at its edges, resulting in net consumer welfare losses.

Public policy should recognize that pro-investment policies have spurred the growth of broadband and that network management plays a critical role in ensuring that consumers realize the full benefits of the technology. Thus, policymakers should be guided by the ***foundational principles*** discussed below:

- The broader advanced communications marketplace, including the broadband and wireless sectors, has responded positively to the pro-investment policies designed by a bipartisan Congress and the FCC to spur innovation, investment, and network build-out.
- Government intervention in the broadband marketplace through the imposition of restrictive policies, such as those that would control how providers price, market, and manage their products and services, would deter innovation, halt competition, and thwart the continued enhancements of broadband networks.
- Network management allows network owners to mange congestion, prevent jitter and latency, ensure a reliable quality of service, and otherwise optimize network performance for all users.
- Consumers would be negatively impacted by efforts to restrict network management. In the short term, the Internet experience of the majority of average users could be negatively impacted by high-capacity users, the actions of which can crash a network or greatly congest it. In the long-term, such policies could impair the effectiveness of lifesaving telemedicine and other applications that ride the network and require connections that are jitter-free.
- The ability of network managers to prioritize emergency and lifesaving data is necessary in order to realize the full potential of many new telemedicine, telehealth, and distance learning services and

applications. Thus, stripping network owners of the ability to effectively manage their networks imperils users and decreases incentives to further innovate in this space.

2. AN OVERVIEW OF BROADBAND DEVELOPMENT, DEPLOYMENT & POLICY MAKING

Throughout the development of the Internet, the federal government, acting through Congress and the Federal Communications Commission ("FCC"), has implemented a regulatory framework designed to rely on technological advancement, competition, and investment, as opposed to one that sough to prop up a monopoly provider, which characterized telecommunications regulation of the past. Support for this policy framework has been largely bipartisan. Even as demand for Internet services and access exploded, regulatory mandates were minimal. This approach has been necessary in order to promote the continued deployment of broadband networks across the country.[5]

In the advanced communications space, narrowly tailored, pro-competition regulation has consistently facilitated competition and innovation. In the broadband sector specifically, deregulatory policies have created consumer welfare gains. Intermodal competition has driven the deployment of next-generation broadband networks to nearly every corner of the country and has similarly spurred innovation among application and content providers. Broadband users now have access to a growing universe of life-enhancing and potentially lifesaving applications and services.

The positive impacts of regulatory policies that support and encourage competition in the broadband sector are multiple. First, the wide availability of robust networks has facilitated the rapid development and consumption of cutting-edge Internet applications like IP video and lifesaving advances like telemedicine and remote monitoring services. Consumers are relying on broadband services more than ever before. Second, increased consumer demand for broadband has spurred further investment and innovation at the network level. Network owners have poured and continue to pour billions of dollars into the physical broadband infrastructure to ensure that consumers have access to the content they most desire.[6] Recent network deployments and announcements of future intentions for investments signal a new primacy for providing consumers with even more robust broadband connections (see Section 2.3.2 for a discussion of these new network offerings).

Third and perhaps most importantly, perceptions regarding the network itself are changing. Long eschewed as just a "dumb" set of pipes used to transmit simple data packets, advanced broadband networks are fast becoming a critical cog in the machine

of innovation. Complex and bandwidth-intensive applications and content require a "smarter" and more robust network to provide reliable service. *To this end, the advent of real-time voice, video, telepresence, and other broadband-enabled services has necessitated the development of protocols for efficiently managing data traffic and congestion on networks.* Without ample latitude to manage this traffic, broadband networks, no matter how robust, will fail to perform at the highest possible levels.

2.1 The Evolution of Policy Making in the Broadband Sector: Less is More

In 1996, a bipartisan Congress made clear its intent to rely on policies that limited government intervention on the Internet. In its overhaul of the 1934 Communications Act, Congress explicitly stated that "[i]t is the policy of the United States…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation."[7] Regulatory authority for the Internet was delegated to the FCC, which outlined a goal of "ubiquitous availability of broadband to all Americans."[8] To reach this objective, the FCC has fostered a "minimal regulatory environment" for Internet access technologies, especially those that deliver broadband service.[9]

With phone, cable, wireless, satellite, and other companies aggressively competing for broadband consumers, the FCC has worked to create regulatory parity among broadband platforms. This policy has provided the marketplace with certainty, which has in turn helped spur competition, network deployments, price and service competition, and increased subscribership.[10]

SNAPSHOT 1
Examples of Subsidizing Competition:
The 1996 Telecom Act

- From March 2000 to July 2004, market capitalization in the telecom sector plummeted from $1,135 billion to $375 billion.
- Some 380,500 jobs were lost between March 2001 and May 2004 in telecom service, Internet service, and equipment manufacturing.
- The communications equipment-manufacturing sector experienced a 74% decline in market capitalization for the same period.
- The telecom industry lost 193,000 jobs between 2000 and 2003.

Unfortunately, many other aspects of the 1996 Act proved to be ineffective because they were too proscriptive. A number of provisions in the Act sought to dictate the market forces of and create artificial competition in a very dynamic and fluid sector. As a result of regulatory arbitrage, a large influx of competitors flooded the local telephone market, helping to inflate a technology "bubble" that eventually exploded in spectacular fashion around the turn of the century (see Snapshot 1).[11]

In diametric opposition, a pro-competitive approach has been successful in the wireless sector. When the Commission revised its rules in the mid-1990s to allow more than two carriers to serve each local market, the wireless industry experienced explosive growth and consumers realized enormous consumer welfare gains, including lower costs and innovative services (see Snapshot 2). Wireless providers invest billions of dollars each year in their networks in order to provide more ubiquitous and reliable service.[12] In addition, as described in more detail below, intermodal competition in both the voice and broadband markets have pushed wireless providers to speed the deployment of third- and fourth-generation networks in order to provider users with a robust mobile broadband experience.

SNAPSHOT 2
The Success of Open Markets & Network Competition:
The National Framework for Wireless

The adoption and implementation of a deregulatory national framework for wireless in the 1990s has had a profound and lasting impact on the sector:

- There are currently over 262 million wireless subscribers in the U.S., up from 44 million in 1996 and 28 million in 1995.
- The penetration rate is currently 84 percent. In 1995, it was 11 percent.
- Nearly 16 percent of households have "cut the cord" and use only wireless for phone calls.
- Prices continue to decline as consumers are offered a growing universe of tailored service options.
- Ovum estimates that mobile service produces annual productivity gains in the hundreds of billions.

Similarly, the Internet was developed under an analogous regulatory rubric that was minimalist in nature. Although initially a government-funded project, the Internet was eventually spun off into a private endeavor that was guided by the efforts of scientists, researchers, academics, and others who were provided with the freedom to tinker with the foundations of the web.[13] These innovations did not come about by government diktat but rather through collaboration. Network engineers, computer scientists, and others belonging to the initial cadre of experts who helped design the Internet were free to act in the best interests of web users.[14] Government did not attempt to micromanage innovation.

Consumers across every demographic have enjoyed the enormous welfare gains that have resulted from a consistently pro-competitive approach to regulation in the advanced communications market. As set forth below, the broadband market in particular has greatly benefited from an approach that has been focused on platform competition and investment.

2.2 The Current Broadband Market

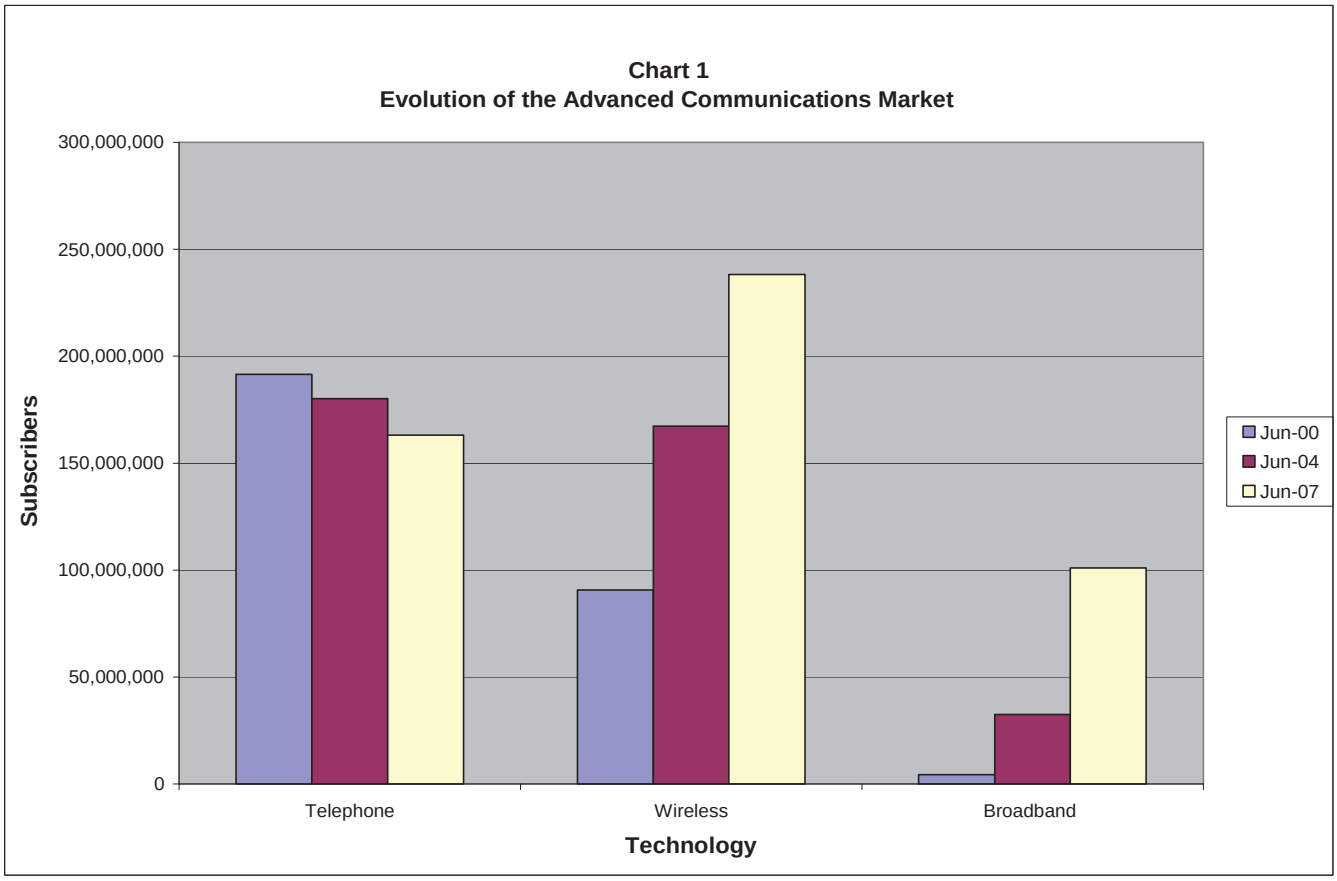
The emergence of broadband as a mainstream method of communication has been remarkable. Since June 2000 the number of broadband lines in the United States has increased by 2,360 percent.[15] Broadband is widely available; indeed, according to the FCC, *only 0.1 percent of zip codes in the U.S. reported no broadband in June 2007*.[16] Moreover, much of the population lives in areas with multiple service providers; nearly 90 percent live in areas with competition and choice of broadband services.[17] Competition among network owners has led to decreased prices for consumers[18] and increased choice for getting online. Across the U.S. there are some 1,360 different broadband providers.[19] Consumers have a number of options for obtaining broadband Internet service. These include digital subscriber line ("DSL"), cable modem, third-generation ("3G") wireless service, fiber-optic networks, and more. With such a diversity of choice, more and more consumers are accessing the Internet via non-traditional means. For example, over 40 million wireless subscribers regularly access the Internet via their mobile phones.[20] The emergence of broadband has stirred intermodal competition and has fundamentally altered the landscape of the advanced communications market (see Chart 1 on the next page).

SNAPSHOT 3
Key Broadband Statistics

- Over 100 million broadband lines in service across the U.S., up from 4 million in June 2000.
- Broadband is available in 99.9 percent of all zip codes.
- 90 percent of the population lives in areas with 4 or more broadband providers.
- The number of fiber-optic connections doubled between 2006 and 2007, and continues to rise.
- 40 million consumers access the Internet on their mobile phones, enabled by next-generation networks.

Sources: FCC; Nielsen Mobile

Current pro-investment policies have allowed for innovation and investment in all facets of the broadband market. Network owners responded to increased consumer demand for advanced applications and faster Internet connections by developing and deploying next-generation broadband networks. The first wave of innovation leveraged existing infrastructure – the copper-based telephone network, coaxial cable networks, and wireless spectrum – to provide the first iteration of broadband service. Over the last several years, however, network owners, including telecommunications firms, cable companies, and wireless providers, have invested billions of dollars in order to build out next-generation broadband networks that are largely based on fiber-optic cables and more advanced spectrum management technologies. These newer networks provide end-users with faster upload and download speeds and more reliable connections (see Section 2.3.2 for further discussion).



Source: FCC

Companies vying for broadband consumers are integrating Internet Protocol ("IP") technology into their products and services. Such convergence of technologies encourages further innovation, allows for a wide range of new products to be deployed, and spurs new types of competition. For example, wireless companies are bolstering their networks with next-generation equipment to enhance the end-user experience and enable cutting-edge handsets like the iPhone. These types of Smartphones are able to access the Internet at broadband speeds, allowing consumers to watch videos on their handsets, download music, and otherwise enjoy a nearly seamless mobile broadband experience. Such diverse functionality, which is enhanced by a wireless broadband connection, provides consumers with the ability to purchase one device for many different uses and thus save money.[21]

2.3 Network Effects: The Shifting Paradigm & Increasing Importance of the Broadband Network in the Modern Digital Age

At the dawn of the Internet age, the underlying physical network of wires and routers was tasked with transporting traffic that consisted mostly of text. Indeed, before the development of "commercial" Internet service offerings like AOL, the Internet was used

mostly by hobbyists, researchers, and academicians for email and file transfers.[22] However, demand grew as soon as the Internet became publicly available in the early 1990s. In 1995 and 1996, Internet traffic grew at an annual rate of 1,000 percent.[23] Traffic continued to grow at a rate of 100 percent per year in 1997 and 1998.[24] *Fortunately, network engineers had the flexibility to adapt the network in order to accommodate the growth in size and scope of the Internet.*[25] Similarly, network providers responded to increasing consumer demand for a more robust online experience by deploying more advanced networks and implementing "new ways of network budgeting and engineering" to accommodate increased traffic and congestion.[26]

Over the last few years, however, the Internet has transitioned to its "third phase," characterized by the ability to transmit rich content like VoIP, video, and a growing array of real-time services that depend on a broadband connection to be reliably delivered.[27] Consumer demand for these types of services has sharply increased and is poised to further expand as faster broadband networks are deployed.

As a result, there have been three fundamental changes within the broadband market, each of which is tied to the evolving nature of the broadband network.

2.3.1 Increasing Consumer Consumption of Internet Services & Applications

First, there has been a dramatic shift in the way people are using their broadband connections. Consumption of online services and content has steadily increased over the last few years. Perhaps the most illustrative example of how consumer use of the Internet has evolved is consumption of online video.

The advent of fast broadband networks facilitates the rapid transmission of very large video files to end users. Depending on their length and quality, video files may contain many gigabits (i.e. billions of bits) of data. Consumers can view or obtain video in a number of ways, including by downloading it directly from a website, downloading it via a peer-to-peer network[28], or streaming[29] it. Streamed video is perhaps the most popular video application and can be found on websites like YouTube and Hulu. YouTube is by far the most popular video site with over 40 percent market share.[30] To get a sense of how popular Internet video is, consider that in December 2007 U.S. users viewed 10 billion videos online, then a new record.[31] By July 2008, that number rose to 11.4 billion.[32] And the amount of bandwidth consumed just by You Tube alone is staggering. It uses as much bandwidth as the entire Internet did in 2000[33] and currently accounts for approximately seven percent of all U.S. Internet traffic.[34] Chart 2 illustrates how very popular streaming video has become in just the last three years.

CHART 2 – U.S. Online Streaming Video Viewing Habits: 2005-2008

	June 2005	July 2007	July 2008
# of U.S. consumers who watched streaming video online	94 million	134 million	142 million
% of U.S. Internet population that watched streaming online video	56	75	75
Avg. # of minutes of video viewed per month by U.S. users	73	180	235

Source: comScore

However, while three quarters of American Internet users have viewed videos online, very few are considered "heavy users." These users consume an average of 841 minutes (or 14 hours) of video viewing per month, compared to just 7 minutes for "light users."[35] Even as more people view videos online, there continues to be a wide disparity between casual viewers who watch only a couple of minutes per day versus a minority of users who consume the vast majority of minutes. Over the past year, the number of videos being uploaded or downloaded online has increased 1,000 percent.[36] Across the board broadband customers are using 40 percent more bandwidth each year.[37] Yet according to Time Warner Cable, only five percent of its users account for more than 50 percent of bandwidth usage.[38] As a result, one study predicts that by 2011, the amount of data on the Internet will have increased tenfold since 2005.[39] By pushing the network to the edge, these extreme users may raise the cost of Internet access for all customers as providers are forced to invest in network upgrades at a faster pace than 95 percent of the marketplace would require.

In addition to video, however, broadband networks have also facilitated the development of services and applications that can be used to enhance an individual's health and, in a growing number of cases, save lives. As discussed in the four companion papers to this study, broadband has had and will continue to have a profound impact on the healthcare and medical services industry, on education, on people with special needs, and on senior citizens. Moreover, consumers are using their broadband-enabled VoIP phones to make emergency calls in addition to low-cost personal calls. *While these types of life-enhancing and lifesaving applications vary in their bandwidth requirements, they often require a secure network connection.*

Rapidly growing use of bandwidth-intensive applications has increased the amount of traffic being sent over broadband networks. At times, networks become overwhelmed with traffic and can become clogged and congested, which in turn slows the transmission of all data packets. As described in further detail below, network operators are currently confronted with a unique problem: managing a network that

transmits a large variety of data, some of which may be purely for entertainment and some of which may be for voice communications or emergency or lifesaving purposes. *Thus, the network – its infrastructure and ability to manage different types of traffic – has fast become a critical factor in enabling further innovation at its edges.*

2.3.2 Innovation at the Network Level

The second change in the broadband market is the amount of innovation at the network level. While network owners have always invested large amounts of money and resources into their infrastructure, recent developments have signaled a new primacy for even more robust networks (see Snapshot 4).

Wire-based network owners – i.e. telephone and cable companies – for example, are currently upgrading their respective networks to provide consumers with voice, video, and broadband services. Verizon, for example, is spending at least $23 billion dollars on its new FiOS system, which replaces its old copper-wire phone with fiber-optic lines capable of delivering double-digit megabit per second broadband speeds.[40] Similarly, AT&T is deploying a fiber-optic system – U-Verse – across its entire service territory.[41] Both plan to have their networks completed in the next few years. Cable providers – e.g., Comcast – are also upgrading their networks with a new technology – DOCSIS 3.0 – which will boost broadband speeds that are comparable to fiber-optic speeds.[42]

SNAPSHOT 4
Broadband Network Innovation

- *Fiber-optic networks.* Fiber-optic cables provide much faster and more symmetrical broadband service.
- *Advanced cable systems.* New delivery methods provide end-users with even faster Internet access.
- *Third-generation (3G) Wireless Networks.* Most major carriers have already deployed these networks, which enable a wide range of mobile applications.
- *WiMAX*. One of the leading 4G wireless technologies, this as-yet deployed service promises broadband-level speeds.
- *Long-term Evolution*. An alternative to WiMAX, these networks will be deployed in the next few years by AT&T and Verizon.

Wireless providers are also deploying next generation networks to provide users with more broadband-enabled applications like email, faster web access, and a host of new location-based services (e.g., GPS directions). For example, most major national mobile operators have already launched, or are in the processing of launching, third-generation

("3G") networks that are capable of delivering broadband-level Internet access and that enable a wide-range of broadband tools. To date, over 64 million wireless users have 3G-capable devices.[43] Additional deployments are expected later this year by carriers like T-Mobile.[44] The next generation of wireless networks is also in the process of being deployed. WiMAX, one fourth-generation ("4G") standard, will be deployed nationwide by a consortium led by Sprint Nextel and Clearwire.[45] Long-term Evolution ("LTE"), another 4G standard, will also be deployed in the next few years by Verizon and AT&T.[46]

In general, innovation at the network level provides applications developers with a reliable and fast infrastructure, thus encouraging further innovation at the edges of the network. However, as discussed in the next section, perceptions regarding the network itself are changing in important ways. Innovation at the edges of the network has populated the Internet with a rich and dizzying collection of information and applications. Yet it is innovation within the network that promises to facilitate further innovation and to ensure that all users have ready and reliable access to the information and applications they demand.

2.3.3 The Network as an Enabler of Innovation

The third change in the broadband market regards the shifting perceptions associated with the network. The physical infrastructure of the Internet – wires, routers, etc. – has been described by some as a "dumb" network that blindly transfers content from user to user.[47] In other words, the network is viewed here as nothing more than a conduit through which both harmful and "safe" content could pass.[48] However, the wide availability and adoption of broadband has changed this dynamic. Increased bandwidth allows for the transmission of much larger amounts of data than older narrowband networks. As a result, the user experience is impacted by not only an individual's actions but by the actions of other users and the actions of the network owner, which must ensure a reliable quality of service to its customers by efficiently managing the exploding amount of traffic flowing over its wires.

The exponential increase in data traversing the Internet infrastructure has challenged the capacity of networks and has necessitated the development and implementation of more effective "network engineering" tools and protocols to manage traffic by nearly every Internet stakeholder. To ensure that their customers have the best Internet experience possible, these companies need the flexibility to quickly and adeptly maximize the reliability, security, and speed of their networks. For example, application provider Google collects enormous amounts of information each day and systematically organizes it to make it useful for consumers.[49] Its primary tool for organizing information is an algorithm that analyzes web pages and ranks them using a subjective set of data.[50] Similarly, Akamai, a company that provides services to facilitate

the transmission of content over the Internet, actively monitors network traffic in order to assure the timely and safe delivery of its clients' data.[51]

The ability to implement similar methods by network owners, however, has recently been questioned. Some argue that the original perception of the network – i.e. a "dumb" set of wires – should still apply in order to preserve the sanctity of the Internet.[52] Yet as described above, this view is no longer tenable at a time *when unmanaged Internet traffic has the potential to overwhelm and potentially crash a network or unduly impair the Internet experience for a majority of users.*

The Internet remains a powerful medium for the transmission of data from user to user. Yet due to the advent of broadband Internet access, the rise in data traffic, and the increasing complexity of online services and applications, the original perceptions associated with the network are shifting. The network is now a critical enabler of continued innovation at its edges. But for robust and reliable broadband connections, consumers would not be able to enjoy the cutting-edge innovations described above and in the companion papers to this study. Indeed, innovation and creativity would likely be stifled if networks became too congested to be useful to consumers or valuable to content and service providers.

3. TURNING POINT: POLICY CHALLENGES & THE 21ST-CENTURY BROADBAND MARKET

> *A small number of wireless sensors blanket the house of a senior citizen, monitoring her movements in a real-timer manner and uploading data wirelessly to a server that is accessible by her family and primary care givers. If the sensors detect an anomaly – a disruption in her movement, e.g., a fall or the inability to get out of bed – an alert is sent over the network to her primary care giver, to her family and, potentially, to emergency medical personnel. However, at the moment when this alert is about to be sent, a small contingent of users on the same broadband network are busy downloading full-length high-definition movies via a peer-to-peer file transfer network.*

High-definition video transfer and other data-intensive applications require tremendous amounts of bandwidth and have, on occasion, caused networks to crash or slow considerably in order to accommodate the large amount of traffic their actions produce. Under the traditional view of the network, each of these data packets – those associated with the movies being downloaded and those associated with the emergency alert regarding the senior citizen – has the same inherent value. In other words, each set of data is assigned the same level of priority when flowing over the network even though those associated with the movies may crash the network and delay the transmission of the emergency alert.

This type of situation, while rare, was nothing more than a hypothetical occurrence only a few years ago. Innovation at the network level and at its edges has facilitated the development, deployment, and adoption of a growing number of broadband-enabled services like real-time health monitoring and the rapid downloading or streaming of video. The original perception of the network as a "dumb" conduit is thus challenged by these new uses. *Of particular importance is the ability of the network owner to manage the increased traffic flowing over its network in order to provide all its customers with a consistent, reliable connection – and to insure, as needed, that traffic like real-time voice communications or real-time health monitoring is not degraded.*

Some would argue that the ability to manage a network should be regulated even though such might degrade the quality of service for all users or crash a network outright and thus jeopardize the transmission of emergency communications. The debate, then, is about whether 20th-century notions of the network ought to still apply in a 21st-cenutry market. As discussed in this section, policy makers should adhere to pro-competitive tenets when carefully considering whether new regulations are needed for the broadband market. Enacting laws or implementing policies that restrict the ability of stakeholders to innovate will decrease the value of broadband for all users. Most critically, such policies would likely have a disproportionate impact on the services and users described in the papers accompanying this study.

3.1 Calls to Regulate Broadband & the Internet Must be Resisted

Internet use and broadband deployment have surged in the United States because of the government's pro-investment policies. This approach must not be reversed. However, a variety of proposals have been put forward to regulate the broadband sector under the guise of making the physical infrastructure more "neutral" to the data flowing over it.

An increase in adoption and use of broadband over the last several years has resulted in a rise in the amount of content flowing through the network. While most use the Internet for emailing, reading the news, etc., a much smaller yet more avid contingent of consumers use their connections to upload and download huge amounts of information, ranging from full-length movies to entire music libraries. *It has been estimated that, at any one time, only five percent of users consume nearly 90 percent of available bandwidth*.[53] These extreme users can damage a network if it crashes or is clogged with traffic, thus raising the cost of Internet access for all customers.

Net neutrality proposals center on limiting the ability of network owners to manage the content that flows over their infrastructure, thus curtailing their power to ensure that all users, from the average senior citizen checking health information online to the college student downloading movies in her dorm room, have the same ability to enjoy the Internet. But, with more and more data migrating online, including telephone service

and video, the amount of bandwidth needed to seamlessly transport these and other services will increase exponentially.[54] *As a result, imposing regulations that limit the ability of a network owner to manage their network would have three negative impacts on consumers in the broadband market*.

First, the adoption of regulation aimed at network owners would hinder the market forces that have driven the development and deployment of advanced broadband infrastructure across the country. Competition in the sector has spurred broadband providers to upgrade their networks to provide users with faster, more reliable service. Upgrading is continuing. Network owners have taken the financial risk of investing hundreds of billions of dollars in their infrastructure based on almost a decade's worth of policy decisions that have determined that limited government intervention is the best way to spur broadband growth.

Altering the pro-competitive framework by adopting network regulation could chill these deployment efforts and ultimately lead to welfare losses for all consumers. For example, the price of broadband could increase if regulatory compliance costs are passed on to the consumer. Moreover, companies might decide to limit investments in network upgrades because of the prospect of having to redesign their networks to comply with future regulations. The dynamic nature of the Internet requires providers to have the flexibility to respond to market demands without fearing that their engineering choices will be subject to second-guessing or censure by the government.

Second, regulation that chills investment and innovation at the network level would trickle down to the application level, depriving consumers of new services. Network upgrades and innovations spur application and content developers to develop new services. If developers of broadband-enabled applications face a stagnant broadband sector, then they, too, will have little incentive to innovate. Innovative bandwidth-intensive applications that provide lifesaving services (e.g., telemedicine) will only be developed and deployed if advanced network infrastructure is in place. Moreover, at-risk users like seniors and people with special needs can only adopt these services if broadband connections are readily available. *Network regulation would serve only to slow innovation and discourage continued network deployment by increasing regulatory uncertainty and decreasing financial incentives to deploy advanced infrastructure.*

Third, regulations that impair network management and data prioritization would ignore the realities of the network. Network management and data prioritization are necessary practices employed daily by network owners (see Snapshot 5). The idea that network owners should be precluded from offering customers prioritized data fails to take into account current techniques used to alleviate congestion on networks. E911 VoIP calls, for example, are usually given priority over regular calls in order to overcome issues like "jitter." Jitter refers to a "variation in the delay of received packets. At the sending side, packets are sent in a continuous stream with the packets spaced evenly apart. Due to network congestion, improper queuing, or configuration errors, this steady stream can become lumpy, or the delay between each packet can vary instead of remaining constant."[55] Jitter can degrade the service of real-time services like VoIP and health monitoring.

SNAPSHOT 5
The Scope of Network Management

Network management allows network owners to:

- Improve network performance for all users.
- Manage network congestion.
- Prevent jitter and latency, which degrade real-time services.
- Identify opportunities for optimizing network performance (e.g., working with P2P providers to increase transmission speeds).
- Ensure that emergency and potentially lifesaving data packets are safely and rapidly transmitted.

Similarly, bandwidth-intensive, real-time applications like streaming video are often given priority over less time-sensitive applications like e-mail[56] in order to preclude "latency". Latency is a measure of how fast a network is running[57] and occurs when too much traffic congests the network, thus slowing speeds for all users.[58] These and other network management decisions are reflective of end-user demand and, in the case of e911 and other calls, of public policy. *An inefficiently managed network, which would likely result if network owners were not allowed to decongest traffic, would jeopardize the quality of service for all consumers and undermine the efficacy of emergency services.*

For those who seek more capacity, the market has been responsive. More active users, like gamers, have the option of purchasing more capacity to suit their needs while more casual users, such as those who use the Internet just for email, have the option of purchasing a baseline plan at prices so low they were unimaginable a few years ago. These types of offerings reflect a healthy market that is considerate of diverse consumer demand.

3.2 Enhancing Pro-Competitive and Pro-Investment Policies in the Broadband Market

The four companion papers being issued in this study highlight the profound and life-altering impacts of broadband on senior citizens, telemedicine, people with special needs, and education. In addition to broadband being a critical and necessary tool for each segment and industry, a common theme among the papers is the importance of government implementing pro-investment policies that promote the deployment of advanced broadband networks to every corner of the country and that bolster efforts to increase the use and adoption of broadband. While each paper identifies a number of sector-specific guiding principles for ensuring that all U.S. consumers have access to broadband and broadband-enabled tools, there are a number of meaningful, overarching policy tools that policy makers should pursue:

- *Government funding allocated to support the broadband industry via an economic stimulus package should be carefully targeted and deliberately disbursed.* Should a portion of a larger stimulus package be earmarked for use in spurring broadband network deployment,[59] funding could be allotted via a number of effective vehicles in order to create a spectrum of incentives for a wide variety of stakeholders. For example, tax breaks could be provided to network owners that deploy advanced infrastructure to unserved areas. In addition, funding could support grants to training programs, community centers, and similar efforts that provide users with computer and broadband access.
- *A full embrace of public-private partnerships will ensure that broadband deployment and adoption efforts are targeted at the most local levels.* A number of public-private approaches – e.g., Connected Nation – have succeeded in devising local and statewide deployment strategies that provide network owners and consumers with incentives to build out and adopt broadband. Federal support of these types of endeavors would enhance their effectiveness at the state level. Support should also be provided to ensure that new federal measures regarding broadband data collection are successful in identifying those parts of the country that are most in need.[60]
- *Rational reform of the Universal Service Fund ("USF") could support federal efforts to spur broadband deployment and could provide critical support in bringing broadband to unserved rural areas.* The USF was created to ensure that all Americans had telephone service. Recent discussions regarding USF reform have centered on recasting its mission to support broadband deployment to unserved areas.[61] Rational reform of the fund that shifts its focus to supporting the deployment of

broadband and advanced wireless networks to unserved areas could supplement other federal efforts to spur network build out.

- *Government efforts should be considerate of the high levels of healthy intermodal competition in the marketplace and policies should thus be tailored that do not threaten to chill these organic efforts.* As discussed in the previous section, there are a number of areas in the broadband sector where the government should not act. Organic competition among a diverse array of broadband providers has increased consumer choice, increased availability, and decreased prices. Going forward, government policies should seek to further these gains by implementing pro-competitive and pro-investment policies.

4. CONCLUSION

The regulatory certainty that has prevailed in the broadband market over the last decade has recently been put in doubt. While the FCC, in theory, provides network owners with the freedom to implement "reasonable network management" methods,[62] in practice it is unclear whether and to what extent they can manage the information flowing over their networks.[63] As discussed above, innovation across the entire broadband sector depends on the availability of advanced network infrastructure. The deployment of such has been "reasonable and timely" to date and has been driven by a regulatory paradigm that allows stakeholders to innovate without the threat of unnecessary government intervention.[64]

In addition, the FCC has adopted four principles "to encourage broadband deployment to encourage broadband deployment and preserve and promote the open and interconnected nature of public Internet: (1) consumers are entitled to access the lawful Internet content of their choice; (2) consumers are entitled to run applications and services of their choice, subject to the needs of law enforcement; (3) consumers are entitled to connect their choice of legal devices that do not harm the network; and (4) consumers are entitled to competition among network providers, application and service providers, and content providers."[65] These principles are working to promote widespread broadband deployment, adoption, and consumer choice. In the context of the dynamic and highly innovative broadband sector, efforts to curtail the ability of network engineers to efficiently manage their networks in real time will harm consumers and hinder innovation. The judgment of network engineers and of consumers should not be replaced with a one-size-fits-all policy.

Each of the four companion papers to this study assesses the impacts of broadband on a discrete segment of the market. Broadband has already had an enormous impact on senior citizens and people with special needs by providing them with an interactive

outlet for realizing economic, social, and healthcare gains. Similarly, broadband has facilitated the development and deployment of a wide range of telemedicine and distance learning services that are currently being used to drive down health care costs, increase access to educational opportunities, and otherwise enhance personal well-being. Broadband is poised to play an even more indispensable role in the lives of seniors and people with special needs and in the further development and adoption of telemedicine and distance learning services. But long-term success for each relies on the present actions of policy makers.

Cutting-edge innovations in the telemedicine and distance learning industries rely on stable and reliable broadband connections. In the case of telemedicine, for example, real-time health monitoring services are increasingly popular among older users and could well become the norm for a large percentage of patients. These services can only be effective if their broadband connection is free of congestion. Similarly, the sophistication of distance learning services runs parallel to the bandwidth of their broadband connections.

Without the ability to design and implement network-specific protocols for the management of traffic, network owners will be limited in their ability to manage traffic, ensure reliability, and otherwise provide consumers with the optimal user experience. Without the availability of robust and reliable broadband infrastructure, innovation at the edges will slow. Without optimal innovation at the edges, the availability of services to seniors, people with special needs, those wishing to decrease the cost of healthcare by using telemedicine services or those wanting to enhance their education remotely will be jeopardized.

It is thus incumbent upon policy makers and all stakeholders to realize that the broadband market is operating efficiently and providing consumers with an array of life-enhancing welfare gains. Regulation of the network is unnecessary and, if imposed, would serve only to halt the many advances described in the accompanying papers. When policy makers ask whether the value of imposing regulation outweighs the many benefits described herein, it should be clear that less regulation, not more, is the key to enabling further innovation across the entire broadband sector.

ENDNOTES

[1] *See, e.g.,* Robert W. Crandall, Competition and Chaos: U.S. Telecommunications Policy Since the 1996 Telecom Act, p. 110 (Brookings Inst. Press 2005).

[2] *See In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, First Report, CC Docket No. 98-146, para. 2 (rel. Feb. 2, 1999).

[3] *See,* John Horrigan, *Home Broadband Adoption 2008*, Pew Internet & American Life Project, at p. 2 (July 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Broadband_2008.pdf ("*Home Broadband Adoption 2008*").

[4] *See Statement of Jonathan Banks to the Subcommittee on Telecommunications and the Internet, Committee on Energy and Commerce, U.S. House of Representatives*, p. 2, July 22, 2008, *available at* http://energycommerce.house.gov/images/stories/Documents/Hearings/PDF/Testimony/TI/110-ti-hrg.072208.Banks-testimony.pdf (quoting a projection made by Yankee Group).

[5] *See, e.g.,* FCC, *Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at Section IX, (June 1999), available at http://www.fcc.gov/connectglobe/sec9.html.

[6] Since 2000, spending on services in support of broadband network infrastructure equipment has totaled nearly $100 billion. It is estimated that spending will top $18 billion in 2008, up from just $3.2 billion in 2000. *See Networked Nation: Broadband in America 2007*, p. 33, Report of the National Telecommunications and Information Administration (Jan. 2008), *available at* http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf.

[7] 47 U.S.C. 230(b)(2).

[8] *See, e.g.*, *In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, para. 2, 22 F.C.C.R. 5901 (2007) ("*Wireless Broadband Order*").

[9] *Id.*

[10] The primary tool that the Commission has used to facilitate continued innovation and build out has been the classification of broadband transmission technologies as "information services" an approach that has created a "consistent regulatory framework across broadband platforms by regulating like services in [a] similar manner." *Wireless Broadband Order*. According to the Communications Act, an "information service" is defined as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service." 47 U.S.C. 153 (20). Classifying a technology as an "information service" exempts it from common carrier regulation and places it under the FCC's Title I ancillary jurisdiction. *See Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv.,* 545 U.S. 967, 968-969 (2005) (upholding the FCC's classification of broadband cable modem service as an "information service"). Over the past few years, the FCC has classified broadband cable modem service, *Id.*, DSL broadband service, *In the Matter of Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket No. 02-33, Report and Order and Notice of Proposed Rulemaking (rel. Sept. 23, 2005), broadband over power lines, *Classification of Broadband Over Power Line Internet Access Service as an Information Service*, 21 F.C.C.R. 13281 (2006), and wireless broadband, *Wireless Broadband Order*, as "information services."

[11] Sources for material in the box on the 1996 Act are: Thomas Hazlett, Coleman Bazelon, John Rutledge & Deborah Allen Hewitt, *Sending the Right Signals: Promoting Competition Through Commerce*, Report of the U.S. Chamber of Commerce (Oct. 2004), *available at*

http://www.uschamber.com/NR/rdonlyres/ewsytfmufpiofdr3r753gtgufvfe7dm7ma4gjz73wwwuwpym3uyxyh3gmtvjzvgxwkqmuyq6tkycnbwn7i7liwbdsbd/0410_telecommstudy.pdf; Stephen B. Pociask, *The Effects of Bargain Wholesale Prices on Local Telephone Competition: Does Helping Competitors Help Consumers?* Joint Study of the New Millennium Research Council & the Competitive Enterprise Institute (June 2003), *available at* http://www.newmillenniumresearch.org/archive/wholesalereport061603.pdf; Stephen B. Pociask, A Failure to Communicate Reforming Public Policy in the Telecommunications Industry (Econ. Policy Inst. 2004).

[12] In the year ending June 2008, wireless carriers invested $21 billion in capital expenditures. *See* CTIA – The Wireless Association, Wireless Quick Facts (Mid-year Figures), http://www.ctia.org/advocacy/research/index.cfm/AID/10323.

[13] *See, e.g.,* Debora L. Spar, Ruling the Waves: From the Compass to the Internet, a History of Business and Politics along the Technological Frontier, p. 258 (2001); Lawrence Lessig, The Future of Ideas, p. 36-41 (2001); Jonathan E. Nuechterlein & Philip J. Weiser, Digital Crossroads: American Telecommunications Policy in the Internet Age, p. 103-131 (2005) ("*Digital Crossroads"*); Jonathan Zittrain, The Future of the Internet, p. 31-32 (2008) ("*Future of the Internet*").

[14] However, up until the early part of the 1990s, many of these stakeholders were funded by various arms of the federal government (e.g., the Defense Department and the National Science Foundation). The Internet was formally privatized in the early 1990s. *Digital Crossroads* at p. 130-131.

[15] *See High-Speed Services for Internet Access: Status as of June 30, 2007,* FCC Wireless Competition Bureau Report, Table 10.

[16] *See* FCC, *In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, *Fifth Report*, *FCC 08-88* (rel. June 12, 2008), para. 35 ("*5th 706 Report*").

[17] *Id*. ("The percent of zip codes reporting four or more providers of high-speed lines also has increased, from 46.3 percent in December 2003 to 88.5 percent in June 2007.").

[18] Prices have dropped four percent since 2005, *Home Broadband Adoption 2008* at p. 7.

[19] *See High-Speed Services for Internet Access: Status as of June 30, 2007,* FCC Wireless Competition Bureau Report, Table 7.

[20] *See* Nielsen Mobile, *Critical Mass: The Worldwide State of the Mobile Web*, p. 3 (July 2008), *available at* http://www.nielsenmobile.com/documents/CriticalMass.pdf.

[21] It was recently reported that a growing number of lower income mobile users have turned to the iPhone as a primary Internet and entertainment device. *See* Press Release, *In Tough Economy, Lower Income Mobile Consumers Turn to iPhone as Internet & Entertainment Device*, Oct. 27, 2008, COMSCORE, *available at* http://www.comscore.com/press/release.asp?press=2545.

[22] *Digital Crossroads* at p. 130.

[23] *See* Andrew Odlyzko, *The Current State and Likely Evolution of the Internet*, p. 2, PROC. GLOBECOM'99, IEEE (1999), *available at* http://www.dtc.umn.edu/~odlyzko/doc/globecom99.pdf.

[24] *Id.*

[25] *See* Robert M. McDowell, *Who Should Solve This Internet Crisis?*, WASH. POST, July 28, 2008 (noting that the "Internet has flourished because it has operated under the principle that engineers, not politicians or bureaucrats, should solve engineering problems") ("*Who Should Solve*").

[26] *See* Andrew Odlyzko, *Internet Growth: Myth and Reality, Use and Abuse*, p. 1, IMP: INFORMATION IMPACTS MAGAZINE, Nov. 2000 (pre-print), *available at* http://www.dtc.umn.edu/~odlyzko/doc/internet.growth.myth.pdf.

[27] *See* Bret Swanson & George Gilder, *Estimating the Exaflood*, p. 4, Discovery Institute (Jan. 2008), *available at* http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=1475 ("*Exaflood*").

[28] A peer-to-peer ("P2P") network "uses diverse connectivity between participants in a network and the cumulative bandwidth of network participants rather than conventional centralized resources where a relatively low number of servers provide the core value to a service or application." *See* Wikipedia: Peer-to-Peer, http://en.wikipedia.org/wiki/Peer-to-peer. In other words, a P2P network is a decentralized way of sharing files among groups of end-users and differs substantially from the traditional, centralized system of data transfer. Under a centralized system, each user downloads a file from the same source (e.g., a website), where under a P2P system, users download bits and pieces of a file from a number of end users.

[29] Streaming media allows an end user to enjoy content "live" by transmitting content in real time. Popular streaming media sites include You Tube (for videos) and Pandora (for music). The more traditional (but increasingly unpopular) method for viewing such content is by downloading the entire media file first and then viewing it.

[30] *See* Press Release, *YouTube Draws 5 Billion U.S. Online Video Views in July 2008,* COMSCORE, Sept. 10, 2008, available at http://www.comscore.com/press/release.asp?press=2444 ("*July 2008 Video Data*").

[31] *See* Press Release, *U.S. Internet Users Viewed 10 Billion Videos Online in Record-Breaking Month of December,* COMSCORE, Feb. 8, 2008, *available at* http://www.comscore.com/press/release.asp?press=2051.

[32] *July 2008 Video Data.*

[33] *See* FCC Commissioner Robert M. McDowell, *Text of Luncheon Address at the Broadband Policy Summit III,* at 13, June 7, 2007, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-273742A1.pdf ("*McDowell Speech*").

[34] *Exaflood* at p. 4.

[35] *See* Press Release, *comScore and Media Contacts Study Highlights Behavioral Differences Among Online Video Viewer Segments*, COMSCORE, Feb. 14, 2008, *available at* http://www.comscore.com/press/release.asp?press=2063.

[36] *McDowell Speech* at p. 13.

[37] *See* Amy Schatz, Dionne Searcey & Vishesh Kumar, *Officials Step up Net-Neutrality Efforts*, WALL ST. J., Feb. 13, 2008.

[38] *Id.*

[39] *See* John F. Gantz et al., *The Diverse and Exploding Digital Universe*: *An Updated Forecast of Worldwide Information Growth Through 2011,* p. 3, White Paper of IDC (Mar. 2008), *available at* http://www.emc.com/collateral/analyst-reports/diverse-exploding-digital-universe.pdf.

[40] Verizon will invest upwards of $18 billion over the next few years to deploy FiOS throughout its service territory. *See* Peter Grant and Dionne Searcey, *Verizon's FiOS Challenges Cable's Clout*, WALL. ST. J., Oct. 24, 2007; *see also* Wikipedia: Verizon FiOS, http://en.wikipedia.org/wiki/Verizon_FiOS.

[41] AT&T will have spent approximately $5 billion by the end of 2008 to deploy U-Verse. *See* Todd Spangler, *AT&T Ups U-verse Spending Estimates by $500 Million,* MULTICHANNEL NEWS, Nov. 6, 2007,

available at http://www.multichannel.com/article/CA6497700.html; *see also* Wikipedia, U-Verse, http://en.wikipedia.org/wiki/U-verse.

[42] *See* Bob Wallace, *Comcast Details its First DOCSIS 3.0 Deployment*, XCHANGE, April 4, 2008, *available at* http://www.xchangemag.com/hotnews/comcast-details-its-first-docsis-3-0-deployme.html.

[43] *See* Tricia Duryee, *3G Adoption in the U.S. Exceeds Western Europe: Report*, WASH. POST, Sept. 4, 2008, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2008/09/04/AR2008090400776.html.

[44] *See* Press Release, *T-Mobile USA Begins Commercial 3G Network Rollout*, T-MOBILE, May 5, 2008, *available at* http://www.t-mobile.com/company/PressReleases_Article.aspx?assetName=Prs_Prs_20080505&title=T-Mobile%20USA%20Begins%20Commercial%203G%20Network%20Rollout.

[45] *See* Cliff Edwards, *Putting WiMAX on the Fast Track,* BUSINESS WEEK, May 7, 2008, *available at* http://www.businessweek.com/technology/content/may2008/tc2008057_480955.htm.

[46] *See* W. David Gardner, *AT&T Plans Fast 4G Wireless Rollout*, INFORMATION WEEK, April 4, 2008, *available at* http://www.informationweek.com/news/mobility/3G/showArticle.jhtml?articleID=207001878; Press Release, *Verizon Selects LTE as 4G Wireless Broadband Direction*, VERIZON WIRELESS, Nov. 29, 2007, *available at* http://news.vzw.com/news/2007/11/pr2007-11-29.html.

[47] This perception stemmed from the "end-to-end" argument, which was originally conceived by a team of network engineers. *See* Jerome H. Saltzer, David Clark & David Reed, *End-to-End Arguments in System Design,* in Integrated Broadband Networks (Amit Bhargava, ed.) (Artech House 1991). Under the end-to-end conception, complexity is pushed to the edge of the network, relegating the "core" or physical network as a "dumb" conduit, much like the traditional telephone system. *See, e.g.,* Lawrence Lessig, Code, Version 2.0, p. 44 (2006).

[48] *Future of the Internet* at p. 164.

[49] Indeed, the company's stated goal is to "organize the world's information and make it universally accessible and useful." *See* Google, Company Overview, http://www.google.com/intl/en/corporate/; *see also* Randall Stross, Planet Google: One Company's Audacious Plan to Organize Everything we Know 21-22 (2008) (noting that "information is a commercially valuable asset, to be hoarded, not shared" and that "Google's search engine needs access to the entire Internet, not merely the patches that remain outside the walled gardens of social networking sites. The company's very existence depends upon advocates of an open online environment holding at bay the threat of encroachment by their opponents.").

[50] *See, e.g.,* John Battelle, The Search: How Google and its Rivals Rewrote the Rules of Business and Transformed our Culture 22 (2005) (describing Google's Page Rank algorithm: "it looks at the links on a page, the anchor text around those links, and the popularity of the pages that link to another page and factors them together to determine the ultimate relevance of a particular page to [a user's] query.").

[51] *See* Akamai, About, http://www.akamai.com/html/about/index.html; *see also The State of the Internet*, p. 4, Vol. 1, No. 1, Akamai (1st Quarter 2008).

[52] This argument has been made by numerous commentators. A brief bibliography of some of the more thoughtful academic pieces includes *Future of the Internet;* Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. Telecomm. & High Tech. L. 141(2003); Mark Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. Rev. 925 (2001).

[53] *Who Should Solve.*

[54] *Exaflood* at p. 4.

[55] *See Understanding Jitter in Packet Voice Networks,* p. 1-2, Cisco, Document ID: 18902 (Feb. 2006), *available at* http://www.cisco.com/application/pdf/paws/18902/jitter_packet_voice.pdf;

[56] *See, e.g.,* Microsoft, Web Server vs. Streaming Server, http://www.microsoft.com/windows/windowsmedia/compare/webservvstreamserv.aspx (explaining how data sent via a streaming server is given priority over data sent via a web server).

[57] *See* Javvin, Network Latency, http://www.javvin.com/etraffic/network-latency.html.

[58] *See* About.com, Latency in Networking, http://compnetworking.about.com/od/speedtests/a/network_latency.htm.

[59] *See* Cecilia Kang, *For the Web, Change All Sides Can Believe In*, WASH. POST, Dec. 17, 2008, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2008/12/16/AR2008121602930.html.

[60] A Broadband Data Collection law was enacted in October 2008. This law "requires Internet service providers to give the FCC more detailed reports so the FCC can identify the actual numbers of broadband connections by customer type and geographic area." *See* Stephanie Condon, *President Signs Broadband Data Collection Bill*, Oct. 10, 2008, CNET NEWS.COM, *available at* http://news.cnet.com/8301-13578_3-10063734-38.html.

[61] *See, e.g., Federal-State Joint Board on Universal Service*, Recommended Decision, FCC 07J-4, WC Docket No. 05-337, CC Docket No. 96-45 (rel. Nov. 20, 2007).

[62] *See* FCC, *In re Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, Policy Statement, fn. 15, 20 FCC Rcd. 14986 (2005) ("*Broadband Policy Statement*").

[63] The FCC recently ruled that Comcast's network management practices vis-à-vis peer-to-peer traffic were not reasonable. *See* FCC, *Memorandum Opinion & Order from the FCC, In the Matters of Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications and Broadband Industry Practices Petition of Free Press et al. for Declaratory Ruling that Degrading an Internet Application Violates the FCC's Internet Policy Statement and Does Not Meet an Exception for "Reasonable Network Management,"* WC Docket No. 07-52, FCC 08-183 (rel. Aug. 20, 2008), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-183A1.pdf.

[64] *5th 706 Report* at para. 59.

[65] *Broadband Policy Statement.*

Attachment #12

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Broadband Industry Practices	)	WC Docket No. 07-52
	)	

Reply Comments of the Advanced Communications Law & Policy Institute at New York Law School

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Reply Comments of the Advanced Communications Law & Policy Institute at New York Law School

I. INTRODUCTION

The Advanced Communications Law & Policy Institute (ACLP) at New York Law School[1] submits these comments in reply to the record in a Petition for Declaratory Ruling of Free Press et al. and a Petition for Rulemaking of Vuze, Inc., which have been incorporated into the above-captioned proceeding.

The Vuze petition seeks Commission action to "determine the parameters of "reasonable network management" by broadband network operators and to establish that such network management does not permit network operators to block, degrade, or unreasonably discriminate against lawful Internet applications, content or technologies."[2] Similarly, Free Press et al. urge the Commission to "declare through a ruling or rules that network providers cannot engage in discrimination against particular applications and that network providers must disclose their network management policies."[3] Both Petitions rely, in part, on the Commission's *Internet Policy Statement*, which was issued in 2005 to ensure that "broadband networks are widely

[1] The ACLP is an interdisciplinary public policy program of New York Law School that focuses on identifying and analyzing key regulatory and legal issues facing the advanced communications marketplace.

[2] *See In re Vuze, Inc. Petition To Establish Rules Governing Network Management Practices by Broadband Network Operators*, at 1, WC Docket No. 07-52 (Nov. 14, 2007) (hereinafter "Vuze Petition").

[3] *See* Comments of Free Press et al. in WC Docket No. 07-52, at 2 (hereinafter "Free Press et al. Comments").

deployed, open, affordable, and accessible to all consumers."[4] These principles were adopted "subject to reasonable network management,"[5] a standard that was left purposefully flexible by the FCC. These Comments endorse the Commission's *Internet Policy Statement*. "Reasonable network management" is a necessarily flexible standard that ought not to be decided by regulatory fiat. Rather, such a determination should be left to the market unless and until there is a clear market failure that negatively impacts consumers. In particular, these comments are grounded in the following:

A "Hands Off" Regulatory Policy Works

- The current "hands off" regulatory approach by the FCC and Congress has resulted in a vibrant, competitive market.
- Intrusive and potentially counterproductive regulation would hinder, not support, the broadband market.

Network Owners[6] *Require Latitude to Manage Networks*

- Network management is necessary to assure the efficient flow of data over networks, preclude network congestion that leads to slow-downs and to maintain network reliability and security.
- Network management facilitates the efficient flow of data for all consumers.
- Imposing rigid network management regulation would compromise the flexibility needed to effectively manage networks.

Market-Based & Legal Remedies Exist to Address Alleged Harms

- As a number of federal agencies have recognized, consumers are the best regulators.
- Existing legal rights and remedies, grounded in contracts law and antitrust law, are preferable to the prescriptive *ex ante* regulation suggested by some.

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[4] *In re Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, Policy Statement, 20 FCC Rcd. 14986 (2005) (hereinafter "Internet Policy Statement").

[5] *Id.* at n. 15.

[6] In this filing, "network owners" refers to infrastructure owners (e.g., telephone and cable companies, wireless carriers, backbone providers, etc.) and any other participant in the broadband market that actively manages data and information within a network. This would include, for example, search engines like Yahoo! and Google, providers of browsers like Microsoft, and other application and service providers (*see infra* Section V for further discussion).

- The availability of these remedies, which would supplement the market-based approaches, cautions against government-mandated network management rules that would stifle competition in the broadband market.

Continued Regulatory Restraint is the Best Approach

- The Commission should continue to exercise regulatory restraint by examining cases of alleged "bad behavior" on a case-by-case basis.
- If regulation is ultimately necessary, any resulting rules should apply equally to all network owners – including content and application providers – that manage data and information within a network.

The current regulatory approach to broadband has proven to be enormously successful, resulting in widespread consumer welfare gains. Competition has spurred the development and deployment of broadband networks and broadband-enabled technologies, all to the benefit of consumers. Innovations in the delivery of broadband and in the services enabled by broadband have provided consumers with an unparalleled user experience. As such, the broadband marketplace requires the continued regulatory certainty of a "hands off" approach and of continued restraint by the Commission. Market-based and legal remedies exist to protect consumers in the event of actual harm. The imposition of rigid *ex ante* network management regulation would chill the marketplace, slow innovation and substitute the judgment of experienced network engineers with that of rigid a set of rules, ultimately to the detriment of consumers.

II. BROADBAND HAS THRIVED UNDER A "HANDS OFF" REGULATORY APPROACH

Throughout the history and evolution of the Internet, Congress and the FCC have been deliberate in their deregulatory approach to it. As demand for Internet access has exploded, regulation has remained consistently "hands off." This approach has been necessary in order to

promote continued development and deployment of networks across the country.[7] As this section will detail, the "hands off" approach has helped spur a robustly competitive marketplace that provides consumers with competitive prices, a growing number of choices for getting online, and innovative new services. There is no evidence that a change in this approach is needed.

A. The Evolution of the "Hands Off" Regulatory Approach to Broadband

In 1996, Congress made clear its intent to keep the regulatory hand off the Internet. In its overhaul of the 1934 Communications Act, Congress explicitly stated that "[i]t is the policy of the United States…to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation."[8] Regulatory authority for the Internet was delegated to the FCC, which has outlined a goal of "ubiquitous availability of broadband to all Americans."[9] To reach this objective, the FCC has fostered a "minimal regulatory environment" for Internet access technologies, especially those that deliver broadband service.[10] The primary tool that the Commission has used to facilitate continued innovation and build out has been the classification of broadband transmission technologies as "information services,"[11] an approach that has created a "consistent regulatory framework across broadband platforms by regulating like services in [a] similar manner."[12]

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[7] *See, e.g., Connecting the Globe: A Regulator's Guide to Building a Global Information Community*, at Section IX, FCC (June 1999), available at http://www.fcc.gov/connectglobe/sec9.html.

[8] 47 U.S.C. 230(b)(2).

[9] *See, e.g., In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, ¶ 2, 22 F.C.C.R. 5901 (2007).

[10] *Id.*

[11] According to the Communications Act, an "information service" is defined as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service." 47 U.S.C. 153(20).

[12] *In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, ¶ 2, 22 F.C.C.R. 5901 (2007).

Classifying a technology as an "information service" exempts it from Title II common carrier regulation and places it under the FCC's Title I ancillary jurisdiction.[13] Over the past few years, the FCC has classified broadband cable modem service,[14] DSL broadband service,[15] broadband over power lines,[16] and wireless broadband[17] as "information services." Such regulatory harmony among broadband delivery technologies has provided the marketplace with certainty and parity, which has in turn spurred competition in the marketplace and has led to the deployment of more advanced networks. As a result, prices have dropped and the number of broadband users nationwide has increased dramatically.

The current investigation into broadband industry practices, which was initiated *sua sponte* by the Commission in April 2007, reflects the explosive growth of the broadband marketplace. By seeking to "enhance [its] understanding of the nature of the market for broadband and related services," the FCC has acknowledged that the broadband marketplace is growing faster than the speed of regulation.[18] The number and type of broadband access technologies, the number and type of broadband-enabled applications, and the number of broadband users have diversified and increased considerably over the last few years. A flexible "hands off" regulatory framework, deliberately established and implemented by the Commission, has created a competitive marketplace where consumer welfare is the primary concern.

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[13] *Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv.*, 545 U.S. 967, 968-969 (2005) (upholding the FCC's classification of broadband cable modem service as an "information service").

[14] *Id.*

[15] *In the Matter of Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Docket No. 02-33, Report and Order and Notice of Proposed Rulemaking (September 23, 2005).

[16] *Classification of Broadband Over Power Line Internet Access Service as an Information Servic*, 21 F.C.C.R. 13281 (2006).

[17] *In the Matter of Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, 22 F.C.C.R. 5901 (2007).

[18] *In the Mater of Broadband Industry Practices*, Notice of Inquiry, at ¶ 1, WC Docket No. 07-52 (released April 16, 2007).

B. Result of the "Hands Off" Approach: The Broadband Market is Competitive

According to the most recent FCC data, the broadband marketplace is robustly competitive. As of December 31, 2006 there were 82.5 million broadband lines in service across the U.S.[19] This represents a 61 percent increase (or 31.3 million) in subscribership over the twelve-month period ending December 31, 2006,[20] and a 1,100 percent increase from 2000 when there were 6.8 million broadband subscribers.[21] Supply of broadband is robust, with availability in 99% of zip codes across the U.S.[22] Over 80 percent of residents live in areas with four or more broadband providers.[23] Nationwide there are nearly 1,400 different broadband providers that provide service in an increasingly diverse number of ways – via cable modem, DSL, wireless (mobile and fixed), satellite, electric power lines, and fiber-optic cables.[24] And service providers continue to invest heavily in their networks in order to attain a competitive advantage on rivals.

Traditional telecommunications firms like Verizon and AT&T have invested billions of dollars in fiber-optic networks that can deliver voice, video and data services to customers. Verizon began building out its FiOS network in 2004, and by 2010 it will have invested $23 billion to bring its customers faster broadband and video.[25] To date, Verizon has signed up over

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[19] *High-Speed Services for Internet Access: Status as of December 31, 2006*, at 1, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-277784A1.pdf/ (hereinafter "FCC Broadband Stats").

[20] *Id.*

[21] *Id.* at Table 10.

[22] *Id.* at 1.

[23] *Id.* at Chart 12.

[24] *Id.* at Table 14; *see also Networked Nation: Broadband in America 2007*, at 13, Nat'l. Telecom. & Info. Admin. (NTIA) Report (January 2008) ("Perhaps the clearest evidence of the success of the Administration's pro-competitive, technologically-neutral approach lies in the sheer growth in the number of broadband service providers and the broad array of technological alternatives they represent."), available at http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf (hereinafter "Networked Nation").

[25] *FiOS Facts: Wrapping up 2007*, Verizon Policy Blog, Feb. 5, 2008, available at http://policyblog.verizon.com/PolicyBlog/Blogs/policyblog/CZBlogger1/420/FiOS-Facts-Wrapping-Up-2007.aspx.

one million customers.[26] Similarly, AT&T will invest some $5 billion over the course of the next year to continue the expansion of its fiber-based U-Verse system.[27] Thus far it is has attracted over 230,000 customers.[28] Combined, these new fiber systems have put pressure on cable companies and have begun to lure away traditional cable customers.[29] In response, the cable industry invested $13.7 billion for infrastructure maintenance and upgrades in 2007 alone.[30]

Increased competition between cable and telephone companies for voice, video and data customers has boosted competition and forced service providers to become more innovative and responsive to consumer demand. For example, Comcast recently unveiled a new broadband service that seeks to directly challenge the faster speeds offered by the telephone companies' new fiber systems.[31] Wireless carriers are also competing for broadband customers. According to the most recent FCC report on the broadband marketplace, over 21 million consumers receive broadband via mobile wireless systems.[32] The wireless industry invested over $20 billion to

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[26] *Verizon 4Q Profits up 3.9 Percent*, CNN MONEY (Jan. 28, 2008), available at http://money.cnn.com/news/newsfeeds/articles/newstex/AFX-0013-22585080.htm.

[27] Todd Spangler, *AT&T Ups U-Verse Spending Estimates by $500 million*, MULITCHANNEL NEWS, Nov. 6, 2007, available at http://www.multichannel.com/article/CA6497700.html.

[28] *Press Release: AT&T Delivers Strong Fourth Quarter, Reaffirms 2008 and Multi-Year Outlook*, AT&T, Jan. 24, 2008, available at http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=25073.

[29] *See, e.g.*, Peter Grant & Dionne Searcey, *Verizon's FiOS Challenges Cable's Clout*, WALL ST. JOURNAL. Oct. 24, 2007.

[30] *NCTA Industry Statistics*, available at http://www.ncta.com/Statistic/Statistic/Statistics.aspx.

[31] *See* Ryan Kim, *Comcast Takes on AT&T with Faster Net Service*, SF GATE, Feb. 11, 2008, available at http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/02/11/BUQ5USL6E.DTL.

[32] FCC Broadband Stats at Table 1, *supra*.

upgrade and expand next-generation networks in 2007,[33] and bidding in the most recent 700 MHz spectrum auction was expected to reach nearly $20 billion.[34]

Demand for broadband is similarly strong, increasing in line with network build-out and investment. According to the Pew Internet & American Life Project, nearly half of all adult Americans have a broadband connection at home.[35] This represents a five percent increase from 2006 and is nearly double the penetration level of three years earlier.[36] Moreover, the Consumer Electronics Association recently reported that 75 percent of households that are connected to the Internet rely on broadband.[37] The Pew Internet & American Life Project contextualized these trends when it stated that "with home broadband penetration poised to surpass 50% this year, it will have taken 9 years from the time the service became widely available for home high-speed to reach half the population. To put this in context, it took 10 years for the compact disc player to reach 50% of consumers, 15 years for cell phones, and 18 years for color TV. Each of those technologies, like broadband, represented an upgrade from a good or service with which most consumers had experience."[38]

C. Conclusion: The Broadband Market Has Thrived Under the "Hands Off" Approach

The broadband marketplace is vigorously competitive and continues to thrive for three interrelated reasons. First, policy makers have kept the regulatory hand off the broadband

[33] *Wireless Quick Facts: Mid-year Figures*, CTIA – The Wireless Association, available at http://www.ctia.org/advocacy/research/index.cfm/AID/10323.

[34] W. David Gardner, *FCC 700 MHz Auction Bids Top $19.3 Billion*, INFORMATION WEEK, Feb. 12, 2008, available at http://www.informationweek.com/news/showArticle.jhtml?articleID=206501363.

[35] John Horrigan, *Home Broadband Adoption 2007*, at 1, Pew Internet & American Life Project (June 2007), available at http://www.pewinternet.org/pdfs/PIP_Broadband%202007.pdf.

[36] *Id.*

[37] *Press Release: CEA Research Finds 72% of U.S. Adults Have Broadband Access*, Consumer Electronics Association, July 23, 2007, available at http://www.ce.org/Press/CurrentNews/press_release_detail.asp?id=11319.

[38] John Horrigan, *Commentary: U.S. Lags Behind*, at 1, Pew Internet & American Life Project (August 2007), available at http://www.pewinternet.org/pdfs/Broadband_Commentary.pdf.

market. A flexible regulatory framework that was developed with regulatory certainty and parity in mind has sent a clear signal to the market that there will not be any undue intrusion by regulators. Second, broadband providers have responded to this signal and to intensifying competition by investing tremendous resources into their networks. This strategy not only seeks to position companies favorably among each other, it also seeks to offer current and potential customers with reliable and affordable services. Third, consumer demand for broadband continues to increase as a result of intermodal competition. They can choose from among a number of intermodal competitors for physically accessing the Internet; they can choose which technology to use when accessing it; and, they can choose from among a variety of service plans depending on their usage.

As the demand for broadband and broadband-enabled technologies and applications continues to both increase and diversify, it is critically important that network owners are given wide latitude to effectively and efficiently manage their networks. Increased use of bandwidth-intensive applications[39] by a small percentage of users, for example, can result in network congestion and slow-downs for the majority of users. As discussed below in Section III, network management is thus a key tool for network owners to ensure that all consumers receive quality broadband Internet access.

III. NETWORK OWNERS SHOULD BE AFFORDED WIDE LATITUDE TO MANAGE THEIR NETWORKS

Concomitant to the surge in demand for broadband Internet access has been a rise in demand for innovative broadband-enabled applications. More advanced broadband networks have spurred application innovation, which has ushered users into a new digital world where

[39] Innovative new products like streaming Internet video and peer-to-peer (P2P) file-sharing services have become enormously popular among one segment of users.

VoIP service, Internet video, e-commerce, e-government, immersive gaming, multimedia research, telemedicine and infinitely more services are available at the click of a button. Demand for these increasingly bandwidth-hungry services requires that network owners employ certain basic data management techniques to ensure that all users can enjoy a seamless web experience.

The Vuze petition argues that some network owners are "deliberate[ly] degrading and blocking" content, leading to the "arbitrary discrimination against traffic carried on their networks."[40] Vuze invokes the Commission's *Internet Policy Statement* and calls on the Commission to "determine the parameters of "reasonable network management" by broadband network operators."[41] The petition bases its call for network management rules on the argument that "[t]he public interest is harmed whenever network operators restrict innovation and access to content, censor political speech, or unreasonably discriminate against or frustrate the legitimate efforts of their competitors."[42] Similarly, Free press et al. cast the debate over network management as a "clash of civilizations," pitting "all citizens" against a handful of "network providers" in the battle for the future of the Internet.[43] *Hyperbole aside, the rulemaking called for by Vuze, Free Press and others is premature, unnecessary and anathema to continued robust competition in the broadband market.*

As discussed in this section, *ex ante* regulation is not necessary and would not be effective in the highly dynamic field of network management. Such regulation would serve only to handcuff network engineers who must adjust network management in a real-time manner depending on network traffic, congestion, time of day and any number of other variables.

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[40] Vuze Petition at 2, *supra*.

[41] *Id.* at 1.

[42] *Id.* at 12-13.

[43] Free Press et al. Comments at 2, *supra.*

"Reasonableness" is a subjective measure of behavior and will change from situation to situation and from case to case. What is "reasonable" on one network at a given point in time on any given day might vary sharply from what is "reasonable" on another network at that same time. Network traffic is unpredictable and oftentimes volatile, which cautions against establishing rigid management standards.

In dynamic markets, *ex ante* regulation, however well-intentioned, cannot keep pace with innovation. The minute the ink dries, the regulations will likely be outdated. As demands on the networks evolve, as new devices, new applications and new content emerge, as new security issues threaten networks, and as a host of other variables come into play, network engineers need the flexibility – and the ability to utilize their academic and professional training, *i.e.*, their judgment – to act reasonably according to the totality of the circumstances at any point in time.

A. Rising Demand for Bandwidth-Hungry Applications Spurs the Need for Effective Network Management

The evolution of the broadband market has empowered consumers in a number of ways. First, it has delivered to them broadband access to the Internet, which allows for a high-speed, always on connection to a universe of information. Second, by increasing the capacity of networks, service providers have enabled cutting-edge innovation in the applications and content delivered over these pipes. As a result, innovations at the network and applications layers have transformed the user experience from a passive, text-based one to an immersive, multimedia, interactive one that is luring more people online for longer periods of time. For example, the average adult American Internet user will spend approximately 31 hours per month online, participating in a wide range of activities, all of which consume varying amounts of bandwidth.[44]

[44] *Press Release: comScore Releases First Comprehensive Review of Pan-European Online Activity*, comScore, June 4, 2007, available at http://www.comscore.com/press/release.asp?press=1459.

For some users, the most popular bandwidth-intensive broadband-enabled application currently in the marketplace is Internet video, which can either be streamed or downloaded. Streamed video can be found on websites like You Tube, by far the most popular video site with over 30 percent market share.[45] To get a sense of how popular Internet video is, consider that in December 2007 U.S. users viewed 10 billion videos online, a new record.[46] And the amount of bandwidth consumed just by You Tube – a for-profit venture – is staggering. It uses as much bandwidth as the entire Internet did in 2000[47] and currently accounts for approximately seven percent of all U.S. Internet traffic.[48] Videos can also be downloaded, either in the "conventional" way (i.e., directly from a website) or by using a P2P file-sharing system. These systems are not new and have been around since the early days of the Internet. However, a new approach to P2P file-sharing has enabled larger videos to be trafficked more quickly to more users.

Decentralized or "torrent" P2P systems "make use of resources — bandwidth, storage, and processing power — on a decentralized basis, allowing large data transfers to be made more efficiently and cost-effectively than ever before."[49] Unlike traditional online data transfer (i.e., files are downloaded directly from the hosting site), "torrent" P2P systems distribute large files by breaking them up into much smaller pieces and routing them to the end user via a number of intermediary users. This model shifts the burdens and costs associated with data transmission away from the distributor and to the broadband infrastructure providers and to the intermediary

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[45] *Press Release: U.S. Internet Users Viewed 10 Billion Videos Online in Record-Breaking Month of December*, comScore, Feb. 8, 2008, available at http://www.comscore.com/press/release.asp?press=2051.

[46] *Id.*

[47] FCC Commissioner Robert M. McDowell, *Text of Luncheon Address at the Broadband Policy Summit III*, at 13, June 7, 2007, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-273742A1.pdf (hereinafter "McDowell Speech").

[48] *See* Bret Swanson & George Gilder, *Estimating the Exaflood*, Discovery Institute Report (Jan. 2008), available at http://www.discovery.org/a/4428 (hereinafter "Discovery Report").

[49] Vuze Petition at 7, *supra.*

and end users.[50] Despite the decentralized nature of these systems, they require substantial amounts of bandwidth to transfer files, which are usually very large (e.g., full-length high-definition movies, video clips and music files).

Even though only a minority of consumers uses these types of P2P applications, participants tend to be among the most active downloaders online. For example, while more than half of all U.S. Internet users have watched videos online,[51] less than 20 percent of this group is considered "heavy users." Indeed, those who are "heavy users" of such sites average 841 minutes of video viewing per month, compared to an average of 77 minutes for "moderate users" and just 7 minutes for "light users."[52] Even as more people view videos online, there continues to be a wide disparity between casual viewers who watch only a couple of minutes per day versus a minority of users who consume the vast majority of minutes. Over the past year, the number of videos being uploaded or downloaded online has increased 1,000 percent.[53] Across the board broadband customers are using 40% more bandwidth each year. [54] Yet according to Time Warner Cable, only five percent of its users account for more than 50 percent of bandwidth usage.[55]

Unlike P2P file sharing systems, a number of less bandwidth-intensive applications rely on a steady Internet connection for optimal use. These applications include VoIP telephony and streaming applications like telemedicine services. VoIP does not require a lot of bandwidth but it

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[50] Wikipedia, BitTorrent (protocol), available at http://en.wikipedia.org/wiki/BitTorrent_%28protocol%29.

[51] Mary Madden, *Online Video*, Pew Internet & American Life Project (July 2007), available at http://www.pewinternet.org/pdfs/PIP_Online_Video_2007.pdf.

[52] *Press Release: comScore and Media Contacts Study Highlights Behavioral Differences Among Online Video Viewer Segments*, comScore, Feb. 14, 2008, available at http://www.comscore.com/press/release.asp?press=2063.

[53] McDowell Speech at 13, *supra*.

[54] Amy Schatz, Dionne Searcey & Vishesh Kumar, *Officials Step up Net-Neutrality Efforts*, WALL ST. JOURNAL, A4, Feb. 13, 2008.

[55] *Id.*

is very sensitive to service degradation. Being a voice service of increasing popularity for the mainstream customer,[56] any drop in quality (e.g., a transmission delay) would be immediately apparent to both callers and might lead to a drop in demand. Similarly, streaming applications like telemedicine services require a steady connection in order to assure service quality and speedy transmission of time-sensitive material.[57]

Service degradation has a discernible negative effect on these types of real-time applications. Degradation stems from network congestion, which is often caused by the heavy data traffic associated with bandwidth-intensive applications like P2P file-sharing systems. Network managers have had to respond to increasingly congested networks by implementing a number of traffic management protocols to ensure that bits associated with a VoIP call or a telemedicine application travel to their destination more quickly than bits associated with a video download or email in order to sustain service quality for all customers.

B. Network Management Facilitates the Efficient Flow of Information to the Benefit of all Consumers

On the most basic level, network management entails monitoring the flow of data over a network, correcting for congestion at various nodes throughout the network, and ensuring that all consumers have a reliable connection to the Internet. All networks share resources at some point in the network. Network managers use a number of tools to monitor data flows and to provide solutions in cases where a network is overwhelmed or too congested. While strategies and approaches differ from network to network and evolve as networks evolve, common management tools include deep packet inspection (DPI) and traffic shaping protocols.

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[56] According to TeleGeography, by mid-2007 there were 11.8 million VoIP subscribers in the U.S., up from 6.5 million in mid-2006. *See U.S. VoIP Market is Growing Fast – but Europe is Growing Faster*, available at http://www.telegeography.com/wordpress/?p=59.

[57] *See Report: e-Health and America's Broadband Networks*, U.S. Internet Industry Association (Aug. 2007), available at http://www.usiia.org/pubs/eHealth.pdf.

DPI allows network managers to identify and inspect each data packet traveling over the network regardless of type or origin.[58] Oftentimes DPI is used to scan packets for viruses, spam and other nefarious elements that might compromise network security.[59] DPI is especially helpful in prioritizing traffic so that data packets associated with sensitive applications like VoIP are given a priority over the data packets of a video download. Ultimately DPI allows network managers to better understand the data flowing over its network, model traffic and devise strategies for routing traffic in such a way that alleviates congestion.[60]

Once the data flowing over a network is analyzed with a tool like DPI, network managers usually employ another set of tools to actually manage the traffic. This is where an approach like traffic shaping is utilized. Traffic shaping tools can analyze the data packets flowing through a network and they can also "shape" or manage network traffic[61] by imposing a delay on some types of traffic in order to control traffic volume, transfer speeds or other aspects of data flow.[62] Moreover these tools have a variety of uses, which make them attractive to network managers. They can "identify and categorize specific types of network traffic," "set per-user traffic limits to ensure that network traffic is shared fairly among all users," and "define the relative importance, or priority, of different types of traffic."[63] Such tools can, for example, help ensure that a voice

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[58] *See Deep Packet Inspection: Introduction*, LIGHTREADING, Dec. 14, 2006, available at http://www.lightreading.com/document.asp?doc_id=111404.

[59] *See* Wikipedia, Deep Pack Inspection, http://en.wikipedia.org/wiki/Deep_packet_inspection.

[60] *See Deep Packet Inspection: Introduction*, LIGHTREADING, Dec. 14, 2006, available at http://www.lightreading.com/document.asp?doc_id=111404.

[61] *See* Rachelle Chong, *The 31 Flavors of the Net Neutrality Debate*, at 7, ACLP Scholarship Series (Dec. 2007), available at http://www.nyls.edu/pdfs/Rachelle%20Chong%20-%20Net%20Neutrality%20Essay%20-%20December%202007.pdf (hereinafter "Chong 31 Flavors").

[62] *See* Wikipedia, Traffic Shaping, http://en.wikipedia.org/wiki/Traffic_shaping.

[63] *See* Joe St. Sauver, *Understanding the Basics of Traffic Shaping*, COMPUTING NEWS (Univ. of Or., Winter 2002) *available at* http://cc.uoregon.edu/cnews/winter2002/traffic.html.

communication or telemedicine application takes priority over a simultaneous upload of five videos.

These and many other management tools have quickly become indispensable to service providers as more and more data flows through their networks. Without wide latitude to use these tools, networks would be more susceptible to crashing under the weight of congestion and data bottlenecks that often result from bandwidth-hungry applications like P2P file-sharing. Conversely the unmanaged flow of data risks depriving many users of a reliable Internet connection, as a consequence of the bandwidth-heavy activities of a few.

C. Wide Latitude to Manage Networks is Required to Protects All Consumers

Managing a network to ensure the efficient flow of data is fraught with uncertainty. For example, there are often surges in bandwidth demand and data traffic during the online release of new games, software, music and videos.[64] In addition, new converged wireless devices like the iPhone, which offer users an unparalleled mobile Internet experience, are driving "unheard-of levels of mobile internet usage" around the world.[65] With Internet usage and demand for applications like Internet video continuing to skyrocket, and with the marketplace for similar applications poised to explode over the next five or ten years,[66] service providers should be afforded wide latitude to manage their networks in order to assure the efficient transmission of data and ensure that all users have a reliable Internet connection.

The capacity-related criticisms made against network owners are not persuasive. In response to the regulatory clarity given by Congress and the FCC, and in response to increasing

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[64] *See, e.g.*, *Sandvine: Xbox, iTunes Grow*, LIGHTREADING, Dec. 5, 2006, http://www.lightreading.com/document.asp?doc_id=112037.

[65] *See Vodafone, 02Test Femtocells*, LIGHTREADING, Feb. 11, 2008, available at http://www.lightreading.com/document.asp?site=gsma&doc_id=145618.

[66] A recent report predicts that "[t]he U.S. Internet of 2015 will be at least 50 times larger than it was in 2006" and Internet traffic will increase by 50-60% over the next few years. *See* Discovery Report, *supra.*

demand for broadband, network operators – including traditional telecom firms, cable companies, wireless companies and others – have invested and continue to invest billions in risk capital to increase the capacity and functionality of broadband networks. *Whatever the capacity of the networks at any point in time, there will always be applications, content, innovations and usages that, under certain circumstances, challenge networks.* As recent data cited above makes clear, the heavy demands of a few users can sometimes outstrip supply of available bandwidth on networks. As such, there will always be a compelling need for network engineers who have the ability and the flexibility to maintain reliable and safe networks for consumers. To this end, network management benefits all users in three fundamental ways.

First, network management ensures the safety and security of the network. By using techniques such as DPI and traffic shaping, network managers can protect consumers from virus infiltration, reduce the amount of spam and foster a safe environment for the transfer of information and applications. Second, network management guarantees a uniform user experience regardless of how much or how little bandwidth the consumer uses. This will ensure that the heavy uploading and downloading of a minority of users will not impair the online experience of a majority of more casual users. Finally, for those using applications sensitive to data latency (e.g., VoIP telephony and telemedicine), network management will prioritize these packets over the packets of less time-sensitive applications like email.

The overall consumer benefits associated with reasonable network management outweigh the likely harm to consumers that would result if network engineers were deterred from implementing the network management strategies they consider to be appropriate under the circumstances. However, in the event that there are abuses by network owners, a number of

market-based and legal remedies exist for users to avail themselves of rather than saddling a robustly competitive marketplace with unnecessary regulation.

IV. MARKET-BASED AND LEGAL REMEDIES SHOULD BE EXHAUSTED BEFORE THE IMPOSITION OF PRESCRIPTIVE REGULATION ON THE BROADBAND MARKET

Effective market monitoring and enforcement can occur without the need for the prescriptive regulation suggested by some. Perhaps the most significant consequence of a competitive broadband marketplace has been the empowerment of consumers to regulate the market. Market forces will address consumer needs in a more efficient and more targeted way than rigid regulation. Furthermore, well-established legal regimes – grounded in contracts law and in antitrust law – provide additional layers of protection against allegedly improper conduct.

The availability of these multiple layers of consumer protection establishes a high burden of proof required for making the case that regulation is the only remedy. It is respectfully suggested that such burden has not been met.

A. In a Competitive Marketplace, Consumers are the Best Regulators

The rise of intermodal competition between cable and telephone companies, and the advent of additional broadband competitors in the wireless realm, has given consumers enormous power to regulate the broadband marketplace. The availability of ready substitutes for broadband service, along with decreasing switching costs, has made customer retention a critical part of a network owner's business strategy. Bundling services into an affordable "triple play" has long been a key point of competition when luring customers to a specific service provider. But with more firms able to offer substitutable bundles, network owners are competing ever more fiercely on price, speed, technological innovation and, most importantly, customer service. To this end, service providers are beginning to cater to more individualized user needs and focusing more attention on resolving consumer complaints. For example, a growing number of

service providers are offering users tiers of service based on their bandwidth needs. Basic packages cater to the more casual user while enhanced packages target more avid users like online gamers and P2P participants. Robust competition, evident in the broadband market, leads to better customer service,[67] thus empowering consumers.

Recent analyses of consumer welfare in the broadband market by a number of government agencies support the conclusion that the consumer is the best regulator of the marketplace. The Department of Justice (DOJ), which shares regulatory oversight of the broadband market with the Federal Trade Commission (FTC) and the FCC,[68] stated in an *Ex Parte* filing in this docket that "free market competition, unfettered by unnecessary governmental regulatory restraints, is the best way to foster innovation and development of the Internet…Past experience has demonstrated that, absent actual market failure, the operation of a free market is a far superior alternative to regulatory restraints."[69]

Similarly the FTC recently issued a staff report on broadband competition policy, which found that, given the recent inquiries and press attention on "net neutrality" issues, "many consumers are now aware of such issues," making them even more vigilant to how they are treated by network owners.[70] The report concluded that "[c]onsumers – particularly online consumers – have a powerful collective voice that should not be ignored by businesses."[71] In

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[67] *See* Robert D. Atkinson, *The Role of Competition in a National Broadband Policy*, 1-3, 5, The Info. Tech. & Innovation Foundation (Oct. 2007), available at http://www.itif.org/files/BroadbandCompetition.pdf.

[68] FTC Staff Report, Broadband Connectivity Competition Policy, at 2 (June 2007) available at http://www.ftc.gov/reports/broadband/v070000report.pdf (hereinafter "FTC Staff Report").

[69] *See Ex Parte Filing of the United States Department of Justice*, In the Matter of Broadband Industry Practices, WC Docket No. 07-52 (Sept. 6, 2007), available at http://www.usdoj.gov/atr/public/comments/225767.htm (hereinafter "DOJ Filing").

[70] FTC Staff report at 161, *supra.*

[71] *Id.*

other words, empowered consumers have the ability to correct adverse network owner behavior more quickly and much more directly than regulation.

Finally, the National Telecommunications and Information Administration (NTIA), the principal adviser to the United States President on telecommunications and information policy, recently echoed these findings in its *Networked Nation* report: "Experience teaches that when government tries to substitute its judgment for that of the free market, or otherwise anticipate consumer demand by favoring one product or vendor over another, it can easily distort the marketplace, resulting in the diversion of investment and/or discouraging the research and innovation necessary to bring new and better products or services to market."[72]

Competition in the broadband market has empowered consumers and made them the most effective regulators, including by providing them with the ability to switch providers or plans. While consumer action offers a strong check on alleged improper conduct, this power is augmented by the existence of various legal regimes geared to addressing actual harm.

B. Contract Law Offers a Viable Alternative to Additional Regulation

In addition to the market-based solutions available to consumers described above, contract law provides parties with a comprehensive set of both rights and remedies. It offers a well-established legal regime for responding to real world problems with fact-specific and narrowly tailored remedies. Such is preferable to the prescriptive *ex ante* regulation suggested by some.

As is the case with the purchase of much in the hi-tech world (e.g., computers, software, communication devices, service plans and website access), purchasers of broadband typically agree to a specific set of obligations, often forth in a Terms of Service agreement, when signing

[72] Networked Nation at 5, *supra.*

up for service with any network owner. These agreements describe the terms and conditions that every user must comply with during the length of the contract. Many users also have the ability to choose, as a matter of contract, between varying service plans. In some instances, casual users who go online to check email and read the news can purchase less expensive, more basic bandwidth plans from some providers. More active users, like avid gamers, might purchase more expensive service plans to accommodate their heavy use of bandwidth-hungry applications. Further, large or enterprise users, like a telemedicine service provider, a community college, a government agency, or an IP video company can negotiate key terms and conditions of service with a provider.

In all of these instances, users can avail themselves of the rights and remedies under their contracts, and under the law, to protect against allegedly wrongful conduct. If a service provider were to violate the Terms of Service agreement, then a user has a viable contract claim. Conversely, if the service provider has clearly outlined the parameters of accepted use in its Acceptable Use Policy,[73] and the user breaches those terms, then the service provider can enforce the terms of the contract to ensure that the actions of one or a small number of users do not jeopardize the network or unduly degrade the Internet connection or online experience of the majority of users.[74]

The petitions of both Vuze and Free Press et al. call on the Commission to require network owners "to disclose their network management tactics" in addition to the disclosures

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[73] Most broadband service providers have Acceptable Use Policies. *See, e.g.*, Comcast Acceptable Use Policy for High-Speed Internet Services, at http://www6.comcast.net/terms/use/; AT&T Acceptably Use Policy, at http://my.att.net/csbellsouth/s/s.dll?spage=cg/legal/att.htm&leg=aup; Time Warner Cable, Operator Acceptable Use Policy, at http://help.twcable.com/html/twc_misp_aup.html.

[74] This sort of enforcement precipitated the current petitions at issue here. *See* Peter Svensson, *Comcast Blocks Some Internet Traffic*, AP, Oct. 19, 2007, available at http://www.msnbc.msn.com/id/21376597/. Comcast enforced its "Acceptable Use Policy" when it slowed certain P2P traffic in order to alleviate network congestion that was affecting the connections of a majority of users.

already make in the Terms of Service.[75] Many broadband providers currently disclose customer use limitations. Further, many also provide in their Terms of Service that, while they do actively manage their networks in order to provide all users with reliable connections, they do not block or degrade service.[76] To the extent that network owners have not publicized such customer-oriented standards, policies encouraging them to do so are appropriate.

It is respectfully suggested that the Commission should not require network owners to disclose the actual network management practices they utilize. Specific network management tools and strategies relate inherently to the architecture of the infrastructure and to the security and functionality of the infrastructure. Requiring disclosure of specific, proprietary network management information could threaten to compromise network security by providing third parties with the information needed to skirt security protocols. Such information also risks network congestion by enabling third parties to bypass necessary data traffic management that is occurring for the benefit of all consumers.

The current level of specificity included in many Terms of Service agreements puts users on ample notice and provides them with sufficient remedies should the terms of the contract be breached. Remedies available include monetary damages, if any are incurred or equitable remedies (e.g., getting one's service restored or being released from a contract). In many instances, Terms of Service agreements and other service contracts between the user and the network owner include arbitration clauses, which seek to facilitate effective dispute resolution. The speed and lower costs associated with arbitration benefit the consumer and network owner

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[75] Free Press Comment at 59, *supra.*

[76] *See, e.g.*, Comcast's High-Speed Internet Acceptable Use Policy, Prohibited Uses and Activities, at http://www.comcast.net/terms/use.jsp; Verizon Online – Terms of Service, at http://www.verizon.net/policies/vzcom/tos_popup.asp; AT&T High Speed Internet and Dial Terms of Service, at http://my.att.net/csbellsouth/s/s.dll?spage=cg/legal/att.htm&leg=tos.

equally. And in the rare instances where arbitration fails or provides an inequitable solution, more formal court proceedings are available.

The existence of these types of contract-based rights and remedies further empowers the consumer. Service providers are increasingly tailoring their service offerings to the individual needs of users. And they are doing so in a competitive environment in which customer satisfaction and retention is paramount. The threat of formal enforcement of contract provisions should not be disregarded. If nefarious behavior by a network owner is widespread and the network owner has done little to correct it, consumers will likely flock *en masse* to another provider or could band together for further legal action. In either case, the network owner is motivated to remedy any wrongful conduct. The "collective voice" of consumers, in the market, the public square or the privacy of a court room is an increasingly powerful force that can successfully regulate the broadband market.[77]

C. The Additional Remedy of Enforcing Antitrust Laws is Available to Correct Anticompetitive Behavior that is Harmful to Consumers

A number of government agencies, including the U.S. Department of Justice and the Federal Trade Commission, charged with monitoring competition in markets, have the authority and the ability to enforce our nation's well-developed antitrust laws on a case-by-case, fact-specific basis. In the event of a clear market failure or an abuse of market power, such agencies have the jurisdiction to determine whether the particular conduct at issue is anticompetitive and harmful to consumers within the meaning of the antitrust laws.

Antitrust laws are "grounded in the principle that competition – "that state of affairs in which output is maximized, price is minimized, and consumers are entitled to make their own

[77] FTC Staff report at 161, *supra.*

choices"– serves to protect consumer welfare."[78] The FTC, in its staff report on broadband competition policy, outlined its approach to enforcing antitrust laws in the broadband market: "In conducting an antitrust analysis, *the ultimate issue would be whether broadband Internet access providers engage in unilateral or joint conduct that is likely to harm competition and consumers in a relevant market*."[79] The relevant questions in such an analysis would include: has the conduct at issue harmed competition generally and diminished consumer welfare; is there a legitimate business justification for the conduct at issue; do pro-consumer efficiencies result from the conduct in question; etc.

Consistent with the FCC's prior endorsement of "reasonable network management," an antitrust inquiry would focus on whether the conduct at issue was reasonable under the circumstances. In the case of network management, conduct on the part of a network owner that was alleged to be anticompetitive and that lessened overall consumer welfare could be examined under established laws and rules. For example, if the hypothetical network owner with market dominance employed certain network management tactics with the intent of lessening competition (e.g., by consistently blocking a popular application without any legitimate justification) and such conduct in fact harmed competition, the nation's antitrust laws provide a comprehensive legal framework for dealing with such conduct.[80]

Antitrust enforcement thus represents yet another buffer of protection for consumers in the broadband marketplace. As such, the Commission should continue to exercise regulatory restraint and examine alleged harmful conduct on a case-by-case basis, leaving regulation as an ultimate last resort.

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[78] *Id.* at 120.

[79] *Id.* (emphasis added).

[80] *Id.* at 161.

V. THE COMMISSION SHOULD CONTINUE TO EXERCISE REGULATORY RESTRAINT, EXAMINING ALLEGED HARMFUL CONDUCT ON A CASE-BY-CASE BASIS, AND IF REGULATION IS ULTIMATELY IMPOSED ON BROADBAND PROVIDERS, IT SHOULD APPLY EQUALLY TO ALL NETWORK OPERATORS, APPLICATION/CONTENT PROVIDERS, AND OTHER NETWORK OWNERS

The point that a diverse array of conditions precedent must be satisfied before regulation is even considered has been laboriously argued because of the real consumer costs associated with premature and unnecessary regulation. By one estimate, the cost of *ex ante* "net neutrality" regulation would be upwards of $24 to $32 billion in consumer welfare losses over the next few years.[81] Another study found that the restrictions on price, product and service differentiation associated with "net neutrality" rules would result in the loss, by consumers, of $69 billion in potential benefits over the next 10 years.[82] In the absence of overwhelming evidence of a broad market failure that cannot be rectified by the market-based and legal remedies available in the American legal system, the Commission should continue investigating allegedly anticompetitive behavior by network owners on a case-by-case basis.

The Commission has an established precedent of using regulatory restraint for examining alleged harmful behavior by a network owner. In 2005, for example, the FCC opened an inquiry to investigate claims that Madison River Telephone Company was blocking ports for VoIP applications, thus precluding consumers from using an alternative voice service. The FCC, after issuing a Letter of Inquiry, brokered a Consent Decree among the parties to solve the problem.[83] The deliberate process established by this case reflects the dynamic nature of the broadband market and cautions against the adoption of sweeping yet rigid policies in the absence of a

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[81] *See Consumer Gram: Internet Regulations Would Harm Consumers*, American Consumer Institute (ACI), available at http://www.aci-citizenresearch.org/NN2.pdf.

[82] *See* Stephen B. Pociask, *Net Neutrality and the Effect on Consumers*, at 2, ACI (May 2007), available at http://www.aci-citizenresearch.org/ACI%20NN%20Final.pdf.

[83] *See Madison River Commc'ns*, 20 F.C.C.R 4295 (Enf. Bur. 2005).

critical mass of complaints against network owners.[84] One need only look at the 1996 Telecommunications Act to see how fast policies that are intended to be forward-looking can become antiquated.

If an additional layer of rules and regulations is ultimately deemed necessary, notwithstanding the advances in and competitive nature of the broadband market, then regulatory parity and notions of fundamental fairness dictate that any such rules apply with equal force to any entity that manages the flow of Internet-related data over a network. A user's Internet experience is impacted by a number of networks, including the user's web browser, hardware (e.g., device, chipset, memory, etc.), software, broadband connection, search engine, online applications and content, etc. Each of these networks is managed by the respective network owners, and none of these networks is subject to prescriptive government mandates.

The network management practices at issue here are not unique to the broadband service market. Indeed virtually every network that delivers, or impacts the delivery of, information over the Internet is managed. For example, Google manages, organizes and prioritizes the data delivered over its network to end-users. Indeed, the express mission of Google is to "organize the world's information and make it universally accessible and useful"[85] – a laudable and extremely profitable goal[86] but one that is grounded nonetheless in manipulating and prioritizing the content delivered to users. Although Google does provide minimal information regarding

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[84] Chong 31 Flavors at 14, *supra.*

[85] Google Corporate Information – Company Overview, at http://www.google.com/corporate/.

[86] *See, e.g.,* JOHN BATTELLE, THE SEARCH: HOW GOOGLE AND ITS RIVALS REWROTE THE RULES OF BUSINESS AND TRANSFORMED OUR CULTURE 75 (2005). Google has "created a ranking system rewarding links that come from sources that were important, and penalizing those that did not." The breakthrough was "to create an algorithm – dubbed PageRank … - that manages to take into account both the number of links into a particular site, and the number of links into each of the linking sites." This system is monetized by pricing the terms and keywords that lead to search results, *at* 106.

how it actually organizes information,[87] it is not required to treat all content equally or is it required to disclose the protocols and algorithms it uses to manage traffic. Requiring Google or any search firm to disclose its exact algorithm (i.e., how it manages its network) would compromise its network, just as requiring any other network operator to disclose the specifics of its network management would jeopardize that network.

If broadband providers, however, were ultimately subjected to prescriptive network management rules, then regulatory certainty and parity would require that any such rules be applicable to all network operators – including content and application providers – that manage data and information within a network. Given all the networks involved in a user's online experience (*i.e.*, web browser, hardware, software, broadband connection, search engine, online applications and content), a rational basis does not exist for concluding that a broadband access provider should be subject to data management rules but that providers of other online services and content should not be.

However, as the preceding comments have made clear, regulation is not required at this point in the broadband market's evolution. The imposition of reporting requirements, more detailed disclosures of network management techniques and related rules on network owners would simply reflect the substitution of the judgment of network engineers with a set of static, prescriptive rules that run counter to hands-off approach that is driving innovation, investment and consumer choice. Rather than risk chilling the vibrant innovation in the broadband marketplace by levying rigid network management rules, the Commission should continue to investigate and address complaints within its jurisdiction on a case-by-case basis.

[87] Google Corporate Information – Technology Overview, at http://www.google.com/corporate/tech.html.

VI. CONCLUSION

Network owners require wide latitude to manage their networks in order to ensure that all users have a reliable Internet experience. Management techniques vary from provider to provider, from network to network, and often change from day to day. A competitive marketplace will police itself and correct behavior that does not contribute to overall consumer welfare. Any effort to impose unnecessary *ex ante* regulation would chill the broadband market, resulting in certain consumer welfare losses. Accordingly, the petitions for declaratory ruling and rulemaking should be denied.

Respectfully submitted,

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