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September 30, 2009

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

Re: Notice of Inquiry, *Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan for Our Future*, GN Docket Nos. 09-157, 09-51 (rel. Aug. 27, 2009).

Dear Ms. Dortch:

Pleased find the enclosed Comments of AT&T Inc. responding to the above-referenced Notice of Inquiry ("*Notice*"). These Comments were filed electronically today via the Commission's Electronic Comments Filing System ("ECFS").

Also enclosed, as attachments to the Comments of AT&T Inc., are responses to the *Notice* by the following leaders in the fields of economics and technology as they relate to wireless innovation, investment, competition and sound public policy:

David J. Farber: Dr. Farber is the Distinguished Career Professor of Computer Science and Public Policy at Carnegie Mellon University. He previously served as Chief Technologist at the Federal Communications Commission and as a member of the Commission's Technological Advisory Council. Hailed by Wired magazine as the "Paul Revere of the digital revolution" and widely recognized as the "Grandfather of the Internet," Dr. Farber has also been a member of the U.S. Presidential Advisory Board on Information Technology, the Advisory Council of the CISE Directorate of the National Science Foundation, the Board of Trustees of the Internet Society, and National Research Council's Computer Science and Telecommunications Board. Dr. Farber received the prestigious John Scott Award for Contributions to Humanity (1997), was named by Network World as one of the 25 most powerful people in Networking (1999), and was listed by Business Week among the top 25 leaders in E-Commerce (2002).

Gerald R. Faulhaber: Dr. Faulhaber is Professor Emeritus of Business and Public Policy at the Wharton School of the University of Pennsylvania. He has researched and written widely in spectrum policy for wireless telecommunications, network neutrality for the Internet, and telecommunications policy and regulation. Dr. Faulhaber previously served as Chief Economist of the Federal Communications Commission (2000-2001), and currently serves on the Editorial Board, Information and Economic Policy and the Advisory Board, Research Program on Telecommunications and Information, Columbia University.

Thomas W. Hazlett: Dr. Hazlett is Professor of Law & Economics and Director, Information Economy Project, at George Mason University. From 1991 to 1992, he served as Chief Economist of the Federal Communications Commission. Dr. Hazlett is published widely in academic and popular journals on the economics of telecommunications markets and, in particular, radio spectrum allocation. He is a columnist for the Financial Times and has provided expert testimony to federal and state courts, regulatory agencies, committees of Congress, foreign governments, and international organizations.

Michael L. Katz: Dr. Katz is the Director of the Institute for Business Innovation at the University of California, Berkeley, where he has joint faculty appointments in the Haas School of Business Administration and the Department of Economics. Dr. Katz served as Chief Economist at the Federal Communications Commission during the Clinton Administration and as the chief economist (Deputy Assistant Attorney General) in the Antitrust Division of the Department of Justice during the George W. Bush Administration, and he has also served as a consultant to both agencies. Dr. Katz is widely recognized as a leading expert in telecommunications policy and the economics of network industries.

Please call me or email me with any questions.

Sincerely,

/s/ David L. Lawson

David L. Lawson

cc (via email): Peter Trachtenberg
Jamison Prime

Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
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

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September 30, 2009

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COMMENTS OF AT&T INC.

Pursuant to the Notice of Inquiry ("*Notice*") released by the Commission on August 27, 2009,[1] AT&T Inc. ("AT&T") submits the following comments.

INTRODUCTION AND SUMMARY

AT&T welcomes this opportunity to further the Commission's "understanding of where and how innovations are happening" in the wireless industry.[2] Innovation has always been front and center at AT&T. Scientists in AT&T's "Labs" division invented cellular telephony (and the transistor, the laser, fiber optic cable, the solar cell, the Unix operating system, key HDTV algorithms and much else).[3] We developed core features of what became the 3G wireless standards and the carrier-grade quality-of-service standards that have turned Wi-Fi into a robust and widely used service, and we continue to pursue fundamental advances that guide the entire industry. Today, AT&T scientists and engineers are working on, among other things, 5G standards that will support gigabit wireless speeds using largely untapped terahertz spectrum,

[1] Notice of Inquiry, *Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan For Our Future*, FCC 09-66, GN Docket Nos. 09-157, 09-66 (rel. Aug. 27, 2009) ("*Notice*" or "*Inquiry*").

[2] *Notice* ¶ 4.

[3] AT&T Website, http://www.corp.att.com/attlabs/reputation/timeline/.

architectures for wireline-quality 4G networks, voice recognition and interaction capabilities in noisy wireless environments, and truly revolutionary wireless smart grid and telehealth applications, to name just a few. AT&T spends close to a billion dollars annually on R&D and other initiatives designed to bring new technologies and services to market, and its innovations (reflecting more than 6000 patents issued in the last ten years alone and an average of three new patents issued every business day) permeate every layer of the wireless "ecosystem." Indeed, for the second year running the Patent Board has ranked AT&T second among all companies in the telecom and communications sector (behind only Cisco) based upon technology strength, industry impact, research intensity, innovation cycle time and patents granted. Even the concept of flipping the screen to landscape mode when a phone is turned sideways is an AT&T innovation.

When most people think about wireless innovation today, they tend to focus narrowly on what is most readily visible – the large number of smartphones with new features and the burgeoning market for applications to run on those devices – and they assume that innovation occurs solely or primarily at the network "edge." This is an incomplete vision – while device manufacturers and applications developers play an undeniably vital role in driving innovation in the wireless sector, so too do carriers, and they do so at every level of the wireless marketplace. To its credit, the Commission seeks to understand "where and how key innovations are happening across the full 'value chain' of the wireless marketplace, including spectrum utilization, technologies, business models, and services."[4] This *Inquiry* thus should bring into sharp focus the carrier contributions that drive so much innovation throughout the wireless industry.

[4] *Notice* ¶ 4.

At the most fundamental level, it is carrier investment in wireless network infrastructure that makes all wireless innovation possible. Consumers and businesses want to do more and more with wireless services, and we are just beginning to tap the many ways in which wireless networks can serve our needs. We are also just beginning to grasp the potential for wireless services to provide enormous public interest benefits in the areas of public safety, health care, energy, the environment, and education. The infrastructure necessary to provide and optimize the delivery of such services, however, is extraordinarily costly, reflecting hundreds of billions of dollars of private carrier investment. It is these carrier investments that create the stable platforms that support new features and higher speeds, that successfully balance competing bandwidth demands, and that enable the astonishing array of innovative devices and applications that develop at the network "edges." It is impossible to predict all of the benefits that next generation networks may provide. But one thing is certain: the Commission must maximize the incentives for carriers to make these foundational investments, because without them, none of the other, more visible innovations would be possible. As Google's Eric Schmidt has stressed: "It's very, very important that the telecom operators have enough capital to continue the build-outs of the so-called 3G and 4G networks."[5]

But meeting the explosion in demand for new services and the bandwidth necessary to accommodate them involves much more than simply investing in new capacity. It requires constant innovation so that we can squeeze more out of each slice of spectrum, provide greater reliability for increasingly latency-sensitive applications, and protect consumers from ever increasing malware and other threats. U.S. carriers have used creative technological advances to increase the efficiency and capacity of their networks tenfold in the last eight years. AT&T and

[5] Maria Bariromo, *Eric Schmidt On Where Google Is Headed*, BusinessWeek (Aug. 6, 2009), http://www.businessweek.com/magazine/content/09_33/b4143011785548.htm.

other carriers are continually modifying network architectures, implementing power and spectrum-saving features in network infrastructure and devices, improving network security, service provisioning, and billing and payment processes, and integrating and improving complementary technologies, like Wi-Fi and femtocells, that reduce loads on the core wireless network. It is because of innovations like these that the U.S. wireless industry continues to carry more calls and data than any other, all while using less spectrum, charging lower prices, and satisfying an extraordinarily broad array of users.

Carrier innovation, though, is not limited to the network and its performance. Carriers also play an active and instrumental role in "edge" innovation. Carriers contribute to network equipment and handset innovation both through standards-setting processes, which in the fast-moving world of wireless can function as forward-looking innovation laboratories that transform basic R&D into real world innovations on the fly, and through participation in the design and testing of individual devices and applications. And carriers are responsible for much of the most important applications development, from revolutionary telehealth applications that allow medical professionals remotely to monitor, diagnose and respond to patients in real time to "smart grid" applications that will greatly improve efficiency in energy use and delivery to interactive wireless video security monitoring of critical infrastructure.

Much of this innovation is the result of carriers' own efforts, but many important "edge" innovations come through collaborative efforts of companies that operate primarily in different layers. And that circle of collaboration is dramatically widening: wireless carriers are now entering into innovative relationships with a vast array of vendors that will introduce specialized wireless capabilities into all types of equipment – from consumer electronic products to sophisticated machinery used by business – with the potential to improve energy efficiency,

health care, education, and countless other aspects of American life in ways that are unimaginable today.

The true engine driving wireless innovation by all participants in the wireless value chain, as the *Notice* properly recognizes, is competition. The U.S. wireless industry is the most competitive in the world, and there is no more powerful spur to innovation than competition – as the U.S. wireless experience so vividly illustrates. Wireless competition today is largely a competition to innovate and to differentiate oneself from one's competitors, and firms compete by innovating in every facet of their offerings – network infrastructure, handsets, applications, pricing plans, and billing systems. And with the transition to 3G and soon 4G and the shift from voice-centric to IP data-centric services, there will be a vast increase in the capabilities that wireless networks can support – which, in turn, will vastly increase the opportunities for competition-driven differentiation and innovation.

If this rapid pace of competition-driven innovation is to continue, however, it is essential that the Commission reject calls to modify its policies in ways that discourage carrier investment and innovation. A regulatory environment that fosters innovation must provide *flexibility* – it must give industry players the freedom to experiment with different approaches and different business models. Transparency – not regulatory limits on business model experimentation – is the best tool to ensure that customers can make the informed choices that drive competing business models to the mix of offerings that maximizes consumer welfare and innovation.

The Commission's spectrum and other wireless policies of the last two decades have provided this flexibility. They have respected the carrier's essential role and have opened the way for the two prime drivers of innovation –investment and competition – to bring about a

golden age of both "new things" and "new ways of doing things."[6] That must continue. Policies that encourage investment in faster, more feature-laden and more broadly deployed wireless infrastructure fuel a virtuous cycle in which improved network capabilities encourage innovation and additional investment throughout the wireless value chain to take advantage of those capabilities in ways that improve the customer experience.

Three additional insights are critical to understanding wireless innovation and how the Commission's policies can encourage – or discourage – it. First, the wireless customer experience is multi-dimensional and dynamic. Consumers value the bells and whistles of the latest "apps" and handsets, of course, but they value other things as well, including service quality, reliability, security, price, and ease of use. Moreover, there is a wide diversity in customer preferences. In contrast to the wireline world, where customers typically must assemble their own experience from generic, separately obtained CPE, connections, applications, and security protections, intense competition in the wireless marketplace has led to an unusually broad range of innovations that provide diverse wireless consumers a variety of experiences. Many customers prefer a more integrated experience that provides greater ease of use, security, and service quality, and any sound innovation policy must respect this range of customer choice, rather than trying to force all consumers into a single "do-it-yourself" model.

Second, the characteristics of spectrum-based mobile networks create unique service quality concerns, and to maintain attractive offerings carriers must actively manage evolving demands on their networks. Wireless operators cannot simply expand capacity at will to address congestion. To the contrary, wireless networks must be dynamically engineered and managed to address bandwidth constraints, a process that is particularly challenging given that voice and data

[6] *Notice* ¶ 2.

services share the same bandwidth and wireless networks must accommodate the shifting usage patterns of a mobile customer base. If a wireless carrier fails adequately to manage its network, even a small percentage of especially heavy or disruptive uses or users can cause congestion that can degrade the quality of *all* voice and data services. Thus, carriers' terms of service typically – and appropriately – prohibit or impose limits on uses that would threaten service quality for everyone. This is necessarily a dynamic and evolving process, and any sound innovation policy must embrace it and resist calls for investment and innovation-chilling government standards for, or second-guessing of, wireless network management decisions.

Third, it would be a mistake of the first order to accept calls to employ a siloed approach to innovation policy that assumes that participants in different "layers" of the wireless ecosystem must always act independently and in isolation, that supposes that innovation is really occurring only at the "edges," and that attempts to turn networks more into "dumb pipes" by discouraging companies from entering into vertical, collaborative arrangements to produce or promote innovative offerings. The reality is that carriers are major engines of innovation, and delivering a robust and varied customer experience often requires close integration between the many inputs that combine to produce that experience, including networks, handsets, operating systems and applications. In that sense, the Commission's use of the term "ecosystem" to describe the wireless industry is apt, because like a biological ecosystem, the various layers of the value chain are interdependent, and innovations result from complex and evolving relationships. Vertical arrangements, in particular, provide a wide array of efficiencies and consumer benefits, facilitating the development, optimization and promotion of complementary services through risk-sharing and the aligning of incentives. The Commission would *reduce* innovation

throughout the wireless ecosystem if it were to adopt heavy-handed policies that denied carriers any role (or reward) in collaborative innovation at any "level" of the wireless value chain.

The remainder of these comments is divided into four sections. Section I details the essential role of carrier investment and innovation and rebuts the fallacy that innovation occurs solely through individual efforts of firms operating in discrete layers of the wireless value chain. Wireless innovation often occurs through collaboration across these increasingly fuzzy boundaries and reflects the close integration between networks, devices, operating systems and applications necessary to deliver the best customer experience and to meet customers' diverse, competing needs for limited bandwidth. Carrier investment and innovation, through business arrangements with other participants throughout the wireless ecosystem, has already enabled and encouraged innovative uses of wireless in the areas of health care, energy, education, and public safety, as well as every other aspect of American life. The future holds even greater promise.

Section II describes how the Commission's policies have strongly promoted wireless innovation. The wireless success story critically depends upon the Commission's enlightened spectrum policies of the last two decades. By allocating sufficient licensed spectrum to sustain multiple competing mobile wireless carriers and employing liberal licensing policies that allow license holders to put that spectrum to its highest value uses, secure in the knowledge that their long-term investments are protected from interference and adverse possession, the Commission has created an open and intensely competitive playing field that has encouraged robust investment and rapid innovation to attract and retain customers. At the same time, the Commission has encouraged experimentation. It has both granted license holders freedom to structure their business models, terms of service and arrangements with other industry participants to meet advancing technology and evolving and competing demands for bandwidth

and allocated separate, discrete spectrum bands for experimentation with unlicensed uses. The results speak for themselves: the wireless industry continues to grow by leaps and bounds and to deliver ever greater benefits to consumers, all built upon massive carrier investments and innovations throughout the ecosystem that those investments enable. The Commission should strengthen these basic polices by auctioning additional spectrum, enforcing existing wireless interference protections more vigorously, taking immediate steps to remove tower siting and other barriers to wireless entry and expansion, and resolving the long-pending rulemakings on intercarrier compensation and universal service reforms.

Section III addresses the Commission's specific spectrum-related inquiries. The section demonstrates that it will be critically important in coming years for the Commission to make more licensed spectrum available for use by mobile wireless carriers. Equally important, the Commission should reject calls to force carriers to share, lease or return licensed spectrum or to mandate inflexible technical standards for the receivers they deploy. The way to promote innovation and investment is to give licensees secure, flexible rights in the spectrum that they hold. Where higher valued uses of spectrum truly exist, the licensee itself has every incentive to employ the spectrum for those purposes, or to monetize it by making it available to others through appropriate arrangements, as active secondary markets confirm. Conversely, authorizing unmanaged, unlicensed uses in licensed spectrum bands would do enormous harm, from interrupting or degrading individual communications to literally bringing down multiple cell sites (and require enormous investments to counter the inevitable increases in the base noise floor). AT&T fully supports experimentation with cognitive radio and other developing technologies in uncongested spectrum bands and AT&T is itself committing significant resources to the basic and applied research necessary to bringing those advances to commercial

fruition. But calls to mandate unlicensed uses in spectrum allocated for mobile wireless services – and thereby to imperil the essential commercial and public safety uses that generate by far the most value and innovation – are simply irresponsible. Instead, the Commission should more strictly enforce its existing interference rules and adopt procedures to assure the prompt resolution of interference disputes.

Section IV addresses the Commission's specific inquiries regarding networks, devices and applications and the importance of continuing to allow participants in the wireless industry flexibility to structure their business relationships. In an intensely competitive environment, wireless carriers enter into vertical relationships only to the extent those relationships will improve the quality, lower the price, or otherwise enhance the attractiveness of their services. Carriers and other wireless participants have exercised this flexibility in myriad ways to enter into risk and reward-sharing relationships that undeniably serve the public interest, and preserving that flexibility is essential to fostering innovation and investment.

Some parties nonetheless continue to propose rule changes that would eliminate existing and potential future business models altogether. These pleas have always been based on speculative claims of "harm" that have been consistently belied by actual experience. Just two years ago, Skype and those supporting its *Carterfone* Petition predicted that, without radical rule changes, carriers would deny access to Bluetooth, photosharing, Wi-Fi, music and video downloads and much else. The exact opposite happened. Carriers have actively *promoted* these and other complements that improve the attractiveness of wireless offerings. Unabashed, many of these same entities continue to call for unprecedented regulatory restrictions notwithstanding the blizzard of new devices and new applications that have become available to consumers in just the past year, often based on allegations that one application has not been made available on

one phone in one precise format. Needless to say, remaking an entire regulatory regime – one that has proven wildly successful – on the basis of rare exceptions (particularly when those exceptions serve entirely legitimate interests) is not sound regulatory policy. "Even worse," as Professors Faulhaber and Farber explain in their attached White Paper, subjecting the wireless industry to an after-the-fact "we'll punish you when we see it" approach to defining acceptable and unacceptable conduct and arrangements would do great harm to consumers: "If ever a policy was designed to increase cost, reduce customer choice, reduce incentives to innovate and reduce incentives for carriers to invest, this would be it."[7] AT&T will address these issues in the recently announced rulemaking proceeding and remains confident that any truly data-driven evaluation must conclude that codifying *Internet Policy Statement* principles (and more) as wireless rules would disserve the public interest and the Nation's broadband policies and goals.

Instead, the Commission should continue the approach it has used until now, which is to allow the marketplace to determine the products and services consumers want. Any truly

[7] *See* Gerald Faulhaber and David J. Farber, Innovation In The Wireless Ecosystem: A Customer-Centric Framework, at 26, attached hereto ("Faulhaber & Farber"). Dr. Gerald R. Faulhaber is Professor Emeritus of Business and Public Policy at the Wharton School of the University of Pennsylvania. He has researched and written widely in spectrum policy for wireless telecommunications, network neutrality for the Internet, and telecommunications policy and regulation. Dr. Faulhaber previously served as Chief Economist of the Federal Communications Commission (200-2001), and currently serves on the Editorial Board, Information and Economic Policy and the Advisory Board, Research Program on Telecommunications and Information, Columbia University. Dr. David J. Farber is the Distinguished Career Professor of Computer Science and Public Policy at Carnegie Mellon University. He previously served as Chief Technologist at the Federal Communications Commission and as a member of the Commission's Technological Advisory Council. Hailed by Wired magazine as the "Paul Revere of the digital revolution" and widely recognized as the "Grandfather of the Internet," Dr. Farber has also been a member of the U.S. Presidential Advisory Board on Information Technology, the Advisory Council of the CISE Directorate of the National Science Foundation, the Board of Trustees of the Internet Society, and National Research Council's Computer Science and Telecommunications Board. Dr. Farber received the prestigious John Scott Award for Contributions to Humanity (1997), was named by Network World as one of the 25 most powerful people in Networking (1999), and was listed by Business Week among the top 25 leaders in E-Commerce (2002).

consumer-centric policy must let customers and the many providers competing for their business, rather than government, decide among more "open" or more "managed" business models, recognizing that firms that fail to satisfy customers' needs will lose out to firms that do. And, of course, the Commission has set aside one block of spectrum – the 700 MHz C Block – and subjected it to strict "any device/any application" requirements that go far beyond the requirements applicable to licensees of any other spectrum. That decision will ensure that consumers who prefer such a model will have that option. Indeed, if consumers truly want that type of experience – and *only* that type of experience – other carriers will readily adopt the same model without regulatory mandates. But there is no legitimate basis for the Commission to *force* all consumers into that model, whether they prefer it or not. It would also be unlawful to do so, particularly given that the Commission's C Block "experiment" has not even begun.

I. THE U.S. WIRELESS INDUSTRY IS EXTRAORDINARILY INNOVATIVE, AND AT&T AND OTHER CARRIERS PLAY A LARGE AND ESSENTIAL ROLE IN THAT INNOVATION.

"Innovation" is an extraordinarily broad topic: as the Commission notes, innovation is the "pragmatic application of new ideas to productive ends," and encompasses both "new things" and "new ways of doing things."[8] Under these (or any other) definitions, the U.S. wireless industry is characterized by innovation that is pervasive, rapid, and profound.[9] And although

[8] *Notice* ¶ 2.

[9] *See* Faulhaber & Farber, at 4-12; Michael L. Katz, Public Policy Principles For Promotion Efficient Wireless Innovation And Investment, ¶¶ 62-73, attached hereto ("Katz Paper"). Dr. Michael L. Katz is the Director of the Institute for Business Innovation at the University of California, Berkeley, where he has joint faculty appointments in the Haas School of Business Administration and the Department of Economics. Dr. Katz served as Chief Economist at the Federal Communications Commission during the Clinton Administration and as the chief economist (Deputy Assistant Attorney General) in the Antitrust Division of the Department of Justice during the George W. Bush Administration, and he has also served as a consultant to both agencies. Dr. Katz is widely recognized as a leading expert in telecommunications policy and the economics of network industries.

innovation is unquestionably rampant in all corners of the wireless ecosystem, it is particularly important to understand the extraordinarily large – and essential – role that wireless carriers, both independently and in collaboration with others, play in the innovative process.[10]

A. "Edge" Innovation.

Innovation is occurring most visibly, of course, with the many new wireless devices and applications that consumers hold in their hands every day. Just a few years ago, the state of the art was a flip-phone with a very small number of embedded applications such a calendar, a calculator and the "brickbreaker" game. The advent of smartphones – and in particular, the iPhone – has had an enormously energizing effect on the pace of innovation.[11] AT&T has elsewhere documented the remarkable pace and breadth of device innovation and differentiation and the near constant announcements of innovative new handsets.[12] Since then, and, indeed, in

[10] *See* Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 2, 23-28, 38-61.

[11] *See* Faulhaber & Farber, at 8, 18-19, 25; Katz Paper, at 14-22, 40, 68; *see also*, *e.g.*, Steven Levy, *Speed, Smarts Keep iPhone 3GS at the Front of the Mobile Race*, Wired, June 17, 2009, http://www.wired.com/reviews/product/iphone_3gs (U.S. wireless consumers are the beneficiaries of a "brutal technology competition that is making the chariot race in *Ben Hur* look like a stroll in the park"); *The iPhone Effect: Smart Phone Features Come of Age*, Yankee Group, May 2009 ("The opportunity for handset manufacturers to innovate new features for service providers to offer compelling service plans has never been greater"); USA: *The World's Most Important Smartphone Market*, Strategy Analytics Insight, Aug. 3, 2009 ("The catalyst for [mobile device] competition . . . was the launch of the Apple iPhone in 2007. . . . This sparked the 'smartphone wars' across the U.S. Heavy subsidies are now commonplace on nearly all new smartphones."); *id.* ("We forecast Blackberry will continue to be the number one OS in North America, accounting for around 1 in 4 smartphones by 2004").

[12] *See* Comments of AT&T Inc., *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 (filed Sep. 30, 2009) ("AT&T Second Competition Comments"); Comments of AT&T Inc., *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66 (filed June 15, 2009) ("AT&T First Competition Comments"); Reply Comments of AT&T Inc., *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66 (filed July 13, 2009) ("AT&T First Competition Reply"); Comments of AT&T Inc., *Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and*

just the last few months, Research in Motion, Motorola, Nokia, Samsung, HTC and others have all announced new "smarter" handsets,[13] more than a dozen new Android-based handsets are about to be released,[14] and wireless carriers, large and small, have announced netbook offers.[15]

As wireless devices have become more sophisticated – many today are essentially pocket-sized computers – tens of thousands of innovative applications are also now flooding the marketplace. Here again, Apple led the way with its 2008 introduction of wireless iPhone "apps" to its iTunes Store.[16] The phenomenal success of the iTunes App Store, which already offers more than 85,000 applications and has experienced more than 2 *billion* downloads in little

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Handset Manufacturers, RM-11497 (filed Feb. 2, 2009); Reply Comments of AT&T Inc., *Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers*, RM-11497 (filed Feb. 23, 2009).

[13] *See*, *e.g.*, Press Release, Research in Motion, *RIM Introduces the BlackBerry Tour Smartphone*, June 16, 2009, http://na.blackberry.com/eng/newsroom/news/press/release.jsp?id=2393; Press Release, Motorola, *Motorola Introduces CLIQ with MOTOBLUR: The First Phone with Social Skills*, Sept. 10, 2009, http://mediacenter.motorola.com/content/detail.aspx?ReleaseID=11799&NewsAreaID=2; Press Release, Nokia, *Nokia E72 Builds On Successful Formula With Slim Dimensions And Comprehensive Messaging Solutions*, June 15, 2009, http://www.nokia.com/press/press-releases/archive/archiveshowpressrelease?newsid=1322480; Press Release, Samsung, *Samsung Launches Corby, First Full-Touch Mobile Designed For Youth Market*, Sept. 1, 2009, http://www.samsung.com/us/news/presskitRead.do?page=2&news_seq=14457&rdoPeriod=ALL&from_dt=&to_dt=&news_group=ALL&news_type=&news_ctgry=&search_keyword=; Press Release, HTC, *HTC Tattoo Brings Android To All*, Sept. 8, 2009, http://www.htc.com/us/press.aspx?id=110136&lang=1033.

[14] *See* Matt Richtel, *Google: Expect 18 Android Phones by Year's End*, N.Y. Times, Sept. 15, 2009, http://bits.blogs.nytimes.com/2009/05/27/google-expect-18-android-phones-by-years-end.

[15] *See*, *e.g.*, Press Release, Cellular South, *Cellular South Debuts Netbook With Built-In 3G High-Speed Mobile Broadband*, July 29, 2009, https://www.cellularsouth.com/news/2009/20090729.html; Press Release, AT&T, *AT&T Unveils Embedded Netbook and Laptop Offers Targeted at Small Businesses*, July 1, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26902.

[16] *See* Faulhaber & Farber, at 8, 18-19, 25; Katz Paper, at 14-22, 40, 68.

more than a year,[17] has spurred other industry players to create their own apps stores.[18] Indeed it has triggered a veritable apps arms race throughout the industry, as carriers, operating system owners, other device manufacturers and independent software developers, from individuals to Silicon Valley giants, scramble to join the fray. As a result, mobile users can now download apps from myriad sources, including device manufacturers (Apple's iTunes Store,[19] BlackBerry's App World,[20] Palm's App Catalog,[21] Nokia's Ovi Store,[22] Samsung's Application Store,[23] Sony's PlayNow arena,[24] and LG's Application Store[25]); mobile operating system developers (Google's Android Market[26] and Microsoft's Windows Mobile Downloads[27]); mobile carriers (AT&T's MEdia Mall,[28] Verizon Wireless' Tools & Applications,[29] Sprint's Software Store,[30] US Cellular's easyedge,[31] Cellular South's Discover Center,[32] and Cricket's

[17] James Pethokoukis, *Update 1-Apple passes 2 billion app downloads*, Reuters, Sept. 28, 2009, http://www.reuters.com/article/rbssTechMediaTelecomNews/idUSN287155720090928.

[18] *See* Faulhaber & Farber, at 8, 18-19, 25; Katz Paper, at 14-22, 40, 68.

[19] http://www.apple.com/iphone/apps-for-iphone/.

[20] http://na.blackberry.com/eng/services/appworld/.

[21] http://www.palm.com/us/products/software/mobile-applications.html.

[22] https://store.ovi.com.

[23] http://www.samsungapps.com.

[24] http://www.playnow-arena.com.

[25] http://www.lgapplication.com.

[26] http://www.android.com/market.

[27] http://www.microsoft.com/windowsmobile/en-us/downloads/default.mspx.

[28] http://mediamall.wireless.att.com.

[29] http://products.vzw.com/index.aspx?id=fnd_toolsApps_all.

[30] http://softwarestore.sprint.com.

[31] http://easyedge.uscc.com/easyedge/Home.do.

[32] http://www.cellularsouth.com/DiscoverCenter/phones-apps/index.html.

Downloads[33]); independent mobile application stores (Handango[34] and GetJar[35]); and stand-alone developers (Facebook[36] and The Wall Street Journal).[37] These portals offer numerous free and paid applications in a mind-boggling array of categories, ranging from the practical (*e.g.*, AroundMe, which lists critical services based on your location),[38] to the entertaining (*e.g.*, Pandora Internet Radio, which creates your own personal music station),[39] and the frivolous (*e.g.*, iLightr, which creates a realistic photo of a flame),[40] to the (hopefully) life-changing *(e.g.*, Dating DNA and iMate, using technology to find matches for singles),[41] and even life-saving (*e.g.*, Pocket First Aid & CPR Guide, an extensive guide to life saving procedures, including

[33] http://www.mycricket.com/cricketfeaturesdownloads/.

[34] http://www.handango.com.

[35] http://www.getjar.com.

[36] http://www.facebook.com/mobile/.

[37] http://online.wsj.com/public/page/0_0560.html.

[38] *See also*, *e.g.*, Loopt (identify proximity to friends), http://www.loopt.com/phones/iphone; NightClock (turns your phone into a bedside alarm clock), http://www.android.com/market/free.html#app=nightclock); MileageMeter (keeps track of your gas mileage and price per mile), http://appworld.blackberry.com/webstore/content/1768; Currency Converter Deluxe, http://softwarestore.sprint.com/products.php?id=122775&cat=82.

[39] *See also*, *e.g.*, Shazam (users can identify songs they hear on the radio through applications that tie into their device's microphone), http://www.shazam.com/music/web/pages/iphone.html; top shelf bartender (over 300 drink recipes), http://www.mycricket.com/cricketfeaturesdownloads/gamesandapps/games/coolapps_bartender; Celebrity Digest, http://products.vzw.com/index.aspx?id=fnd_toolsapps_detail&appId=2033774.

[40] *See also*, *e.g.*, FingerMill (turns your iPhone into a treadmill for your fingers), http://images.businessweek.com/ss/08/10/1001_apple_appstore/4.htm; FarmSounds (hear a cow, pig, horse, or duck), http://appworld.blackberry.com/webstore/content/1851; Pocket Shaker Lite (shake your device to play maracas), http://store.ovi.com/content/710CFC6DD4BDE149E040050A873241A5?clickSource=browse&contentArea=applications.

[41] *See* www.datingdna.com/iphone; http://www.prleap.com/pr/132039; *see also* WebDate, http://www.mycricket.com/cricketfeaturesdownloads/gamesandapps/games/coolapps_webdate.

videos).[42] There are applications focusing on education,[43] the environment,[44] and healthy living.[45] Other apps provide reference materials,[46] travel aids,[47] business information,[48] finance

[42] *See also* iSOS – GPS emergency locator (reports your position to the police, medical services, family or friends and whoever else it is programmed it to contact), Airstrip OB (allows doctors to track patients vitals on the go and can send notices in the event of an emergency like cardiac arrest), Diabetes Log (tracks glucose readings, food intake and medicine records), Pillbox (tracks medication list and links all listed medications to an information database), PEPID (comprehensive toxicology resource that allows you to spot poisonous plants, track dangerous drug interactions and includes a guide on how to identify and manage any toxicology emergency; everything from inhaled gases and occupational poisonings to drug abuses and medication overdoses), Smart-ICE (a database of allergies, medical history, emergency contacts and your express wishes), Emergency Preparedness Checklist (a 59-point checklist that helps prepare for any kind of emergency), iSurvive Wilderness Support (shows how to tie knots, construct a shelter, set a snare and more), http://www.survival-spot.com/survival-blog/11-iphone-apps-that-could-save-your-life.

[43] *See, e.g.*, Brain Thaw (a brain exercise game for the iPhone), http://www.brainthawgame.com/; Lonely Planet Spanish Phrase Book, http://softwarestore.sprint.com/products.php?id=71241&cat=; Maths Workout (daily math exercises), http://www.android.com/market/free.html#app=mathsworkout; Periodic Table, http://appworld.blackberry.com/webstore/content/2114.

[44] *See, e.g.*, GreenMeter (computes your vehicle's power and fuel usage), http://hunter.pairsite.com/greenmeter/; GreenCalculator (calculate CO2 emissions based on lifestyle), http://www.handango.com/catalog/ProductDetails.jsp?storeId=2218&deviceId=1029&platformId=40&productId=249676&sectionId=7630; ShopGreen (provides recommendations for eco-friendly activities), http://appworld.blackberry.com/webstore/content/1594.

[45] *See, e.g.*, Quitter (track how long you have been smoke free and how much money you have saved), http://www.pazeinteractive.com/iphoneapps/quitter; FluRadar (up to date information on the H1N1 swine flu), http://appworld.blackberry.com/webstore/content/2818; CardioTrainer (records path, climb, pace, calories), http://www.android.com/market/featured.html#app=cardiotrainer; Calorie Countdown (track your diet and weight management), http://store.ovi.com/content/6A173A7C1D71220CE040050A85320A88?clickSource=search.

[46] Concise Oxford English Dictionary, Eleventh Edition, available for iPhone, http://www.mobilemarketer.com/cms/news/content/1877.html; Britannica Mobile Encyclopedia, http://appworld.blackberry.com/webstore/content/608; Yellowbook Mobile Search, http://www.android.com/market/free.html#app=yellowbook.

[47] NextFlight, available for iPhone, http://www.apptism.com/apps/next-flight; Flight and Hotel Travel Search by Kayak, http://appworld.blackberry.com/webstore/content/2890; Wikitude – Mobile Global Travel Guide, http://www.android.com/market/free.html#app=wikitude.

information,[49] news,[50] weather,[51] and much, much more. And many of the most popular applications are available from multiple portals and compatible with many of today's devices.

This is electrifying stuff, and if the question is simply does the U.S. wireless industry exhibit robust innovative health, we could surely stop here. The wireless marketplace is generating innovations that improve Americans' lives at a truly unparalleled pace.

B. The Essential Role of Carriers in Innovation at all Layers of the Ecosystem.

As visible and exciting as those edge changes are, however, it is easy to lose sight of the role that *carriers* play with respect to these and other innovations in the wireless ecosystem. Carriers are the driving force behind much wireless innovation.[52] AT&T is, at its core, an innovation company.[53] And carriers like AT&T play a key role in (1) building the network platforms that support everything in the wireless ecosystem, (2) innovating within those core wireless network to enable a larger array of wireless services and applications, and (3)

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[48] Salesforce Mobile for iPhone, http://www.salesforce.com/crm/sales-force-automation/mobile-crm/; Exgis Time and Expense Pro, http://appworld.blackberry.com/webstore/content/726; The Law Pod - Complete Federal Rules of Procedure, http://www.handango.com/catalog/ProductDetails.jsp?storeId=2218&deviceId=1029&platformId=40&productId=251437&merch=L2_sponsored_product&ad=l2_sp_251437.

[49] Bloomberg Mobile for iPhone, http://download.cnet.com/Bloomberg-Mobile-iPhone/3000-18553_4-10863509.html?tag=mncol;txt; SplashMoney Personal Finance, http://appworld.blackberry.com/webstore/content/853; Mortgage Calculator, http://www.android.com/market/free.html#app=mortgagecalculator.

[50] New York Times Mobile, http://www.nytimes.com/services/mobile/iphone.html; AP News, http://appworld.blackberry.com/webstore/content/895; USA Today, http://www.android.com/market/free.html#app=usatoday.

[51] AccuWeather, http://www.accuweather.com/iphone.asp; WeatherBug, http://appworld.blackberry.com/webstore/content/760; The Weather Channel, http://www.android.com/market/free.html#app=weatherchannel.

[52] *See* Faulhaber & Faber, at 8-15; Katz Paper ¶¶ 12-28.

[53] *See* AT&T Labs Website, http://www.corp.att.com/attlabs/reputation/timeline/ (interactive timeline of AT&T Labs discoveries and innovations).

developing important edge applications of their own and collaborating with other wireless participants to innovate in equipment, devices and applications.[54]

1. AT&T: An Innovation Leader.

Building on a decades long tradition, AT&T spends close to a *billion* dollars each year on research and development ("R&D") and other initiatives designed to bring to market new technologies, products, services and applications. There are more than 1,300 employees working across the nation (New Jersey, California, Texas, and Washington) in laboratories that, together with other AT&T employees, relentlessly pursue innovation through basic and applied sciences, often in collaboration with universities and the government.[55] AT&T was among the top 20 companies in U.S. patents received in 2008 (and, with Microsoft and Samsung, one of only three substantially involved in wireless),[56] and AT&T earned the Patent Board's number two ranking among *all* communications companies in innovation impact (close behind Cisco and ahead of *all* handset manufacturers) based upon "technology strength," "industry impact," "research intensity," "innovation cycle time," and "patents granted."[57]

[54] *See* Faulhaber & Farber, at 8-15; Katz Paper, at 23-28.

[55] *See, e.g.*, Kirk Ladendorf, *Before AT&T Releases Gadgets, Local Lab Puts Them To The Test*, This is Austin, Sept. 24, 2009, http://www.statesman.com/services/content/business/stories/technology/2009/09/24/0924att.html?cxtype=ynews_rss.

[56] *See* http://www.ipo.org/AM/Template.cfm?Section=Top_300_Patent_Owners&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=23598

[57] *See* Lindsey Gilroy and Scott Oldach, The Patent Scorecard 2009 – Telecom & Communications, Intellectual Property Today, available at http://www.iptoday.com/articles/2009-8-gilroy.asp. AT&T was ranked second only to Cisco, and was ahead of Nokia, Qualcomm, Motorola, Samsung, Alcatel-Lucent, Nortel, Research in Motion, and Fujitsu.

AT&T's "Labs" division is legendary. The science conducted in what began as Bell Labs has produced seven Nobel Prizes,[58] and AT&T's patent portfolio includes more than 6,000 patents issued in the last ten years and hundreds more that are pending. AT&T is issued an average of three new patents *every single business day*.[59] In addition to inventing the transistor and touch tone phones, solar cells, fiber optic communications, the UNIX and C++ operating systems, and key components of satellite communications and HDTV, the Labs division invented the first mobile phone, the first mobile network, and made the first rudimentary mobile phone call.[60] AT&T followed through on these successes by developing the modern "cell" system: AT&T Labs "divided wireless communications into a series of cells, then automatically switched callers as they moved so that each cell could be reused," which "led to the development of cellular phones and made today's mobile communications possible."[61] The Labs even patented designs that included one of the first handsets with the automatic portrait/landscape display

[58] *See* AT&T Website, http://www.att.com/gen/press-room?pid=5045.

[59] *See* AT&T Website, http://www.corp.att.com/attlabs/products/patent.html.

[60] *See* AT&T Labs Timeline, http://www.corp.att.com/attlabs/reputation/timeline/46mobile.html.

[61] *Id.* *See also* AT&T Milestones, 1946: First Mobile Telephone Call, http://www.corp.att.com/attlabs/reputation/timeline/46mobile.html ("[C]ellular telephone service . . . had been conceived in 1947 by D.H. Ring at Bell Labs. . . . The system comprised multiple low-power transmitters spread throughout a city in a hexagonal grid, with automatic call handoff from one hexagon to another and reuse of frequencies within a city. The technology to implement it didn't exist, and the frequencies needed were not available. [I]n the 1960s . . . Richard Frenkiel and Joel Engel of Bell Labs applied computers and electronics to make it work. AT&T turned their work into a proposal to the Federal Communications Commission (FCC) in December 1971. After years of hearings, the FCC approved the overall concept. . . . AT&T conducted FCC-authorized field trials in Chicago and Newark, N.J. Four years later, the FCC granted commercial licenses to an AT&T subsidiary. . . . Illinois Bell opened the first commercial cellular system in October 1983. President Clinton awarded Frenkiel and Engel the National Medal of Technology [for their invention]").

switching feature that is now so popular on touch screen handsets.[62] AT&T has continued to advance these technologies, by developing innovative ways to more efficiently use spectrum, playing a central role in the development of 3G standards and the packet-signaling protocols that are used in today's 3G networks,[63] and by developing and driving many of the fundamental techniques to use spectrum more efficiently in the soon-to-be-deployed 4G networks.[64]

AT&T's wireless innovations have also played an essential role in the wide availability and use of Wi-Fi – an increasingly important component of managing limited wireless bandwidth in a multimedia environment. Within the 802.11 standards-setting process, AT&T initiated the key study groups and developed the carrier grade quality of service standards that have allowed Wi-Fi to be used as a robust wireless broadband service. AT&T provided those innovations to the industry free of charge, and key 4G LTE innovations can also be directly traced to AT&T's leadership role on space-time coding and beam forming, quality of service, automatic network optimization and other research which also found its way into the 802.11

[62] *See, e.g.*, U.S. Patent Number 5,414,444 (May 9, 1995) (describing "[a] personal communicator for use in a wireless communications network [that] includes a wireless communications LCD and multimedia LCD" that "includes a steerable video manager for controllably optimizing image field coverage and adjusting to the orientation of the user relative to the personal communicator").

[63] For example, as discussed further below, AT&T played a central role in developing the UMTS/HSPA 3GPP standards, that, among many things, enable higher data rates over the radio channel, reduce latency for data services, enable data to be sent over multiple HSPA carriers to provide higher data rates, provide interference cancellation and other techniques to improve the performance of the device receivers, enable improved voice encoding for increased voice quality, enable higher data rates on the uplink, improve performance for handset receivers.

[64] For example, as discussed further below, AT&T played a key role in developing the LTE standards that allow different LTE channels to be used together to enable higher data transfer rates, allow the network to control the vocoder (voice encoder) bit rate to improve network efficiency, and allow LTE technology to use U.S. 700 MHz spectrum. AT&T has also made significant contributions to the Java Community Process (leading the creation of JSR289, which significantly enhanced the SIP Servlets specification), to VoIP and to MPEG video encoding standards that have been instrumental in lowering bandwidth requirements for high definition video and will enable more robust wireless video applications.

standards setting process. In short, while AT&T's wireless innovation contributions may not always be the "flashiest" ones that receive the most attention, behind the scenes AT&T has long been a thought leader making fundamental advances that have guided the entire wireless industry. It is no exaggeration to say that every time some one uses a mobile wireless handset, he or she is relying on path breaking AT&T inventions and contributions.

True to its history, AT&T today is thinking well beyond the "next big thing" and is actively involved in inventing and designing the next technologies after that. For example, AT&T is currently doing pioneering work (in collaboration with MIT and Intel) to develop 5G wireless service standards using "terahertz" waves – submillimeter wavelength spectrum in the 300 GHz to 3 THz range (between conventional radio and infrared light).[65] That spectrum's short wavelengths make it particularly well-suited for small, very high throughput systems[66] and there is more bandwidth in this range than in *all* of the spectrum in use today. Standards-setting that would permit a whole range of mobile wireless services to be provided over that spectrum has already begun (802.15), and the technology is very promising in the medium term.[67]

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[65] *See, e.g.*, http://www.ieee802.org/18/Meeting_documents/2007_Sept/18-07-0074-00-0vht-Proposed%20ITU-WRC%20Spectrum%20And%20Uasge%20Allocation%20For%20Teraherts%20Frequencies.ppt (AT&T labs IEEE presentation promoting the use of submillimeter wavelength spectrum).

[66] *See, e.g.*, http://news.techworld.com/mobile-wireless/8503/metal-foil-heralds-terahertz-radio ("THz signals could in theory - given adequate electronics - carry data 1,000 times faster than current WiFi or WiMax"); http://www.google.com/url?sa=t&source=web&ct=res&cd=3&url=http%3A%2F%2Fwww.ips.gov.au%2FIPSHosted%2FNCRS%2Fwars%2Fwars2006%2Fproceedings%2Finvited%2Fbird_abs.pdf&ei=bJuzSpe3IcHelAfK2Y2EDw&usg=AFQjCNGGMV09cQuHC3HDDIhqqzM878Tl1w&sig2=jTRVCmoiyLXbDbge6t1Iqw ("Terahertz (THz) frequencies (also called T-rays) have almost unlimited potential in a wide variety of applications including . . . wideband communications.").

[67] An AT&T employee is the Vice Chairman of the of 802.15 working group for IEEE standards setting organization, *see* http://www.ieee802.org/15/pub/IGthz.html, and AT&T Labs personnel are actively participating and advancing that standards setting process with many technical contributions. *See, e.g.*, http://mentor.ieee.org/802.15/file/08/ 15-08-0133-01-0thz-feasibility-of-

AT&T is also heavily involved in basic research to design the architectures, protocols, and networking techniques that will allow the creation of multi-tiered wireless area networks in the context of 4G technology. Using advanced antenna and signal processing, distributed intelligence, IP-based protocols, and small-cell wireless architectures based on 4G technology, AT&T is designing ways to integrate new, intermediate "neighborhood area networks" ("NANs") with more traditional local and metropolitan area networks ("LANs" and "MANs") to create a hierarchical, all-wireless 4G access and distribution networks that could match the quality of service provided by wired broadband offerings.[68]

AT&T also continues to lead the innovation charge in voice recognition and recommender systems research. AT&T's research innovations are already used in most commercial speech products and services,[69] and the ongoing research holds enormous wireless potential, because these advances allow users to interact with knowledge bases without having to cope with small displays on handheld devices. AT&T is pursuing basic and applied research to the complex problem of accurate voice recognition in "noisy" wireless environments, and AT&T

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giga-bps-data-rates-at-thz-frequencies-shannon-based-link-budget-analysis.ppt (presentation by AT&T describing the proposed "system model" for use in the standard); http://grouper.ieee.org/groups/802/15/pub/2002/Jul02/02278r0P802-15_SG3a-802-15-UWB-PathLoss-Model-Presentation.pdf (describing a method to address "path loss" in wireless communications).

[68] *See*, *e.g.*, http://www.research.att.com/viewProject.cfm?prjID=105 (describing AT&T's role of developing mobile systems "with advanced antenna and signal processing, distributed intelligence, IP-based protocols, and small-cell wireless architectures based on 4G, it is possible to realize composite wireless systems that parallel the access, distribution, transport, and core hierarchy of the wired network").

[69] AT&T is recognized worldwide for its pioneering research in speech recognition (Watson), text-to-speech synthesis (Natural Voices), natural language understanding, machine learning, and speaker identification. AT&T invented speaker independent automatic speech recognition ("ASR"), word spotting, barge-in (recognizing when speaker talks before being prompted), spoken natural language understanding, and the first one million word speech recognizer. More than 400 U.S. patents have been issued to AT&T for speech recognition, and AT&T personnel have published more than 4,000 papers on the subject.

continues to lead the rest of the industry in harnessing complex machine learning to learn from and interact with people in plain English (or Spanish or any other language).[70] AT&T is also a recognized leader in text to speech capabilities, which facilitates, among other things, "hands busy, eyes busy" use of mobile devices. *See* AT&T Natural Voices Website, http://www.naturalvoices.att.com. Together, these innovations will pave the way for everything from "smart" mobile e-commerce applications to mobile medical applications that provide each user with customized, voice-controlled, interactive health assistance and wellness management.[71]

[70] *See, e.g.*, Discover Magazine, *Think Tech Want an Easy Way to Control Your Gadgets? Talk to Them.*, Nov. 2008, available at http://discovermagazine.com/2008/nov/17-talk-to-your-gadgets ("For decades AT&T has been working on a voice recognition system that can handle just such requests. Known as Watson, it is so complex that it is more practical to run the software on centralized servers than to install, manage, and maintain it on countless mobile devices. Fortunately, today's mobile devices have the ability to connect to the Internet in spades. By including some very basic hardware and software to capture and compress speech (which phones already possess), any device can be given the gift of voice recognition. Captured speech is sent, via the Internet or a cell phone network, to AT&T computers running Watson. The Watson software analyzes the speech and sends back a digital response that the device can translate into commands."); AT&T Labs Research, Description of Voice Services, http://www.research.att.com/viewProject.cfm?prjID=355 (describing AT&T's "mash-up" and other text-to-speech capabilities); AT&T Labs Research, Description of Watson Technology, http://www.research.att.com/viewProject.cfm?prjID=49. AT&T Labs routinely presents breakthroughs in this areas. *See*, *e.g.*, Goffin, V., Allauzen, C., Bocchieri, E., Hakkani-Tur, D., Ljolje, A., Parthasarathy, S., Rahim, M., Riccardi, G., and Saraclar, M. (all of AT&T Labs), *The AT&T Watson Speech Recognizer* (IEEE 2005) ("We showed a 5% absolute improvement in word accuracy and a factor of 2-3 speed-up in processing time over the baseline system.").

[71] These technologies, for example, can reduce medical costs by translating doctor dictations into electronic medical records (avoiding costs of manually typing such entries), provide automatic translations that enable doctors to better treat non-English speakers without adding staff, provide biometric voice authentication to enhance security for electronic medical records, facilitate prescription refills, facilitate insurance claim filings (as well as ID card requests, co-pay information requests, and many other), assist the sight impaired by providing voice translations of written text (*e.g.*, provide turn-by-turn voice directions), assist the hearing impaired by providing speech to text translations, and facilitate natural language access to government services.

Indeed, AT&T recently reaffirmed its leadership in recommender systems and interaction with knowledge bases when AT&T scientists won the coveted Netflix Prize.[72]

As AT&T's history exemplifies, no serious consideration of wireless innovation can be complete without full consideration of the essential role of carrier investment and innovation.

2. Carrier Investment Enables The Platforms Needed for the Entire Wireless Ecosystem.

At the most basic level, of course, none of the cutting "edge" innovations that we see today could even exist without the carriers' ubiquitous, reliable, and constantly evolving platforms that allow consumers to use a vast and ever-growing array of wireless services and applications.[73] Building networks to keep pace with wireless demand requires investment, and lots of it. In recent years, carriers have spent many billions of dollars acquiring spectrum, adding cellsites, building out infrastructure, introducing and improving new technologies and entering into arrangements to develop and distribute new devices and services that exploit these capabilities.[74]

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[72] Two of AT&T's scientists who work on "visualizing and analyzing large networks with AT&T Labs-Research, were part of the team presented with the Netflix Prize, a multi-year contest to improve upon the advanced Netflix movie recommendation system. More than 40,000 teams from 186 countries participated in the competition." Press Release, AT&T, *AT&T Researchers Take Home Hotly-Contested Netflix Prize*, Sept. 21, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27152.

[73] *See* Faulhaber & Farber, at 8-15; Katz Paper, at 23-28.

[74] *See* Katz Paper ¶ 22 ("The U.S. wireless carriers reported incremental capital expenditures in their operational systems of $20.17 billion in 2008"); Declaration of Thomas Hazlett ¶ 9, attached hereto ("Hazlett Decl.") ("By one key metric – capital outlays for network development – resulting investment has been robust: over $240 billion has been sunk in U.S. mobile networks"). Dr. Thomas W. Hazlett is Professor of Law & Economics and Director, Information Economy Project, at George Mason University. From 1991 to 1992, he served as Chief Economist of the Federal Communications Commission. Dr. Hazlett is published widely in academic and popular journals on the economics of telecommunications markets and, in particular, radio spectrum allocation. He is a columnist for the Financial Times and has provided expert testimony to federal and state courts, regulatory agencies, committees of Congress, foreign governments, and international organizations. *See also* Reply Comments of CTIA, *A*

If this innovation is to continue apace, government policies that encourage – and do not discourage – billions of dollars of additional wireless carrier investment are more important today than ever before.[75] Now that the iPhone and follow-on devices have shown consumers the potential benefits of multimedia over wireless, Americans are consuming wireless bandwidth like never before. AT&T's wireless data traffic has increased by nearly *5000 percent* in the past 12 quarters,[76] and other carriers likewise have reported dramatic increases.[77] This trajectory is expected to continue.[78] As an aide to Chairman Genachowski recently explained, "[d]emand for more capacity is exploding and increased spectral efficiency can only do so much."[79] Meeting and anticipating the voracious bandwidth demands of the evolving multimedia wireless ecosystem is extraordinarily expensive. In just the past two years, AT&T spent more than $38 billion to upgrade its wireline and wireless networks, and AT&T will spend between $11 and

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National Broadband Plan for Our Future, GN Docket No. 09-51, at 8 (filed July 21, 2009) ("wireless carriers spend more than $22 billion per year on network expansion and upgrade").

[75] Faulhaber & Faber, at 19; Katz Paper ¶¶ 23-29.

[76] Kris Rinne, SVP Architecture and Planning for AT&T, *Tuesday Keynote*, 4G World, at 5, Sept. 15, 2009; *see also* Kevin Fitchard, *4G World: AT&T says HSPA+ is off the table for now*, TelephonyOnline, Sept 15, 2009, http://telephonyonline.com/3g4g/news/Rinne-4gworld-keynote-091509 ("data traffic on [AT&T's] 3G network has grown by almost 5000% in the last three years").

[77] *See, e.g.*, *Ex Parte* Letter from Kathleen O'Brien Ham (T-Mobile) to Marlene H. Dortch (FCC), GN Docket No. 09-51, WT Docket No. 06-150, PS Docket No. 06-229, WT Docket No. 05-265, WT Docket No. 00-193, WC Docket No. 05-25, at 9 (filed Aug. 6, 2009) ("T-Mobile G1 customer's use 50 times the data of the average T-Mobile customer"); *see also* Faulhaber & Faber White Paper, at 12-13.

[78] *See* Hazlett Decl. ¶ 14; Faulhaber & Farber, at 9-10; Katz Paper ¶ 17.

[79] Howard Buskirk, *Google Voice Probe Shows Changes Overtaking Wireless Industry, Federal CTO Says*, Communications Daily, Sept. 16, 2009.

$12 billion in the next year and a half within the current 3G framework to increase available bandwidth by deploying new cell sites, adding spectrum and upgrading to HSPA 7.2 Mbps.[80]

The industry is now poised to upgrade to the next generation of technology, 4G. Although we cannot yet imagine all that the 4G revolution may enable, each previous leap forward in network technology has led to extraordinary innovation at all levels of the value chain, and there is every reason to expect even greater advances with the transition to 4G.[81] The 4G/LTE networks that AT&T and others are preparing to deploy will be all-IP networks capable of theoretical peak download speeds of 326 Mbps and peak upload speeds of 86 Mbps[82] that will support a broad array of beneficial new applications, services and devices – including important advances in public safety and health care,[83] energy and the environment,[84] and education[85] that

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[80] Andrew Berg, *Rinne: AT&T Ready for 4G Jump*, Wireless Week, Sep. 15, 2009, http://www.wirelessweek.com/News/2009/09/Rinne--AT-T-Ready-for-4G-Jump/ ("AT&T has invested $38 billion in its wired and wireless networks over the past two years."); Press Release, AT&T, *AT&T to Make Faster 3G Technology Available in Six Major Cities This Year*, Sept. 9, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27068 ("AT&T is responding to this unprecedented growth in its history with plans to invest between $17 billion and $18 billion this year, more than two-thirds of which is going toward broadband and wireless.").

[81] *See, e.g.*, David Waite, *The Business Case for LTE*, Telephony Online, Mar. 2, 2009, http://telephonyonline.com/wireless/commentary/long-terms-evolution-economic-benefits-0302 ("LTE's new capabilities promise to essentially change how we think about mobility, from core voice and data services to high-value-added content and applications. However, for the LTE business case to prove-out, all segments of the ecosystem must enable the capabilities necessary for end users to reap the full benefits of LTE.").

[82] 3G Americas, LTE, http://www.3gamericas.org/index.cfm?fuseaction=page&sectionid=249 (last visited Sep. 21, 2009) ("LTE capabilities include: Downlink peak data rates up to 326 Mbps with 20 MHz bandwidth; Uplink peak data rates up to 86.4 Mbps with 20 MHz bandwidth; Operation in both TDD and FDD modes; Scalable bandwidth up to 20 MHz, covering 1.4, 3, 5, 10, 15, and 20 MHz in the study phase; Increased spectral efficiency over Release 6 HSPA by a factor of two to four; Reduced latency, up to 10 milliseconds (ms) round-trip times between user equipment and the base station, and to less than 100 ms transition times from inactive to active").

[83] Press Release, APCO, *APCO & NENA Endorse LTE As Technology Standard For The Development Of Nationwide Broadband Network*, June 9, 2009, http://www.apco911.org/new/news/nena_endorse_lte.php ("The Board of Officers of the

go well beyond the capabilities of today's wireless networks. As explained in a recent report by the UMTS Forum, "LTE will be characterized by a complex ecosystem that includes not only

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Association of Public-Safety Communications Officials (APCO) International and the Executive Committee of the National Emergency Number Association (NENA) today announced both organizations' endorsement of Long Term Evolution (LTE). . . . LTE is a standard capable of supporting public safety needs for voice, video and data communications with high bandwidth and low latency, which can significantly improve first-responder access to mission-critical communications using bandwidth-hungry applications. . . . [I]t is anticipated that public safety will reap substantial benefits by adopting LTE as the standard for its nationwide interoperable network from the start by capitalizing on research and development currently underway."); Alcatel/Lucent Information Page For LTE, http://www1.alcatel-lucent.com/technology/lte/ (last visited Sep. 23, 2009) (another benefit of LTE will occur in "[v]ertical markets where information accuracy, reliability and immediacy are key will also see benefits. For example, the healthcare sector will be able to deploy medical applications where latency and high-resolution imaging are important"). AT&T was the first U.S. carrier to adopt the international GSM standard for its network, to upgrade its network to GPRS and EDGE technology, and to deploy UMTS (W-CDMA) and HSPA technology. Today, even as AT&T is now planning its next upgrade to 4G/LTE technology, AT&T continues to implement upgrades to its existing HSPA technology in ways that will further increase spectrum efficiency and bandwidth. Press Release, AT&T, AT&T to Make Faster 3G Technology Available in Six Major Cities This Year (Sep. 9, 2009), http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27068. In addition, AT&T continues to add more cell sites to reduce the number of devices served by each cell site, to deploy handsets with "smarter" radios that can use spectrum more efficiently, to deploy 850 MHz HSPA spectrum technology, and to use techniques often referred to as "cognitive radio" that are managed by AT&T's network and that use AT&T's licensed spectrum more efficiently. As a result, wireless networks are vastly more efficient today than in previous years as the rate of innovation continues and network operators continuously improve network performance and efficiency.

[84] *See, e.g.*, Fierce Wireless, *Smart grids: The next wireless goldmine?*, May 15, 2009, http://www.fiercebroadbandwireless.com/story/smart-grids-next-wireless-goldmine/2009-05-15 ("For utility companies, smart metering apps probably present the biggest potential as smart grids could be used to control and monitor energy consumption in order to help customers save energy. Ultimately, consumers would receive incentives or discounts for using their electronic devices during low-peak hours. . . . Today, companies like AT&T, Verizon, Sprint Nextel/Clearwire and T-Mobile USA appear to be out in front, as M2M apps like smart grids could become a key element of their upcoming 4G (LTE/WiMAX) strategy.").

[85] Editor, *Ericsson in talks with region's mobile operators to launch 4G services*, Wireless Federation, June 30, 2009, http://wirelessfederation.com/news/16875-ericsson-in-talks-with-regions-mobile-operators-to-launch-4g-services ("The 4G services will truly revolutionize your life by facilitating the means of communication for both institutions and individuals. These will include not only Internet telephones and videophones, but also easy teleconferencing, practical telecommuting, medical services such as remote diagnosis, interactive distance education, rich multimedia entertainment, digitally-controlled home appliances, and much more.").

operators, infrastructure providers, terminal vendors, standard bodies and regulators, but also chipset manufacturers, application developers, content platform providers and consumer electronics vendors. Supported by a healthy ecosystem, LTE will also see the emergence of dynamic new business models not hitherto seen in the mobile space."[86] Other next generation services, such as Wi-Max, are also expected to bring large benefits to consumers. Without the continuous, multi-billion dollar investments of the carriers to improve their networks, however, none of these innovations can be delivered to consumers.

3. Carrier Innovation Within the Network.

But carriers contribute a lot more than capital to the nation's wireless ecosystem. They are among its most prodigious innovators. AT&T is constantly redesigning and re-engineering its network to improve spectral efficiency. AT&T was the first U.S. carrier to adopt the international GSM standard for its network, to upgrade its network to GPRS and EDGE technology, and to deploy UMTS (W-CDMA) and HSPA technology. Today, even as AT&T is now planning its next upgrade to 4G/LTE technology, AT&T continues to implement upgrades to its existing HSPA technology in ways that will further increase spectrum efficiency and bandwidth.

AT&T has always operated at the tip of the technological spear, launching new devices, applications and business models for the first time anywhere. As a result, AT&T's network has long been the world's wireless network test-bed for experimentation with innovative ways to

[86] Chris Solbe, *New study investigates tomorrow's LTE mobile broadband ecosystem*, UMTS Forum, June 4, 2009, http://www.umts-forum.org/content/view/2830/174/; *see also id.* ("LTE will enhance many existing services while enabling new ones. In this new environment, non-voice mobile services – including real-time video, P2P content sharing and social networking – will be increasingly important. This evolution from a 'traditional' mobile ecosystem to embrace new internet-based applications, devices and content delivery mechanisms will see the emergence of a broader ecosystem than for any previous mobile technology.").

respond to soaring wireless demand and new wireless uses. Among other firsts, AT&T was the first nationwide carrier to commercially launch BlackBerry service,[87] the first to introduce the Motorola RAZR,[88] the first to introduce the iPhone, and the first to introduce netbooks with embedded wireless cards.[89] AT&T was also first or among the first to offer visual voicemail,[90] two-way texting,[91] a national one rate plan,[92] and technology that tracks customers unused minutes each month and allows them to use those minutes in subsequent months.[93] Our network was also the first to be used to support tens of thousands of applications, including business applications, social applications, life saving applications, life changing applications, gaming applications and myriad others (discussed above). And, as discussed below, AT&T's network is

[87] *See* AT&T Developer Program – devCentral Webcast Series, 2008, http://developer.att.com/devcentral/Webcast_VCS/ATT_Bold_Nov_21st-Webcast.pdf. AT&T was also the first to launch Push to Talk on a GSM/EDGE BlackBerry, the first to launch XM Mobile Radio feature on BlackBerry with 20 music channels, the first to launch TeleNav Maps for driving directions as a free OTA download on BlackBerry, the first to launch TeleNav GPS Navigator on BlackBerry with audible driving directions and traffic information, and the first carrier to offer BlackBerry voice roaming in 205+ countries, data roaming in 150+ countries. *Id.*

[88] Press Release, AT&T, *AT&T Continues RAZR Tradition*, 2007, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=24197.

[89] Tara Seals, *AT&T First to Stake Claim on Netbooks, Xchange*, CTIA, April 1, 2009, http://www.xchangemag.com/hotnews/ctia-att-first-to-stake-claim-on-netbooks.html ("Standing at the intersection of computing and telecom, AT&T Inc. has borrowed a page from its European counterparts with the expansion of its subsidized netbook strategy. The move solidifies its status as the first and so far only U.S. carrier to commercially embrace the sub-laptop market.").

[90] Press Release, AT&T, *AT&T and Apple Announce Simple, Affordable Service Plans for iPhone*, June 26, 2007, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=24018.

[91] Sixth Report, *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, 16 FCC Rcd. 13350, 13411 (2001).

[92] *Id.* At 13377 ("many in the industry questioned AT&T Wireless's wisdom when it introduced the first DOR [digital one-rate] plan in May 1998").

[93] AT&T Web Site, http://www.wireless.att.com/learn/why/rollover.jsp.

currently being used to support some of the most innovative machine to machine and other applications available today.

Ensuring that these new devices and applications deliver what customers expect requires constant re-engineering and innovation.[94] AT&T is leading the industry in increasing the number, and reducing the size of wireless cells, improving interaction and handoffs between cells, and deploying "smarter" handsets and infrastructure to reduce power and interference.[95] In this regard, wireless networks are vastly more efficient today than in previous years as the rate of innovation continues and network operators continuously improve network performance and efficiency. As Professor Hazlett shows, U.S. mobile carriers have increased the efficiency and capacity of their networks, in terms of the number of independent channels that can be used at one time, *tenfold* over the last eight years.[96]

AT&T is also investing heavily to deploy and improve complementary networks and technologies that reduce loads on core network. For example, AT&T was the first carrier to deploy a large network of Wi-Fi hotspots; today, it provides customers "widespread access to its Wi-Fi network – the largest in the country with more than 20,000 hotspots in all 50 states."[97]

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[94] Faulhaber & Farber, at 8-12; Katz Paper ¶¶ 18-23, 45-47.

[95] Press Release, AT&T, *AT&T to Make Faster 3G Technology Available in Six Major Cities This Year*, Sept. 9, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27068 ("The AT&T rollout of HSPA 7.2 will be matched with the availability of multiple compatible wireless handsets and devices . . . [that] will enable customers to quickly take full advantage of HSPA 7.2 speeds. In contrast, LTE devices are still in development"); *id.* (AT&T is adding "about 2,000 new cell sites to [its] network in 2009); *id.* (AT&T is beginning "[p]reparation for field trials of 4G LTE wireless networks next year, with deployment planned to follow in 2011").

[96] Hazlett Decl. ¶ 46. *See also* Faulhaber & Farber, at 8-12; Katz Paper ¶¶ 18-23, 45-47.

[97] Press Release, AT&T, *AT&T to Make Faster 3G Technology Available in Six Major Cities This Year*, Sep. 9, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27068; Lynette Luna, *The New Data Offloading Industry*, FierceWireless, June 16, 2009,

AT&T is also developing and deploying femtocells within its network, which provide shorter-range wireless connectivity that can quickly offload calls to wireline broadband networks and thus reduce the load on the wireless network.[98]

Equally important, carriers innovate to facilitate and optimize the performance of customer-facing equipment. Carriers are in a unique position to understand the needs and wants of their customers both with respect to services and devices; indeed, that is their lifeblood. Accordingly, carriers often lead manufacturers in new directions, working with them to develop new devices or new features that carriers believe will find acceptance in the marketplace. Carrier innovation also extends to device-specific network changes and upgrades to enable handsets and other devices to work optimally with the network and provide all customers with a rewarding experience. Some devices – a classic example being the iPhone –require an unusual degree of network innovation and investment to accommodate the device's features and capabilities and to

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http://www.fiercebroadbandwireless.com/story/offload/2009-07-16 ("Data traffic, especially video traffic, is skyrocketing and will soon, if it already hasn't, grow much faster than revenues. Operators are looking for ways to offload that traffic onto WiFi"); *id.* ("AT&T said the number of WiFi users and connections has dramatically increased on its 20,000-some domestic hotspots, totaling 10.5 million in the first quarter 2009. That number is more than triple the 3.4 million connections the carrier recorded in the first quarter of 2008").

[98] Colin Gibbs, *AT&T Jumps on the Femtocell Bandwagon*, CNN Money.com, Sep. 21, 2009, http://money.cnn.com/news/newsfeeds/gigaom/mobile/2009_09_21_att_jumps_on_the_femtocell_bandwagon.html (AT&T "has launched a consumer trial of its 3G MicroCell, a femtocell that uses the customer's home Internet connection to connect to AT&T's network for both voice and data usage.").

optimize its performance;[99] indeed, the more innovative the device, the more likely such carrier innovations will be necessary.[100]

Carrier innovation in "provisioning, billing, [and] how customers pay,"[101] has been equally compelling. In the wireless industry, "[e]ase of use is [the] killer app,"[102] and carriers have responded by developing systems and processes that make procuring, using and paying for wireless services ever more user-friendly. At the same time, new and improved provisioning and billing systems have enabled AT&T and others to offer customers a wide-array of innovative rate plans. These include pre-paid plans for voice, Internet, text messaging, email, and other services.[103] Wireless carriers have increasingly been offering pay-as-you go plans that permit

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[99] *See*, *e.g.*, Comments of AT&T Inc., *Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers*, RM-11497 (filed Feb. 2, 2009) (describing innovation and investment, including visual voicemail integration, instant activation systems, networks upgrades, and sales representative training).

[100] AT&T proactively supports the creation of new devices that can take advantage of AT&T's cutting edge network. For example, members of AT&T's "devCentral" program (registration is free), can obtain information and suggestions for creating devices for AT&T's UMTS/HSPA, information for optimizing devices for AT&T's network, special considerations that should be considered for devices intended for enterprises, information for developing devices and applications for different platforms and operating systems, information for developing for emerging technologies (*e.g.*, Real-Time Location Systems, Biometrics, and IP Multimedia Subsystems), security, and a number of others. This resource also provides numerous whitepapers and manuals addressing everything from "Antenna Fundamentals" to "Security Requirements," to "Sample Code and Applications." AT&T DevCentral, http://developer.att.com/developer/index.jsp?page=toolsAndTech (requires free registration).

[101] *Notice* ¶ 63.

[102] Michael Woodward, *Ease of Use is Industry's Killer App*, RCR Wireless, Aug. 6, 2009, http://www.rcrwireless.com/article/20090806/WIRELESS/908069997/ease-of-use-is-industry-146-s-killer-app.

[103] Examples of these plans are available at carrier web sites. *See*, *e.g.*, AT&T, http://www.wireless.att.com/cell-phone-service/cell-phone-plans/index.jsp; Verizon Wireless, http://www.verizonwireless.com:80/b2c/splash/plansingleline.jsp?lid=//global//plans//voice+plans//individual; Sprint, http://nextelonline.nextel.com/NASApp/onlinestore/en/Action/SubmitRegionAction?isUpgradePathForCoverage=false&currZipCode=&upgradeOption=&nextPage=DisplayPlans&equipmentSKUurlPart=%3FcurrentPage%3DratePlanPage&filterStringParamName=filterString%3DIndivid

customers to purchase minutes and data capacity as they need them.[104] Carriers also have introduced myriad other customer-facing innovations, including, rollover minutes,[105] free night and weekend calling,[106] free calling to designated numbers or other mobile numbers,[107] and

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ual_Plans_Filter&newZipCode=20005&x=49&y=12; T-Mobile, http://www.t-mobile.com/shop/plans/Cell-Phone-Plans.aspx?catgroup=Indvidual-cell-phone-plan&WT.z_shop=Individual; US Cellular, http://www.uscc.com/uscellular/SilverStream/Pages/b_plan.html?zip=60601&mkt=608830&tm=1&tabPlan=2; Metro PCS, http://www.metropcs.com/shop/phonelist.aspx ; Cricket, http://www.mycricket.com/cricketplans/washingtondc.

[104] *See, e.g., U.S. Prepaid Wireless 1Q09 Vendor Profiles: Strategy Drill* Down, IDC, July 2009 ("At the close of the first quarter 2009, the number of U.S. wireless prepaid customers stood at just over 52.6 million. As a result, with more than 274.1 million total wireless subscribers in the United States for the same period, prepaid wireless services accounted for 19.2% of the market"); AT&T, http://www.wireless.att.com/cell-phone-service/cell-phone-plans/prepaid-cell-phone-plans.jsp?_requestid=576557; Verizon Wireless, http://www.verizonwireless.com/b2c/splash/prepay.jsp?lid=//global//plans//voice+plans//prepaid; T-Mobile, http://www.t-mobile.com/shop/plans/Prepaid-Plans-Overview.aspx; US Cellular, http://www.uscc.com/uscellular/SilverStream/Pages/b_plan.html?zip=60601&mkt=608830&tm=1&tabPlan=2; Virgin Mobile USA, http://www.virginmobileusa.com/cell-phone-plans/; Boost Mobile, http://plans.boostmobile.com/planhub.aspx.

[105] *See* http://www.wireless.att.com/learn/why/rollover.jsp (AT&T roll-over minutes).

[106] *See, e.g.*, MyRatePlan, http://www.myrateplan.com/wireless/knowledge/nightsandweekends.php (identifying several carriers offering free nights and weekend plans, including AT&T, Sprint, T-Mobile, Verizon).

[107] *See, e.g.*, Saul Hansell, *AT&T's Free-Calling Offer Preserves Revenue*, N.Y. Times Technology, Sept. 9, 2009 ("AT&T today copied other wireless carriers' promotions and is giving customers on its higher-priced calling plans free calls to five numbers of their choosing. It's a sign that the price competition, spurred by unlimited-use wireless plans of as low as $40 a month is affecting the biggest carriers."); *see also, e.g.*, Press Release, AT&T, *AT&T Customers Enjoy Unlimited Calling to Their A-List*, Sept. 9, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27093; Press Release, Sprint, *Sprint Customers Can Break Free of Calling Circles with Any Mobile, Anytime*, Sep. 10, 2009, http://newsreleases.sprint.com/phoenix.zhtml?c=127149&p=irol-newsArticle_newsroom&ID=1330317&highlight=; Verizon's Friends and Family, http://www.verizonwireless.com/b2c/splash/plansingleline.jsp?lid=//global//plans//voice+plans//individual; T-Mobile My Faves, http://www.t-mobile.com/shop/plans/Cell-Phone-Plans.aspx?catgroup=Indvidual-cell-phone-plan&WT.mc_n=Individual_PlanFirstTile1&WT.mc_t=OnsiteAd#Individual+myFaves.

handset subsidies.[108] Innovation on the billing and payment side has also been robust. Customers can now electronically pay (using their wireless handset if they prefer),[109] monitor their usage in real time (or choose to receive usage alerts when they are approaching plan limits),[110] and manage their minor children's usage.[111]

4. Carrier Innovation That Drives Equipment, Device and Application Innovation.

Carrier innovation is not confined to the network or the provision of network services. Through their participation in wireless standards bodies and through the fruits of their own R&D, carriers play an important role in developing and guiding wireless innovation in equipment and devices.[112] Unlike some industries, the standards-setting process for wireless, which involves participation by and collaboration among industry participants throughout the wireless value chain, is not merely an after-the-fact effort at translating settled advances into written standards. Rather, wireless standards-setting is a forward-looking laboratory for innovation in which carriers, manufacturers, and others can work through ideas for new devices and functionalities.

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[108] *See*, *e.g.*, J.D. Power and Associates, U.S. Wireless Mobile Phone Evaluation Study, 2007 (J.D. Power has estimated that 36% of wireless customers received a free phone from their carrier, and many more consumers received highly subsidized handsets.).

[109] *See*, *e.g.*, AT&T myWireless Mobile iPhone Application, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26794 (view data and voice usage, manage bill payments, and add new wireless features); T-Mobile Payment Options, http://support.t-mobile.com/doc/tm21002.xml?; US Cellular Payment Options, http://www.uscc.com/uscellular/SilverStream/Pages/x_page.html?p=autopay_Menu_Features.

[110] *See*, *e.g.*, AT&T Answer Center, http://www.wireless.att.com/answer-center/main.jsp?t=solutionTab&solutionId=KB61946 (monitoring minutes and text usage); T-Mobile's Minute Messenger, http://support.t-mobile.com/doc/tm10032.xml?.

[111] *See*, *e.g.*, AT&T's Smart Limits for Wireless, http://www.wireless.att.com/learn/articles-resources/parental-controls/smart-limits.jsp (setting limits on content accessible by children); Verizon Wireless Usage Controls, https://wbillpay.verizonwireless.com/vzw/nos/uc/uc_home.jsp; FireFly Mobile, The mobile phone for mobile kids (http://www.fireflymobile.com/).

[112] Faulhaber & Farber White Paper, at 12-15.

Given the rapid pace of change in the wireless industry, the standards-setting process serves as both a forum for the invention of new capabilities in real time and as an incubator for the next generation of innovation. Carriers, large and small, can play an essential role in the standards-setting processes that are the catalyst for much wireless innovation.

Among the most prominent wireless standards-setting exercises today is the 3GPP standards-setting process,[113] which is an organization that was developed as a world-wide partnership to develop standards for 3G systems such as UMTS, HSPA, and HSPA+, and which is now in the midst of developing standards that address every key aspect for next-generation LTE networks, including multi-media messaging, quality of service protocols, femtocell standards, voice encoding CODECs, security protocols, signaling and much more.[114] AT&T personnel routinely participate in the 3GPP standards groups, including, among others, the radio access network and core network and terminals areas (AT&T personnel are Vice Chairs of both), and many of the significant innovations in these standards were aided by AT&T science and contributions. For LTE, a few examples include: driving the development of Bandwidth Aggregation technology, which allows different LTE channels to be used together to enable higher data transfer rates; developing standards called "Vocoder Rate Adaptation," which allows the network to control the vocoder (voice encoder) bit rate to improve network efficiency; developing many of the concepts for 3GPP Voice Call Continuity, which allows in-call handoffs between different access technologies (*e.g.*, an in-call handoff from CDMA to GSM or Wi-Fi); and working to incorporate U.S. 700 MHz spectrum in the 3GPP LTE standards to ensure device

[113] The 3GPP standards groups hold meetings on a monthly or bi-monthly basis throughout the world where thousands of engineers, technologists, and developers come together to work out the complex problems involved in mobile wireless networks for voice and data services.

[114] *See, e.g.*, 3GPP Web Site, "technologies" section, http://www.3gpp.org/technologies. The 3GPP also continues to develop extensions to AT&T's prior-generation GSM/GPRSa and EDGE technologies.

and application compatibility.[115] AT&T is also an active participant in a wide range of other standards-setting bodies that play a central role in wireless innovation, including, among others, the IEEE 802 LAN/MAN Standards Committee, the Internet Engineering Task Force, the Wi-Max Forum, the Wi-Max Alliance, and the ITU (where the requirements for future spectrum allocations and 4G systems are currently being addressed).[116]

Although participants in all layers of the wireless ecosystem provide critical input to standards setting bodies and in other contexts, carriers can play an especially critical role in the standards-setting process, in part because they are the market participants that have the most direct experience with consumers, in part because they must build the networks that create the platforms for all wireless activity and innovation, and in part because the scientists and engineers in their employ are among the best and brightest. The incentives of carriers to participate in these standards settings processes – and thus to facilitate the development and deployment of

[115] For the UMTS/HSPA 3GPP standards, AT&T was very involved in developing the technology and standards for, among many others, Multi-input, Multi-output, *i.e.*, MIMO, technology (enables higher data rates over a radio channel), Higher Order Modulation (enables higher data rates over the radio channel), Continuous Packet Connectivity (reduces latency for data services), Multi-Carrier (enables data to be sent over multiple HSPA carriers to provide higher data rates), Advanced Receivers (provides interference cancellation and other techniques to improve the performance of the device receivers), Adaptive Multi-Rate (AMR) Codec (improves voice quality), and Uplink Transmit Diversity (higher data rates on the uplink). In addition, AT&T was the first operator to introduce UMTS/HSPA service using 850 MHz and 1900 MHz spectrum bands. For GSM/Edge, AT&T was very involved in the development of standards for, among many others, Single Antenna Interface Cancellation (improved performance for handset receivers), the Adaptive Multi-Rate Codec (improved voice quality), and AT&T was the first operator to provide such services using 850 MHz spectrum. AT&T was also instrumental in the development of intelligent roaming. This advance led to significant reductions in roaming costs and is one reason why carriers are able to offer flat rate national plans.

[116] *See*, *e.g.*, http://www.research.att.com/index.cfm?portal=12&h=58; ATIS Conference, AT&T's Vision of LTE, at 20, dated January 29, 2009, http://www.atis.org/lte/ ("AT&T participates heavily in the international and domestic standards community (3GPP, OMA, ITU, ATIS, TIA, and others) in both the leadership and the working levels"). As just one more example, AT&T helped lead the development of a comprehensive security standard in the WiMax Forum.

innovative edge services – would be greatly diminished if they were siloed to the provision of "dumb pipe" network facilities.[117]

Even beyond the standards-setting process, carriers are also critical participants in all layers of the wireless ecosystem on other core wireless innovations. AT&T and other carriers, for example, are spearheading the development of a Commercial Mobile Alert System (the mobile version of the emergency alert system broadcast by radio and TV stations today). AT&T has partnered with others to develop ways to improve battery life for devices and to implement audio noise cancelation techniques in wireless devices to provide improved acoustic performance. AT&T is also a significant contributor to the development of methods for mobile networks to support TTY for the hearing impaired.

Finally, even if one focused myopically only on "edge" wireless applications, AT&T and other carriers are important innovators in that space as well. In addition to applications that allow customers to receive and pay bills (as well as track usage and other statistics) directly from their handsets, AT&T has collaborated with others to develop applications that allow customers to view family members' wireless phone locations on a map from a mobile phone or computer (Family View), keep the user connected to Facebook, MySpace and Twitter, plus the latest in news, sports, and entertainment (AT&T Social Net), and others.[118] AT&T has supported the development of (and distributes from its MediaMall applications store) myriad other applications, such as Where (uses location data to find places, things to do, and local information), AllSport GPS (turns phone into a GPS trainer for biking, running, walking and

[117] Faulhaber & Farber, at 26 ("If ever a policy was designed to increase costs, reduce customer choice, reduce incentives to innovate and reduce incentives for carriers to innovate, this would be it."). *See also* Katz Paper ¶¶ 29-37.

[118] *See, e.g.*, AT&T MediaMall Website, http://mediamall.wireless.att.com/sf/storefront/endUserHTMLHome.jsp?pc=U&dc=.

other sports activities by tracking record time, speed, calories burned and distance traveled, elevation and more), mtoolbox (a calculator, stopwatch, dice, a timer, a task list, a flashlight, a counter, a world clock and converter), and many, many more, which are available on the iPhone and myriad other devices.[119]

AT&T Labs is also working on wireless applications that have the potential to revolutionize the telehealth and smart grid fields, among many others. Indeed, other wireless industry participants are "playing catch-up to AT&T, which has had health care as a focal point of wireless and other research at AT&T Labs."[120] One good example is the trial AT&T is currently conducting with Texas Tech University to test whether wireless devices can help to prevent older people from suffering falls (a common cause of serious injury or death among the elderly) by informing medical professionals in real time of potential problems. The technology includes, for example, special sensors built into the insoles of shoes that measure the person's gait and beam the information wirelessly to a gateway connected to a health care network. "AT&T's scientists are hoping that by catching changes in a patient's walking pattern, the software can alert doctors to a problem before they take a tumble."[121]

AT&T Labs is also leveraging its industry-leading speech recognition innovations to enable revolutionary wireless applications. One way AT&T has aided this process is its Watson speech mashups software – *i.e.*, AT&T has made its speech recognition software APIs available as a web service, so that applications developers can have access to speech processing

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[119] *Id.*

[120] *Telecom Giants Focus on Health Care Business Opportunity*, Telephony Online, August 31, 2009.

[121] *See*, *e.g.*, Damian Joseph, *Could AT&T Prevent Falls Among the Elderly?*, Business Week, May 14, 2009.

technology for the creation of applications.[122] This service provides network-hosted speech technologies for wireless broadband devices without the need to install, configure, and manage speech recognition software and equipment – which allows developers the freedom to design applications and services without the transaction costs of having to invest in licenses and hardware to advance and commercialize the technology developed by AT&T.[123]

In short, it is through carrier investments in basic wireless research, applied research to improve and optimize network efficiency and the customer experience, and particular edge devices and applications, that much of the wireless innovation consumers have come to enjoy is made possible. Carriers can continue to make those essential investments only if they are allowed to participate in – and profit from their participation in – all aspects of the wireless ecosystem.[124]

C. Collaboration, Vertical Arrangements and Experimentation.

It would be a fundamental mistake if the Commission were to think about innovation as solely or even primarily the product of individual efforts occurring at discrete "layers" of a "value chain."[125] Wireless networks today are dynamic and evolving, and customers today increasingly want a seamless and reliable experience. Because of these realities, much innovation, including many of the most important "edge" innovations, comes through

[122] AT&T has long been a leader in voice recognition capabilities, and it is continuing to make advances in that technology in the context of wireless services today. Indeed, AT&T is a leader in work to enhance the robustness of voice recognition under the sort of magnified noise conditions common to the mobile wireless world (in which the device can be used anywhere, including crowded areas with lots of background noise, and in which the user may not hold the device directly to his mouth). *See, e.g.*, Discover Magazine, *Think Tech Want an Easy Way to Control Your Gadgets? Talk to Them*, Nov. 2008, http://discovermagazine.com/2008/nov/17-talk-to-your-gadgets.

[123] *See, e.g.*, http://www.research.att.com/viewProject.cfm?prjID=355.

[124] Katz Paper ¶¶ 29-37.

[125] *See* Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 43-46.

collaborative efforts of companies that operate primarily in different layers.[126] In an industry in which carriers have voluntarily chosen not to vertically integrate with manufacturers, *ad hoc* contractual arrangements have become a common method of working together to innovate in ways that optimize the experience for the customer and to share in the risks and potential rewards of those innovations. Individualized vertical arrangements in the wireless industry provide a wide array of efficiencies.[127] Integration can make network management more efficient, can facilitate development of complementary services through risk-sharing and collaborative innovation, can more efficiently coordinate the customer's experience of the combined complementary inputs, and the fact that different collaborations may take different approaches to solve similar problems further enhances the potential for innovation.[128] Indeed, wireless competition is increasingly evolving, and vertical collaborations are catalysts for evolutionary adaptation.[129]

[126] *See* Faulhaber & Farber, at 12 ("Innovations in devices depend crucially upon innovations in core networks, and innovations in applications depend crucially upon innovations in devices and core networks. And the applications that customers demand drive innovations in all three segments. Customers demand access to the Internet and other data services, so Internet applications are developed, devices become Internet-enabled, and core networks ensure that capacity is available for high-speed data through spectral efficiency innovation. All of this innovation is driven by customer demand; it is *customer-centric innovation.* To achieve this, cooperation and collaboration is required among all three segments."); Katz Paper ¶ 43 ("[T]here is a need for coordination among component suppliers to ensure that the different complementary components of the system can, in fact, work together. The need for coordination applies on a forward-looking basis as well: in many cases, innovation or investment in one component may create consumer value only if there is also complementary innovation or investment in other components.").

[127] Katz Paper ¶¶ 47-53.

[128] *See, e.g.*, Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 43-53.

[129] *See, e.g.*, Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 43-46.

These vertical collaborations take many forms, and, as prime drivers of investment, innovation and competition, they produce enormous customer benefits.[130] Carriers have entered various coordinating arrangements with device manufacturers, and the combined offerings compete vigorously against one another. As the iPhone illustrates, these collaborative arrangements have produced disruptive innovations that serve as a catalyst for competitive responses based on similar vertical integration arrangements.[131] At the device level, device manufacturers such as RIM (Blackberry), Amazon (Kindle) and other competitors integrate operating systems and devices, often in conjunction with further vertical arrangements to secure carriage, and through this vertical integration provide compelling new wireless products and set off new rounds of innovative responses.

Indeed, vertical arrangements are often the key ingredient to setting off these innovations.[132] As carriers upgrade their networks, it is critical to them that there are devices that can take advantage of the improved capabilities of the networks. *See* Katz Paper ¶43 ("in many cases, innovation or investment in one component may create consumer value only if there is also complementary innovation or investment in other components"); Faulhaber & Farber, at 13 ("Manufacturers of handsets and carriers must work closely to ensure that the phones and the networks function as they must to maintain quality transmission and use the spectrum efficiently.") Through vertical arrangements, carriers can provide significant incentives for

[130] *See, e.g.*, Faulhaber & Farber, at 12-19; Katz Paper ¶¶ 43-53.

[131] *See* Faulhaber & Farber, at 8, 18-19, 25; Katz Paper, at 14-22, 40, 68.

[132] Katz Paper ¶ 45 ("Because the supplier of any one component tends to ignore the benefits that it creates for complementary component suppliers, there tends to be underinvestment." Vertical arrangements can address this issue.); *id.* ¶ 44 ("in a market subject to rapid technological change and innovation, the suppliers of different components may need to communicate constantly as their products advance. In such markets, formal standard setting may not be a sufficient form of communication to keep up with market developments").

devices manufactures to develop devices for the improved networks. Such vertical collaborations were instrumental, for example, in ensuring wide availability of laptops, netbooks and other devices that could take advantage of capabilities of AT&T's HSPA networks.

Device manufacturers and carriers each also work with applications developers, by providing design kits and creating "app stores." AT&T alone offers many resources for prospective applications designers, with its devCentral program that makes AT&T's Universal Design guidelines and many other resources available to developers to help them design applications,[133] and its innovative new program "AT&T Apps Beta," a special program that allows developers to test applications with customers and receive customer feedback during the development process.[134]

As the capabilities of wireless services has continued to expand, so too has the scope of vertical collaborative efforts. AT&T is a member of the Continua Health Alliance, which is a "a non-profit, open industry coalition of the finest healthcare and technology companies joining together in collaboration to improve the quality of personal healthcare,"[135] and, as discussed below (Part II.D), AT&T has separately partnered with device manufacturers to develop wireless devices and services that can improve the cost and quality of healthcare. As also discussed below, AT&T is collaborating with others to develop smart grid devices and applications makers

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[133] *See* http://devloper.att.com/devloper/?_requestid=126958; *see also* http://choice.att.com/developers/GettingStarted.aspx; http://choice.att.com/developers/CreateIt.aspx ("Whether you are building a mobile web site or a downloadable application or even an application for the device's native operating system, we provide you with the tools and resources to help. In addition to the usual tools like SDKs, emulators, and custom APIs, AT&T offers dev support in the form of expert tutorials, web boards, webcasts and podcasts").

[134] *See* http://appsbeta.wireless.att.com/login?id=choiceconsumer.

[135] Continua Health Alliance Web Site, http://www.continuaalliance.org/about-the-alliance.html.

to enable utilities and consumers to more efficiently manage power usage using wireless technology.

AT&T has partnered with automobile manufacturers, insurance companies, satellite companies, consumer electronics companies, GPS companies, security companies, and many others to collaborate on innovative new devices for consumers and businesses. For example, AT&T has partnered with an automobile company to provide car diagnostic repair and assistance anytime/anywhere, and to provide emergency service assistance. AT&T is collaborating with GPS device makers and applications developers to provide innovative tele-navigation services to businesses and consumers. As one example, AT&T and Xora Inc. are collaborating to "provide a GPS Locator application that will provide small and medium-sized businesses with real-time visibility into the location of their mobile workforce," to help "customers improve the productivity and accountability of field-based employees, as well as lower expenses related to overtime and fuel costs."[136] And, AT&T has teamed up with Garmin to provide the wireless network connection for Garmin's nüvi 1690, a portable navigation device with a built-in wireless module[137] that, using AT&T's wireless network, will "provide customers mobile access to Google Local search and up-to-date local information, including traffic, weather, fuel prices, movie listings, flight status, local events, and white page telephone listings."[138]

AT&T also recently announced a strategic arrangement with Vlingo to integrate AT&T's Watson speech-recognition technology into a broad variety of mobile devices. Vlingo will use

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[136] Press Release, AT&T, *AT&T to Offer Xora GPS Locator Phone Tracking Solution for Small and Medium-Size Businesses*, July 7, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26914.

[137] Press Release, AT&T, *Garmin nuvi 1690 and nuLink! to Connect Drivers to Real Time Data through AT&T Wireless Network*, Sept. 17, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27141.

[138] *Id.*

AT&T technology in its various speech-driving apps, which "are currently available for the iPhone, BlackBerry, Symbian, and Windows Mobile smartphones," to "enable users to send text messages and e-mails, make calls, record to-do list, browse the Web, and interact with social networks like Twitter and Facebook."[139] In addition, AT&T is working with CDW to develop and distribute netbooks for small business customers that "feature[] AT&T's embedded wireless technology."[140] Under this arrangement, purchasers will obtain access to AT&T's ubiquitous 3G network and the tens of thousands of AT&T hotspots worldwide.[141] This offering allows customers to avoid the cost and hassle of using separate suppliers, and instead allows them to purchase an all-in-one solution.[142]

AT&T and other carriers have also entered into innovative collaborations with Qualcomm to provide high quality video streaming to consumers over a network optimized for

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[139] *See, e.g.*, Marin Perz, *AT&T, Vlingo Team For Voice Apps*, InformationWeek, Sept. 16, 2009. As explained by Vlingo's CEO, "Natural and unconstrained voice recognition user interfaces represent the next major breakthrough for the mobile industry as well as many other industries" and "[b]ased on our evaluation, we have seen significant accuracy and performances gains with Watson compared to other core speech technologies that will allow us to create a dramatically improved user experience." *Id. See also* FierceWireless, *AT&T and Vlingo to Bring Innovative Speech Recognition to Mobile Devices Worldwide*, Sep. 16, 2009, http://www.fiercewireless.com/press-releases/t-and-vlingo-bring-innovative-speech-recognition-mobile-devices-worldwide ("A leader in speech technology for decades, AT&T is a pioneer in voice-enabled services and has developed hundreds of voice applications deployed throughout our advanced telecommunications network. AT&T's Watson speech recognition technology includes the latest advances and innovations in the field of speech and language processing with a rich set of tools for custom development and adaptation of acoustic and language models. In addition to Watson, AT&T's suite of speech technologies also includes AT&T Natural Voices, an award-winning text-to-speech product that converts text into voice for a wide variety of applications.").

[140] Press Release, AT&T, *AT&T Unveils Embedded Netbook and Laptop Offers Targeted at Small Businesses*, July 1, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26902.

[141] *Id.*

[142] *Id.*

those services.[143] Qualcomm purchased spectrum that it dedicates in part to providing video (such as major league baseball video streams), and creative arrangements with Qualcom's MediaFlo subsidiary (and with handset suppliers that have agreed to include the additional chipsets and radios necessary to enable the MediaFlo services) have allowed AT&T and other mobile carriers to provide attractive video services that do not create congestion on their core networks.[144]

D. Machine-to-Machine: The Next Innovation Frontier.

As the discussion above makes clear, AT&T and other carriers are increasingly looking for new and innovative ways to tap into the potential of wireless connectivity, and they are collaborating with consumer electronics makers and industrial manufacturers to create entirely new kinds of wireless devices and services. Indeed, we are fast approaching the day when it will be commonplace for consumer electronics devices and industrial devices to be wireless enabled.

The possibilities for consumer "embedded" wireless devices are endless: e-readers, navigation devices, wireless tracking devices, and gaming devices are just some of the products recently announced or already on the market, and some analysts have predicted that 95 million such devices may be sold in the U.S. by 2013.[145] The possibilities for industrial machine-to-

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[143] Press Release, AT&T, *AT&T to Deliver MediaFLO USA's FLO TV Service in 58 Markets on New AT&T-Exclusive Handsets Designed for Mobile TV Viewing; AT&T Introduces CNN Mobile Live, PIX and CNCRT, a Special Concert Channel*, May 1, 2008, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=25610.

[144] Gigacom, Mobilize: *Qualcomm's Future in a Post-3G World*, Sep. 10, 2009 ("Qualcomm has built a broadcast network (sending data from one to many, instead of one to one) based on its MediaFLO wireless technology, and it currently is working with carriers to offer mobile TV broadcast services. If there's anything that can overload 3G networks, it's cell phone users watching hours and hours of mobile video.").

[145] *Report: 95M M2M modules shipped by 2013*, RCR Wireless, Jan. 9, 2009, http://www.rcrwireless.com/article/20090109/WIRELESS/901089997/report-95m-m2m-modules-shipped-by-2013.

machine devices are just as endless: remote metering devices for electric utilities; in-car automotive diagnostic devices; dual mode GPS/mobile wireless devices in trucks, containers and rental cars; active monitoring of alarm systems; remote monitoring of manufacturing equipment, cash registers, and vending machines; the list goes on and on. The opportunities for innovation here are especially broad, because these types of devices often do not require 4G or even 3G speeds.

AT&T is playing a very active role in developing many of these types of machine-to-machine innovations. AT&T has already certified hundreds of devices for use on its network.[146] And, AT&T just announced the establishment of a new lab designed specifically to test and certify embedded wireless and machine-to-machine devices for use on AT&T's network.[147] These devices are used in a wide range and ever growing number of industries, including consumer products (*e.g.*, GPS devices, cameras, music/video players, TVs), automotive (*e.g.*, in-car diagnostics, repair assistance, pay-as-you-go insurance), industrial automation (*e.g.*, remote monitoring of manufacturing equipment, environmental monitoring), payments and point of sales (*e.g.*, remote monitoring of cash registers and vending machines), utilities (e.g., remote metering, measuring of pollution and weather), transportation logistics (*e.g.*, tracking automotive fleets, containers, locate stolen assets), security (*e.g.*, active alarm monitoring, backup to wireline

[146] A list of certified devices is available at http://developer.att.com/developer/device_list.jsp?_DARGS=/developer/device_list.jsp.; *see also* Press Release, AT&T, *AT&T Launches Dedicated Certification Lab for Emerging Devices, Reinforces 'Open Innovation' Leadership*, Sept. 2, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27080 ("Last year alone, AT&T certified 355 non-stock wireless units, including devices, modules, and maintenance releases").

[147] Press Release, AT&T, *AT&T Launches Dedicated Certification Lab for Emerging Devices, Reinforces "Open Innovation" Leadership*, Sept. 2, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27080.

connections), and healthcare (*e.g.*, advanced diagnostics and tracking of hospital personnel and equipment).

Machine-to-machine innovation in telehealth industry hold particular promise. AT&T is working with manufacturers to continue to develop devices that remotely monitor a patient's medical information and wirelessly transmit the information to doctors – *e.g.*, in ambulances on the way to an emergency room, or for elderly patients at home (which can both reduce doctor visits and also alert doctors to problems in real time).[148] These "devices can measure, for example, temperature, weight, pulse rate, blood oxygen level, blood-pressure, and blood glucose," and an even "wider variety of instruments are now approaching certification [by AT&T] for use."[149]

Another example is "smart grid" technology. "For utility companies, smart metering apps probably present the biggest potential as smart grids could be used to control and monitor energy consumption in order to help customers save energy."[150] "A new suite of services by

[148] Tim McKeough, *AT&T's Telehealth Wirelessly Monitors Patients' Health*, Fast Company, Jan. 15, 2009 ("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."); Alexander H. Vo, *The Telehealth Promise, Better Health Care and Cost Savings for the 21st Century*, AT&T Center for Telehealth Research and Policy Electronic Health Network University of Texas Medical Branch Galveston, Texas, at 1, May 2008 ("With telemedicine, physicians at remote hospitals can link to distant specialists for real-time guidance in emergency situations to save lives without the delay of long ambulance rides while a patient deteriorates. Difficult transfers of patients to doctors' offices from nursing homes, between emergency rooms, or from institutions such as prisons to medical care providers can be substantially reduced by resorting to online communications. Expectant mothers living long distances from medical care providers can receive quality prenatal care through online consultations and remote monitoring. Individuals with chronic illnesses or those recently released from hospital care can take advantage of remote monitoring programs to go about their daily routine with confidence that potentially worrisome changes in vital signs will be instantly communicated to care givers.").

[149] Robert Miller, *The Role of Telehealth Remote Monitoring in Healthcare Reform*, AT&T Labs, Feb. 12, 2009, http://www.research.att.com/viewTechView.cfm?id=1.

[150] *See, e.g.*, *Smart grids: The next wireless goldmine?*, FierceWireless, May 15, 2009, http://www.fiercebroadbandwireless.com/story/smart-grids-next-wireless-goldmine/2009-05-15.

AT&T, designed for SmartSynch's grid solutions, will enable machine to machine communication and create a cheap way for utilities to hook up with smart grid technology" by allowing each meter to "communicate with the utility via the AT&T wireless network."[151] AT&T is working with partners throughout the smart grid value chain jointly to provision and market to utility companies smart grid sensor devices that are certified on AT&T's wireless data network. These arrangements will allow utilities to "receive real-time system performance data to efficiently operate their electric grids, reduce the need for on-site inspections, and identify and solve problems that could cause outages or increase system energy losses."[152]

AT&T is also developing innovative machine-to-machine devices and applications to protect against unauthorized entry into manholes, which is a significant national security issue.[153] As explained in the Homeland Security News Letter, a recent unauthorized entry into a manhole and vandalism "crippled" the telecommunications facilities in "parts of three counties," and resulted in outages for "public safety crews that rely on 911 calls, hospitals trying to access medical records, and people who wanted to make a landline or cell phone call, use an ATM or make a purchase with a credit card."[154] AT&T's innovative machine-to-machine technologies

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[151] *See, e.g.*, Jaymi Heimbuch, *AT&T Offering Wireless Network as Smart Grid Solution*, Treehugger, March 18, 2009 ("A new suite of services by AT&T, designed for SmartSynch's grid solutions, will enable machine to machine communication and create a cheap way for utilities to hook up with smart grid technology. With this package, each meter will communicate with the utility via the AT&T wireless network."); *AT&T To Offer Wireless Smart Grid Technology To Utility Companies*, Reuters, March 17, 2009.

[152] AT&T, Press Release, *AT&T and Cooper Power Systems to Offer Wireless Smart Grid Sensors*, June 24, 2009, http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26874.

[153] *See AT&T Increases Reward In Cable Vandalism To $250,000*, Homeland Security Newswire, April 14, 2009, http://homelandsecuritynewswire.com/single.php?id=7775.

[154] *Id.*

will allow AT&T to better monitor breaches in manhole security and more quickly alert authorities to unauthorized access or sabotage.

The development of machine-to-machine wireless uses is necessarily an extraordinarily complex and highly collaborative process. Customers obviously do not want to buy their own chipsets, figure out how to embed them in modules and the device they want to use, and then work around AT&T's existing back office systems to make the device work. AT&T takes care of all of this. AT&T works with chip and module manufactures to identify or develop appropriate chipsets, with device makers to develop a device that will be compatible with those chipsets and modules and with AT&T's wireless network, and with third party developers to create the necessary software applications (or, in some instances AT&T develops those applications on its own). AT&T then tests the products in its lab and develops the necessary back-office systems for provisioning, billing, and otherwise serving customers that seek to use that device. The result is a final end-to-end product that customers can purchase off the shelf.

In other cases, device manufactures or applications developers will approach AT&T to incorporate wireless technology into their device. In those cases, AT&T works closely to ensure that the product will work seamlessly with AT&T's network. For example, many of these products require innovative and non-traditional approaches to billing – *e.g.*, e-readers where it would be appropriate to bill lower rates for content downloaded during off-peak hours than during peak ours – and AT&T frequently customizes its systems to facilitate such offers. Purchasers of consumer electronics also have established expectations about activation right out of the box, and AT&T must develop new provisioning systems to "wake up" a device according to the specific needs and expectations relating to it. Indeed, because of its expertise in wireless

technology and product design, AT&T often provides advice on how to design the device to best incorporate wireless communications capabilities.

Each consumer electronics or machine-to-machine device tends to be highly specialized, and the provision of these services often requires significant innovation even beyond the technical development and back-office billing innovations. For example, retail pricing is often a significant driver in these products, and AT&T works closely with device manufacturers and applications developers to create innovative terms of service to maintain the desired price and terms commensurate with intended use of the device or application. Some devices, for instance, use wireless services only at non-peak times, and AT&T works with such device makers to develop service terms and pricing schemes that reflects those demands. Other devices require only very low capacity communications, and AT&T works with these devices makers to develop pricing plans that reflect those lower demands on AT&T's network.

One prominent example is the Amazon Kindle (on Sprint's network). The Kindle is a device that runs on a wireless broadband Internet access connection (provided by Amazon as part of the one-time fee for the device).[155] The device is optimized to permit users to read books selected and wirelessly downloaded from Amazon's website. The Kindle, actually *could* be used to perform any Internet access function. Kindle's users, however, agree in Amazon's Terms of Service *not* to use the wireless connectivity for non-Amazon purposes (and Amazon reserves the right to charge fees or terminate the connectivity if these terms are breached).[156] In other words,

[155] *See, e.g.*, Johna Till Johnson, *What's an ISP? (That's Not a Trick Question)*, Network World, Nov. 24, 2008 ("*What's an ISP?*").

[156] *See* Amazon Kindle Terms of Service § 2 ("You agree you will use the wireless connectivity provided by Amazon only in connection with Services Amazon provides for the Device. You may not use the wireless connectivity for any other purpose"; "You may be charged a fee for wireless connectivity for your use of other wireless services on your Device, such as Web

Amazon has made market-driven trade-offs: the fact that there is no extra charge for connectivity goes hand-in-hand with the limitations on the Kindle's uses, and those limitations are part and parcel of the Kindle's unique value proposition.

In sum, the central role of carrier innovation, independently and through creative arrangements with others, reinforces the importance of the link between innovation and investment. At the most basic level, all the innovation in the wireless industry is the product of investment. None of these innovations could occur if carriers had not invested the hundreds of billions of dollars required to establish wireless networks that efficiently provide service within the allocated spectrum. In addition, the innovations that result in new or improved services, applications, or devices themselves all require additional incremental investments. Some of these investments are substantial: *e.g.*, those required to introduce the iPhone. Others are quite small: *e.g.*, those required to develop a new application on the platforms that have been established. Because all innovations require some incremental investments in support of approaches that may or may not succeed in the marketplace, all innovations entail risks. Accordingly, a central driver of innovation and investment in the wireless industry is that carriers, like others in the value chain, have the opportunity to capitalize on successful investments and earn rewards commensurate with the risks, and any sound innovation policy must preserve the incentives that come with that flexibility. Regulatory changes that limit flexibility or the rewards of risk-taking will inevitably slow the pace of innovation.[157]

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browsing and downloading of personal files, should you elect to use those services," and Amazon reserves the right to change those fees at any time).

[157] Katz Paper ¶¶ 29-37.

II. THE WIRELESS INDUSTRY'S EXTRAORDINARY RATE OF INNOVATION IS A DIRECT RESULT OF THE COMMISSION'S POLICIES CONCERNING SPECTRUM AND COMPETITIVE FLEXIBILITY.

Naturally, the Commission cannot simply mandate "innovation." The only thing the Commission can do is to establish a regulatory environment that is conducive to investment and innovation and that maximizes the chances that it will flourish.[158]

For the last two decades, the Commission has achieved a regulatory environment conducive to innovation by establishing four foundational, interrelated policies: (1) allocating enough spectrum to facilitate competition from multiple carriers and to support growth in usage and to facilitate the provision of advanced wireless services; (2) encouraging licensees to devote their spectrum to its highest valued uses; (3) protecting licensees' spectrum from interference; and (4) granting licensees flexibility to pursue the business models that they believe will be most effective in serving the diverse needs of customers over the limited spectrum.[159] These four

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[158] Katz Paper ¶ 6 ("it is vital that public policies create an economic environment in which firms have incentives to engage in investment and innovation that satisfy consumer demands"); *see also* Faulhaber & Farber, at 1-4; 18-20, 29.

[159] *See, e.g.*, First Report and Order and Further Notice of Proposed Rule Making, *Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services*, 11 FCC Rcd. 8965, ¶ 1 (1996) ("the public interest would be served by giving licensees maximum flexibility in the uses of CMRS spectrum. Allowing service providers to offer all types of fixed, mobile, and hybrid services will allow CMRS providers to better respond to market demand and increase competition in the provision of telecommunications services"); Gregory L. Rosston, Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 1997 FCC LEXIS 384, *58 (Jan. 1997) ("If spectrum users and their financial supporters are not reasonably certain of the rules that will govern spectrum use, they will be less willing to invest in obtaining and developing the spectrum. For example, entrepreneurs likely will bid and invest greater amounts in spectrum if they know in advance that the use will be flexible and are confident that it will remain that way. In the absence of such certainty, the spectrum may not be used to its full potential and the public may fail to realize its full value."). *See also* First Report And Order And Further Notice Of Proposed Rule Making, *Unlicensed Operation in the TV Broadcast Bands*, 21 FCC Rcd. 12266, ¶ 27 (2006) ("The licensed model is more efficient in many cases, and tends to work best when spectrum rights are (1) clearly defined, (2) exclusive, (3) flexible, and (4) transferable. When spectrum rights lack these attributes, potential licensees face uncertainty and may lack incentive to invest in a license or

policies, which have been followed consistently by both Democratic and Republican administrations, have now produced an incredible, two-decade track record of unmatched innovation.[160] As explained more fully below, they have been especially effective in enabling the wireless industry to respond to the marketplace as it has developed over the years through innovations that address both the increasingly varied preferences of consumers and the unique security and reliability demands of modern wireless networks. The Commission should retain and strengthen each of these foundational policies, by allocating and auctioning additional licensed mobile wireless spectrum, enforcing interference protections more vigorously, and pre-empting undue restrictions on the tower siting process.

A. The Four Foundational Commission Policies That Have Fostered Innovation.

The astounding degree of innovation that we see today in the wireless marketplace can be directly traced to four foundational Commission polices that work hand in hand. *First*, the Commission has repeatedly taken action over the last twenty years to make more licensed spectrum available for auction to commercial carriers.[161] The Commission has set aside enough

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offer service."); Second Report And Order And Memorandum Opinion And Order, *Unlicensed Operation in the TV Broadcast Bands*, 23 FCC Rcd. 16807, ¶ 46 (2008) ("a licensed model tends to work best when spectrum rights are clearly defined, exclusive, flexible and transferable. When spectrum rights lack these attributes, potential licensees face uncertainty and may lack incentives to invest in a license or offer service").

[160] Katz Paper ¶ 103 ("[T]he Commission's policies of licensing additional blocks of spectrum, allowing flexibility to licensees in terms of how the spectrum is used, and facilitating secondary markets to buy and sell spectrum licenses have been successful in promoting innovation and competition in the wireless industry over the past 25 years."); Hazlett Decl. ¶ 9 ("A pronounced regulatory shift has been a crucial element in the development of these valuable networks: U.S. regulators moved from traditional licenses that imposed technology, service, and business model mandates on licensees, to liberal licenses delegating such choices to competitive markets. These extend flexibility to licensees creating complex networks, configuring service menus, and experimenting with customized business models.").

[161] Thirteenth Report, *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*, 24 FCC Rcd. 6185, ¶ 65 (January 15, 2009) ("*Thirteenth Report*")

licensed spectrum to support multiple carriers throughout the nation, and the result is that the U.S. wireless marketplace has grown into the most competitive and least concentrated in the world.[162] This intense competitive rivalry forces all carriers to do their best to attract and retain customers, which in turn creates powerful incentives for each carrier to promote innovation at all levels of the wireless ecosystem to provide new and exciting devices and services to differentiate themselves from their competitors and obtain a return on their investments.[163] Indeed, much of the competition in today's mature wireless marketplace is the competition to innovate and to differentiate one's services from one's competitors.[164]

This competition to innovate will only intensify as carriers migrate from voice to data-based networks. Numerous carriers are in the process of upgrading to data- based 3G and 4G networks, with new announcements of additional upgrades seemingly coming every week.[165]

("the Commission has progressively increased the amount of spectrum available for the provision of CMRS. . . . [B]eginning in the mid-1990s, the allocation of 120 megahertz of spectrum to broadband PCS and the assignment of broadband PCS spectrum licenses through auction ended the cellular duopoly by facilitating the entry of new mobile telephone service providers. More recently, the auction of licenses for spectrum allocated to AWS in 2006 raised the total amount of spectrum made available for CMRS by an additional 90 megahertz, and the auction of 700 MHz band licenses in 2008 added another 62 megahertz to the amount of spectrum made available for CMRS. Moreover, the current transition of the BRS/EBS spectrum band has further increased the amount of spectrum available for CMRS.").

[162] *See*, *e.g.*, CTIA, *The United States and World Wireless Markets*, at 6, 11 (attached to Letter from CTIA to FCC, RM-11361, May 12, 2009) ("*CTIA Study*") (the United States wireless marketplace is the least concentrated of the 26 OECD countries tracked by Merrill Lynch); *see also* Faulhaber & Farber, at 15-18; Katz Paper ¶¶ 63-67.

[163] Faulhaber & Farber, at 16-20; Katz Paper ¶¶ 68-73.

[164] Faulhaber & Farber, at 15-20; Katz Paper ¶¶ 61-74.

[165] In addition to AT&T, Verizon, Sprint and T-Mobile, other carriers that are upgrading (or that have already upgraded) to 3G and 4G networks include, ACS, Alaska DigiTel, BendBroadband, Bluegrass Cellular, Cellular South, Cellular South, Clearwire, Cricket, MetroPCS, Mobi PCS, Mosaic Mobile, Nex-Tech, Ntelos, Silver Star Communications, Stelera Wireless, U.S. Cellular. *See*, *e.g.*, http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=66; http://www.acsalaska.com/corporate/index.asp; http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=228;

Already, "more than 90% of American live in areas with more than four 3G wireless broadband service providers."[166] These new networks facilitate a much broader range of applications, services, and devices, which can only fuel competition by dramatically increasing the opportunities for carriers to differentiate themselves through innovation in an increasing number of ways, including by specializing in innovative voice services, video service, location-based

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http://www.akdigitel.com/catalog/newsdesk_info.php?newsPath=2&newsdesk_id=19; http://www.gsmworld.com/roaming/gsminfo/net_usbc.shtml;

http://www.bendbroadband.com/residential/wl_index.asp?adct=2; http://www.bendbroadband.com/press/BendBroadband%20Wireless%20Announcment%20--%207-31-09.pdf; http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=283; http://www.bluegrasscellular.com/network/nationwide_3g_ev_do; http://www.bluegrasscellular.com/about/history; https://www.cellularsouth.com/networks/; https://www.cellularsouth.com/news/2009/20090310.html; http://newsroom.clearwire.com/phoenix.zhtml?c=214419&p=irol-overview; http://newsroom.clearwire.com/phoenix.zhtml?c=214419&p=irol-newsArticle&ID=1326282&highlight=; http://phx.corporate-ir.net/phoenix.zhtml?c=191722&p=irol-newsArticle&ID=1324425&highlight=; http://gigaom.com/2009/03/04/the-gigaom-interview-tom-keys-metropcs/; http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MzMyNDM4fENoaWxkSUQ9MzE0NzYwfFR5cGU9MQ==&t=1; http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=441; http://www.mobipcs.com/releases/20081203.php; http://www.gsmworld.com/roaming/gsminfo/net_usc1.shtml; http://www.mosaictelecom.net/Cellular/index.html; http://www.mosaictelecom.net/Newsletters/Newsletters/nlmay09.pdf; http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=281; http://www.nex-techwireless.com/news.aspx; http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=63; http://nteloswireless.com/mobilebroadband/;http://www.cdg.org/technology/product_pavilion/operator_detail.asp?operatorid=495; http://www.silverstar.com/~/link.aspx?_id=84FF37BC1D15461BB42E822F1EECD2C3&_z=z; http://www.gsmworld.com/roaming/gsminfo/net_uss2.shtml; http://dev.stelerawireless.com/Portals/0/docs/2.08.08%20Stelera%20Wireless%20Launches%20Inaugural%20Wireless%20Network,%20Providing%20High%20Speed%20INternet%20in%20Rural%20America.pdf; http://dev.stelerawireless.com/Portals/0/docs/3.12.08,%20Stelera%20Receives%20$35M.pdf; http://www.uscc.com/uscellular/SilverStream/Pages/x_page.html?p=3G.

[166] Reply Comments of CTIA – The Wireless Association, *National Broadband Plan for Our Future*, GN Docket No. 09-51, at 2 (filed July 21, 2009).

service, netbook service, Internet service, virtual private networks ("VPNs"), or some combination of the myriad options that will be available on these new networks.

Second, the Commission generally has not tried to restrict or dictate the uses to which the spectrum would be put, but instead has ensured that it would be put to its highest valued uses by auctioning the spectrum and permitting secondary market transactions, without any further restrictions unrelated to interference.[167] The Commission properly understood that competition would be the best driver of innovative and high quality services.[168] Accordingly, it auctioned the spectrum to the highest bidders, and allowed the licensees to judge, based on changing market conditions, what services would best serve customers.[169] The fact that the licenses were

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[167] *Notice* ¶ 22 ("many licenses are granted through competitive bidding at auctions, in part to enhance the likelihood that the spectrum will be put to its highest-value use"); Report and Order and Further Notice of Proposed Rulemaking, *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, 22 FCC Rcd. 8064, ¶ 235 (2007) ("Congress and the Commission have determined that using competitive bidding mechanisms for assigning spectrum licenses offers significant public interest benefits. For example, the competitive bidding process ensures that spectrum licenses are assigned to those who place the highest value on the resource and will be suited to put the licenses to their most efficient use."); Policy Statement, *Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets*, 15 FCC Rcd. 24178, ¶ 9 (2000) ("an active secondary market will facilitate full utilization of spectrum by the highest value end users"); Report, *Bringing Broadband To Rural America: Report On A Rural Broadband Strategy*, 2009 WL 1480862, ¶ 146 (2009) ("The Commission's rules permit licensees to transfer their licenses, or partition or disaggregate their licenses, in the secondary market with Commission approval. The Commission's secondary markets rules also provide flexibility to a wide array of wireless licensees, including broadband providers, to enter into spectrum leasing arrangements with other providers that seek access to spectrum in rural areas.").

[168] *See*, *e.g.*, First Report and Order and Further Notice of Proposed Rule Making, *Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services*, 11 FCC Rcd. 8965, ¶ 19 (1996) ("If we were to restrict fixed service to certain configurations . . . carriers might be reluctant to pursue some potentially efficient options out of concern that they would be considered to fall outside the definition of our prescribed service definition. Rather than limit the flexibility of carriers in this manner, we prefer to encourage innovation and experimentation through a broader, more flexible standard."). *See also* Faulhaber & Farber, at 15-20; Katz Paper ¶¶ 61-74.

[169] *See* Hazlett Decl. ¶ 15; Faulhaber, Hahn, & Singer, *Should the FCC Depart From More Than A Decade Of Market-Oriented Spectrum Policy? Reply To Skryzypacx and Wilson*, at 3, June

auctioned at considerable cost also gives the winners powerful incentives to find the most highly valued uses, which in turn creates powerful incentives to pursue innovations that can help them to distinguish themselves from their competitors.[170]

The Commission has also encouraged secondary market transactions, which allow additional parties to make use of the spectrum where the licensees have gaps in their own needs. Existing licensees have made enormous investments in their spectrum licenses, and thus have ample incentive to lease or sell spectrum to others where it would be worth more than the uses to which the licensee itself can put the spectrum.[171] The existence of active secondary markets thus provides significant additional opportunities to bring innovations to the marketplace and the licensed CMRS bands are in fact the most intensively shared spectrum bands of all.[172]

2007 ("Since embracing auctions in the early 1990s, the [FCC] has consistently embraced a market-oriented spectrum policy that sough to maximize participation in spectrum auctions and allowed winning bidders to develop business models of their own choosing. The result has been nothing short of spectacular: wireless competition has thrived, as multiple carriers with differentiated products compete aggressively for customers").

[170] Second Report And Order, Order On Reconsideration, And Fifth Notice Of Proposed Rulemaking, *Rulemaking To Amend Parts 1, 2, 21, and 25 Of the Commission's Rules to Redesignate The 27.5-29.5 GHz Frequency Band, To Reallocate the 29.5-30.0 GHz Frequency Band, To Establish Rules and Policies for Local Multipoint Distribution Service And for Fixed Satellite Services Petitions for Reconsideration of the Denial of Applications for Waiver of the Commission's Common Carrier Point-to-Point Microwave Radio Service Rules*, 12 FCC Rcd. 12545, ¶ 309 (1997) ("Carriers who have invested in their acquisition of LMDS licenses have an incentive to utilize the spectrum in the manner that best ensures a return on their investment, and a component of this utilization is likely to involve the licensees' pursuit of spectral efficiencies"); *Notice* ¶ 21 ("One way that the Commission has increasingly sought to encourage innovation is by allocating the spectrum flexibly so that it can be used in a variety of ways.").

[171] Report, Spectrum Policy Task Force, Federal Communications Commission, ET Docket No. 02-135, at 21 (Nov. 2002) ("Spectrum Policy Task Force Report") ("Flexibility provides incentives for economically efficient use and discourages economically inefficient use by ensuring that spectrum users will face the opportunity cost of their spectrum use. In most instances, the application of flexible service rules and efficient secondary market mechanisms are the best means of achieving this goal.").

[172] *See, e.g.*, Faulhaber & Farber, at 20-22; Katz Paper ¶¶ 97-98; Hazlett Decl. ¶ 39; Spectrum Policy Task Force Report, at 57 ("The Task Force does not agree with commenters that contend

Third, the Commission established strong rules to protect licensees from interference from non-licensed uses. As the Commission understood, licensees would have significantly reduced incentives to invest fully in innovation if the fruits of those investments could be diminished by interference that degrades the quality of the resulting services.[173] Mobile wireless uses represent some of the very highest valued uses of the spectrum (and 270 million subscribers in the U.S. depend on it), and the Commission has properly adopted rules that, if enforced, help to avoid the risk that the quality and reliability of those services – and the incentives to make long-term investments in the facilities needed to provide these services – could be degraded by permitting increased unlicensed uses of that spectrum.[174]

Fourth, the Commission generally has allowed licensees to fashion their own business models and practices.[175] Wireless carriers have been classified as nondominant and freed from price regulation and most other common carrier regulation since 1994.[176] The result has been that wireless carriers generally have been free to *experiment* with different marketplace

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that making an exclusive licensee the access 'gatekeeper' (*i.e.*, requiring potential spectrum users to obtain licensee consent) will inhibit access by new technology. . . . If the rights afforded to licensees are sufficiently well-defined and flexible, and the secondary market mechanism is fast and efficient with low transaction costs, licensees will have ample incentive to negotiate with potential secondary users for such access").

[173] *See*, *e.g.*, Spectrum Policy Task Force Report, at 25 ("without adequate interference management, new spectrum-based services could be prematurely thwarted and, correspondingly, mature services might not be able to reach their full potential").

[174] *See*, *e.g.*, Faulhaber & Farber, at 20-22; Katz Paper ¶¶ 97-98.

[175] *Notice* ¶ 22 ("Today a variety of licensing approaches are used that are often intended to encourage competition among service providers and allow flexibility in the kinds of services that are offered."); Report, *Bringing Broadband To Rural America: Report On A Rural Broadband Strategy*, 2009 FCC LEXIS 2637, ¶ 146 (2009) ("the Commission has provided wireless licensees with the flexibility to deploy the technologies and services that best fit their business plan and meet the needs of consumers.").

[176] Second Report and Order, *Implementation of Sections 3(n) and 332 of the Communications Act Regulatory Treatment of Mobile Services*, 9 FCC Rcd. 1411 (1994).

approaches and test different ways of offering value to consumers.[177] As shown above, this experimentation in the mobile marketplace has resulted in countless pricing plans (including dozens of post-paid plans and pay-as-you-go plans), free calling provisions (*e.g.*, nights and weekends, mobile-to-mobile, A-list), various texting plans (*e.g.*, pay-as-you go, unlimited, fixed number), and numerous data, Internet and email plans. It has also produced literally hundreds of handsets to meet just about any consumer demand. Experimentation is the foundation of all beneficial innovation, and the Commission's approach has allowed a wide array of innovations to reach the marketplace through a variety of marketplace business models that are being offered by both the largest nationwide carriers and the smaller regional and local carriers.[178]

B. These Foundational Policies Are Especially Well-Adapted To the Realities of The Modern Wireless Marketplace.

There can be no serious dispute that these four Commission policies, working in tandem, have been an enormous success: by any possible measure the U.S. wireless marketplace is one

[177] *Notice* ¶ 22 ("Today a variety of licensing approaches are used that are often intended to encourage competition among service providers and allow flexibility in the kinds of services that are offered.").

[178] *See, e.g.*, First Report and Order and Further Notice of Proposed Rule Making, *Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services*, 11 FCC Rcd. 8965, ¶ 1 (1996) ("Allowing service providers to offer all types of fixed, mobile, and hybrid services will allow CMRS providers to better respond to market demand and increase competition in the provision of telecommunications services."); *id.* ("In light of the dynamic, evolving nature of the wireless industry, we are concerned that regulatory restrictions on use of the spectrum could impede carriers from anticipating what services customers most need, and could result in inefficient spectrum use and reduced technological innovation."); Spectrum Policy Task Force Report, at 16 ("As a general proposition, flexibility in spectrum regulation is critical to improving access to spectrum. . . . Flexibility enables spectrum users to make fundamental choices about how they will use spectrum (including whether to use it or transfer their usage rights to others), taking into account market factors such as consumer demand, availability of technology, and competition. By leaving these choices to the spectrum user, this approach tends to lead to efficient and highly-valued spectrum uses"). *See also* Faulhaber & Farber, at 15-20, 27; Katz Paper ¶¶ 6-23; Hazlett Decl. ¶ 15.

of the most dynamically innovative in the world.[179] The extraordinary degree of innovation occurring today in the wireless marketplace, however, stems not just from the fact that the Commission has established the correct regulatory framework for encouraging innovation, but from the fact that these policies fit especially well with the way in which the wireless marketplace itself as evolved over the years. As the capabilities that wireless services can offer continue to increase exponentially, both the multiplicity of consumer desires and the demands on a scarce resource have increased exponentially with them, and therefore a renewed commitment to the flexibility and relative certainty of the Commission's policies will be necessary in the coming years if the current pace of innovation is to continue.[180]

It has long been recognized in the economic literature that "[w]hen technology is in flux, businesses must adapt to remain innovative and to deploy efficiently new and improved technologies. This process of adaptation is critical to the operation of a market economy, and ultimately is driven by competitive forces. During such times of change, the need to reallocate and recombine existing assets is especially important. For these fundamental reasons, we have been seeing . . . a veritable explosion of all manner of business collaboration during the past five to ten years."[181] In the specific context of spectrum, economists have "applaud[ed] the important steps the Commission has taken toward flexible spectrum allocations" and have explained that "[m]ore flexible use of spectrum will unleash large efficiencies in spectrum management."[182]

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[179] Faulhaber & Farber, at 4-12; Katz Paper ¶¶ 12-23, 102.

[180] Faulhaber & Farber, at 19-20, 27; Katz Paper ¶¶ 38-61, 102.

[181] Carl Shapiro, *Competition Policy and Innovation*, STI Working Papers 2002/11 (2002).

[182] Gregory L. Rosston and Thomas W. Hazlett, *Comments of 37 Concerned Economists*, WT Docket No. 00-230, at 1 (Feb. 7, 2001).

The Commission's flexible policies for wireless have allowed carriers to recognize and respond competitively to the fact that there is a wide diversity in customer preferences.[183] In contrast to the wireline world, in which customers must assemble their own experience from generic, separately obtained CPE, connections, applications, and security protections, many wireless customers *prefer* a more integrated, managed experience that provides greater ease of use, security, and quality of service.[184] Two good examples of these varying approaches are the Apple iPhone, which offers a more protected environment in which applications have been screened in advance, optimized for the device, and tested to ensure no adverse effects on security, quality of service, or the consistent "look and feel" of the user interface, and the Google/Android model, which offers a more wireline-type of experience that places more of the burden of security, quality, and reliability on the customer. Neither business model is a free-for-all, because both filter the applications they make available (Apple pre-screens, and Google post-screens applications),[185] but their different approaches represent significant choice for consumers.[186]

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[183] *See* Faulhaber & Farber, at 15-20; Katz Paper ¶¶ 62-73, 102.

[184] *See* Faulhaber & Farber, at 13-14, 24-25, 27; Hazlett Decl. ¶¶ 19-20; *see also Android vs. iPhone: Why Openness May Not Be Best*, Gigacom, Feb. 22, 2009, http://gigaom.com/2009/02/22/is-being-"open"-an-absolute-in-mobile/ ("The reality is that openness is just an attribute – it's not an outcome, and customers buy outcomes. They want the entire solution and they want it to work predictability. Only a tiny minority actually cares about how or why it works. It's little wonder, then, that the two device families that have won the hearts, minds and pocketbooks of consumers, developers and service providers alike (*i.e.*, BlackBerry and iPhone) are the most deeply integrated from a hardware, software and service layer perspective.").

[185] For example, Google's Android content policy states that "Developers should not upload or otherwise make available applications or any other materials that display (via text, images, video or other media) or link to: illegal content; invasions of personal privacy or violations of the right of publicity; content that interferes with the functioning of any services of other parties; promotions of hate or incitement of violence; violations of intellectual property rights, including patent, copyright (*see* Google's DMCA Policy), trademark, trade secret, or other proprietary right of any party; any material not suitable for persons under 18; pornography, obscenity, nudity or

Until now, the Commission has wisely refrained from trying to force all consumers into one model, and in particular attempting to force all consumers into extreme "any application on any device" types of models. In the wireless world, licensees have had the freedom to experiment and explore various business models, and many wireless consumers have gratefully flocked to more managed, protected, and easier to use environments (even as others prefer other approaches).[187] This customer choice is a *good* thing and promotes innovation: it is indisputable that many of the most celebrated innovations in recent years (such as app stores) have gained wide marketplace acceptance via these more managed and protected environments, rather than through models emphasizing extreme customization, and the Commission should preserve the flexibility in its policies that allow a plethora of models to compete in the marketplace.[188]

Moreover, the Commission's policies recognize that, as explained above, much innovation in the wireless industry requires collaboration at different "layers" of the ecosystem. The Commission's policies have appropriately placed no restrictions on vertical relationships. The rules grant carriers, equipment vendors, device makers, and apps developers the *flexibility* to enter into whatever contractual vertical arrangements that they believe will maximize the benefits and innovations that they can bring to consumers. Carriers have used this freedom to

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sexual activity. *See Android Market Content Policy for Developers*, http://www.android.com/market/terms/developer-content-policy.html. Further Google's Android Market Distribution Agreement, § 7.2 (http://www.android.com/us/developer-distribution-agreement.html) allows Google to "take down" any applications that violate these policies (or a number of other policies). These provisions are very similar to Apple's pre-screening policies as set forth in Apple's SDK Agreement, §§ 3.3.10-14.

[186] Faulhaber & Farber, at 25, 27.

[187] *See* Faulhaber & Farber, at 23, 27.

[188] *See id.*

enter into a wide range of *ad hoc* vertical agreements, and the boundaries between the "network" and the "edge" are more blurred today than ever.[189]

Basic economic principles confirm that companies may readily create efficiencies through vertical arrangements, and that there are no set or fixed "markets" that delimit firms' activities or that naturally or inherently provide the basis for regulatory segregation.[190] This is particularly true for the wireless industry, which increasingly reflects ever-shifting technology and competitive arrangements among a range of infrastructure equipment suppliers, marketers, network operators, software platform developers, device manufacturers and application creators. There is no inherent "network" boundary that excludes handsets or other communications devices; quite the contrary, the communications device is necessary to complete and perform the underlying network communications service.[191] "Technologist Charles Johnson emphasizes that 'handsets are part of the network,' and this reality drives economic organization."[192]

In this regard, exclusive handset arrangements are a prime example of the type of innovative arrangements that enhance consumer choice and competition.[193] In competitive

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[189] *See* Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 24-28, 37-53.

[190] *See id.; see also* Gregory L. Rosston and Michael D. Topper, *An Antitrust Analysis of the Case for Wireless Network Neutrality*, at 29, July 2009 (prohibiting vertical restraints in the wireless industry "would not be in consumers' interests" because "there are plausible efficiency justifications for many vertical restraints on equipment and application providers"); *id.* at 13 (wireless providers "have a scarce resource – network bandwidth – that they need to manage" to ensure that "all users . . . receive good quality of service" and to prevent some users from consuming "disproportionate amounts of bandwidth"); *id.* at 25 (even though vertical restraints can also facilitate anticompetitive conduct, this is unlikely in industries, such as the wireless industry, that are marked by a high degree of competition).

[191] Faulhaber & Farber, at 12-15; Katz Paper ¶¶ 43-46.

[192] Thomas W. Hazlett, *Modular Confines Of Mobile Networks: Are iPhones iPhony?*, George Mason University, Paper for the GMU/Microsoft Conference, Arlington, Virginia, at 13, May 7, 2009.

[193] *See* Katz Paper ¶¶ 76-81.

industries like the wireless marketplace, firms seek to differentiate and improve their products to attract new customers and to retain existing ones. One common form of differentiation is an exclusive offer. Exclusive handsets enhance one competing carrier's offer, much like better service, better call quality, fewer dropped calls, or a lower price. When an exclusive offer is successful, it raises the competitive bar for everyone else, igniting the virtuous cycle of innovation and response and resulting in better prices, better features, and/or better service.[194] Exclusivity agreements also align incentives in ways that lead to more innovation more quickly: they permit the manufacturer to focus its resources on working with only one carrier to optimize, introduce and promote a new handset, while increasing the carrier's incentives to make supporting network investments and to promote the handset (because no carrier wants to invest in and heavily advertise a handset only to have consumers buy the phone from a competitor).[195]

The Commission's flexible policies have also facilitated the ever growing pro-consumer collaborations described above by providing the flexibility for equipment manufacturers, carriers and others jointly to develop and provide telehealth services, energy grid services, integrated navigation services, netbooks, e-books, and other innovative machine-to-machine and similar offerings. Without that flexibility, each carrier would have to go it alone, and consumers would be forced to cobble together their own services from the various piece-parts offered by the different providers.

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[194] *See* Reply Comments of AT&T Inc., *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, Exhibit A (Declaration of Michael Katz), ¶¶ 41-44 (filed July 13, 2009) ("Katz CMRS Decl."); Comments of AT&T Inc., Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers, RM-11497, attached Declaration of Michael Katz ¶ 9 (Feb. 2, 2009) ("Katz Handset Decl.").

[195] *See* Katz Paper ¶¶ 76-81; Katz CMRS Decl. ¶¶ 41-44; Katz Handset Decl. ¶¶ 12-27.

The wisdom of the Commission's flexible approach has been confirmed abroad. There has been considerable experimentation in other countries as to the degree to which these collaborative arrangements will be "open," and which approach provides the best customer experience and supports the greatest range of investment. For example, there has been strong bundling in Japan, which has led to rich innovation, whereas Finland has pursued a much more restrictive approach, which has impeded network and service development.[196]

Finally, the Commission's policies recognize that carriers must manage an increasingly large variety of users using a very scarce resource, spectrum. Accordingly, carriers must actively manage access to and use of the network, in order to assure safety, reliability, and quality of service for all.[197] Wireless operators cannot simply expand capacity at will to address congestion.[198] To the contrary, wireless networks must be engineered and dynamically managed to address unique spectrum-based bandwidth constraints, a process that is particularly challenging given that voice and data services share the same bandwidth and that wireless networks must accommodate the shifting usage patterns of a mobile customer base.[199] If a wireless carrier fails to manage its network adequately, even a small percentage of especially heavy users can cause congestion that can degrade the quality of basic service (voice and data) experienced by the majority of customers.[200]

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[196] Thomas W. Hazlett, *Modular Confines Of Mobile Networks: Are iPhones iPhony?*, George Mason University, Paper for the GMU/Microsoft Conference, Arlington, Virginia, at 9-11, May 7, 2009. *See also* Faulhaber & Farber, at 23-24; Katz Paper ¶ 58.

[197] Faulhaber & Farber, at 22-24.

[198] *Id.*

[199] Faulhaber & Farber, at 8-12.

[200] Faulhaber & Farber, at 26.

The Commission's policies recognize that the carriers themselves are in the best position to judge potential negative impacts on their networks from competing uses and to internalize the benefits of wise decisions and the costs of unwise ones in an intensely competitive marketplace in which customers dissatisfied with their choices can vote with their feet.[201] Carriers maintain rigorous certification processes to assure potential partners that all devices that will use the network are fully compatible, will not cause service quality issues, and meet public safety and other regulatory requirements. Carriers' terms of service also typically include terms designed to protect the network as a whole, which prohibit or impose limits on certain data-intensive or malicious uses. The Commission thus far has wisely refrained from attempting to legislate these issues, recognizing that carriers already have ample incentives to fill their networks with any and all services and applications that do not present legitimate security and reliability issues.

C. The Commission Should Retain and Strengthen These Policies.

It is vitally important that the Commission strive to preserve the four foundational policies that have been successful in driving an extraordinary level of innovation in the U.S. wireless marketplace for the past two decades. Any significant change in any of these four foundations of the current environment would risk retarding innovation and creating substantial public interest harms. And in particular, policies that discourage private investment in 21st century wireless networks – by increasing regulatory uncertainty, reducing flexibility to

[201] Faulhaber & Farber, at 19 ("The FCC has allowed the competitive marketplace to work its magic, and that is exactly what it has done. As it turns out, that policy has indeed been customer-centric. Customers are in the driver's seat; when they want better handsets, manufacturers, sometimes in collaboration with network provider partners, innovate. When they want more bandwidth, carriers innovate. When they want more applications, developers (and the other segments) innovate. In this competitive marketplaces, firms survive by giving customers their best value proposition, and this means innovation."); Katz Paper ¶ 73 ("[I]n a competitive marketplace, those companies that successfully satisfy consumers' needs and desires earn the greatest financial returns. Competition thus drives firms to act to the benefit of consumers. Consequently, policies that protect competition serve to promote consumer welfare").

experiment with business models and limiting carriers' ability to obtain returns on their investments – would inevitably have direct negative impacts on *edge* innovation.[202]

As discussed below, there are, however, certain steps the Commission should take to ensure that this level of rapid innovation continues. First, the Commission should auction additional spectrum (and clear existing spectrum already allocated for mobile use) to address the growing demands on commercial mobile services as the industry moves to 4G networks.[203] Second, it should more vigorously enforce and strengthen its existing wireless interference protections. Third, it should take immediate steps to remove tower siting and other barriers to wireless entry and expansion. Finally, the Commission should resolve the long-pending rulemakings on intercarrier compensation and universal service reforms.

III. SPECTRUM ISSUES.

A. Making More Licensed Spectrum Available, Secondary Uses And Auctions.

The nearly 300 million mobile wireless customers in the U.S. place enormous value on their wireless services and rely on them for an ever increasing array of new and innovative functions. With the flood of new mobile wireless services on the horizon, and the planned upgrades to 4G, the need for more mobile spectrum has never been greater.[204] Experts recommend that the Commission allocate as much as an additional one Gigahertz of spectrum to

[202] Faulhaber & Farber, at 20-29; Katz Paper ¶¶ 37, 74-114.

[203] Faulhaber & Farber, at 22-24; Katz Paper ¶¶ 99-103; Hazlett Decl. ¶¶ 54-58.

[204] *Notice* ¶ 20 ("as wireless is increasingly used as a platform for broadband communications services, the demand for spectrum bandwidth will likely continue to increase significantly, and spectrum availability may become critical to ensuring further innovation").

mobile use,[205] and the Commission correctly recognizes that "[t]he provision of innovative wireless services is critically dependent on having access to spectrum."[206]

AT&T strongly supports the allocation of additional spectrum for licensed mobile use, by (1) repurposing spectrum to mobile use; (2) providing more flexibility to buy and sell existing licensed mobile wireless spectrum in secondary markets, and (3) adopting additional auction mechanisms to allocate new licensed mobile wireless spectrum efficiently and quickly.

Repurposing Spectrum For Mobile. The *Notice* (¶ 27) asks "which frequency bands present the best opportunities for repurposing spectrum." In making this determination, the Commission should focus principally on four objectives. First, because modern mobile services require significant bandwidth over large areas effectively to provide the many broadband services that mobile wireless customers expect, new mobile spectrum should generally be made available in large contiguous blocks covering large geographic areas. Second, because mobile wireless networks typically use different spectrum bands for uplinks and downlinks, spectrum should generally be allocated in compatible pairs. When only a single orphaned block is allocated, often it either must be divided to allow for the separate uplink and downlink channels or used for other purposes. Third, the Commission should, where possible, harmonize its mobile wireless spectrum allocations with those used for mobile service in the rest of the world. Mobile infrastructure and devices, and in some cases applications, are designed and built for the

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[205] *See, e.g.*, Faulhaber & Farber, at 22-24; Howard Buskirk, *Google Voice Probe Shows Changes Overtaking Wirless Industry, Federal CTO Says*, Communications Daily, Sep. 16, 2009 (quoting aide to FCC Chairman Julius Genachowski explaining that "Spectrum is the oxygen of the wireless world. Demand for more capacity is exploding and increased spectral efficiency can only do so much"); Anne-Tuulia Leino, Chair of the UMTS Forum Spectrum Aspects Group, International Telecommunication Union (ITU), World Radio Conference 2007, Mar. 2, 2007, http://www.umts-forum.org/content/view/2026/151 ("studies carried out in ITU-R and the UMTS Forum indicate that about 1 GHz more spectrum is needed after the year 2015").

[206] *Notice* ¶ 20; Hazlett Decl. ¶¶ 11-13.

spectrum they use. When U.S. wireless providers use the same spectrum as the rest of the world, device manufacturers and applications developers can take advantage of economies of scale associated with making a single device or application that can be used almost anywhere, rather than having to devote scarce resources to making separate devices and applications for the U.S. marketplace.[207] Fourth, the Commission should consider allocating additional lower frequency spectrum, with superior propagation characteristics, in rural areas to enable more economical coverage.

With these factors in mind, an obvious candidate for repurposing is the 1755-1780 MHz band.[208] This 25 MHz spectrum band is large enough to support modern broadband capabilities, and it can be paired with the existing AWS-3 spectrum band (2155-2175 MHz), which is currently orphaned. It would also harmonize the U.S. with much of the rest of the mobile wireless world, which already operates in these spectrum bands. Of course, 25 MHz is a far cry from 1 GHz, and much work remains to be done to identify other suitable candidates for repurposing. Industry groups are working diligently to identify such candidates. The International Telecommunication Union,[209] for example, has set the goal of finding 1 GHz of appropriate spectrum for mobile wireless, and at a recent conference, the worldwide participants examined spectrum in the 470-862 MHz band and in the 3.4-4.2 GHz band.[210] But informed repurposing analyses are greatly hampered by the dearth of information on government spectrum

[207] Faulhaber & Farber, at 23; Hazlett Decl. ¶ 28.

[208] *Id*.

[209] "ITU is the leading United Nations agency for information and communication technology issues, and the global focal point for governments and the private sector in developing networks and services." *See* http://www.itu.int/net/about/index.aspx.

[210] News Release, International Telecommunications Union, http://www.itu.int/newsroom/wrc/2007/chairman-review.html. *See also* Faulhaber & Farber, at 23.

use. In this regard, AT&T supports efforts to conduct a comprehensive inventory of government spectrum use and needs that will greatly advance the goal of prompt and efficient spectrum allocations.

To further facilitate investment and innovation, the Commission should, as soon as possible, set a publicly available schedule identifying the spectrum it intends to repurpose and the timeline under which it expects to auction it.[211] Today, network providers and other innovators do not know what spectrum, if any, may become available in the longer term, which reduces their ability and incentive to develop long term business plans and to raise the capital necessary to develop innovative uses for such spectrum. More advanced notice would provide the certainty necessary for innovators to more quickly begin raising capital and innovating.

Relatedly, the Commission should make plans to clear the spectrum allocated for mobile use under exclusive licenses, as it has done each time it has previously repurposed spectrum. As discussed below, mobile wireless cannot be provided effectively using spectrum that also is being used for another purpose, due to bandwidth requirements and very significant interference issues. In addition, when spectrum is repurposed it generally will be appropriate to compensate the existing spectrum users for the cost of moving to alternative spectrum (or shutting down). But past experience starkly demonstrates that it is essential that the relocation and compensation requirements be specified in detail *prior* to the auction of the spectrum.[212]

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[211] *See also* Comments of CTIA, *Spectrum Policy Task Force Seeks Comment On Issues Related To Commission's Spectrum Policies*, ET Docket No. 02-135, at 4 (July 8, 2002) ("A key reform should be the initiation of a more systematic longer-term spectrum planning process").

[212] *Notice* ¶ 28. *See also 3GPP Technology Approaches for Maximizing Fragmented Spectrum Allocations*, 3G Americas Whitepaper, July 2009, http://www.3gamericas.org/documents/3GA%20Underutilized%20Spectrum_Final_7_23_092.pdf ("identification of technical restrictions prior to auction, while promoting broader access to spectrum by various technologies, is a hallmark of sound spectrum policy"). The *Notice* seeks comment on whether existing license holders could be compensated when their spectrum is

Secondary Markets. The Commission's rules currently provide substantial flexibility for mobile wireless license holders to lease and transfer spectrum, and these marketplace driven mechanisms are working extremely well.[213] Perhaps the best known example of innovation driven by the Commission's flexible leasing rules for mobile spectrum is Clearwire, which has announced that it is building a mobile network based principally on 2.5 GHz spectrum obtained in the secondary market through leases and transfers from Sprint Nextel and others.[214] Other mobile providers have likewise expanded and upgraded using almost exclusively spectrum obtained in secondary markets, including U.S. Cellular, Leap Wireless, and MetroPCS.[215] AT&T also has entered into arrangements under which it obtains spectrum from other carriers in areas where AT&T requires additional spectrum. As the Commission's own license records

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repurposed by allowing them to participate in auctions already being held by the Commission to sell spectrum in the same band. This example of intra-band repurposing is inapplicable to spectrum for mobile wireless use, which must be auctioned under exclusive use licenses.

[213] *Notice* ¶¶ 32-33; Hazlett Decl. ¶ 39.

[214] *Clearwire continues broadband spectrum roadmap,* FierceBroadbandWireless, June 17, 2009, http://www.fiercebroadbandwireless.com/story/clearwire-continues-broadband-spectrum-roadmap/2009-06-17; News Release, Clearwire, *Clearwire Completes Transaction With Sprint Nextel and $3.2 Billion Investment to Launch 4G Mobile Internet Company*, Dec. 1, 2008, http://newsroom.clearwire.com/phoenix.zhtml?c=214419&p=irol-newsArticle&ID=1231029; *McCaw Bets Again On Wireless Frontier*, Wall St. J., Nov. 14, 2007, *available at* http://online.wsj.com/article/SB119498643110891751.html. *See also* See also Hazlett Decl. ¶¶ 30-31.

[215] Press Release, *Leap Wireless International, Inc. and MetroPCS Communications, Inc. Enter into National Roaming Agreement and Spectrum Exchange Agreement*, Sept. 29, 2008, http://phx.corporate-ir.net/phoenix.zhtml?c=95536&p=irol-newsArticle&ID=1203114; Press Release, Metro PCS, *MetroPCS Signs Asset and Spectrum Purchase Agreements for Jacksonville, Florida*, Jan. 9, 2008, http://investor.metropcs.com/phoenix.zhtml?c=177745&p=irol-newsArticle&ID=1093816; *Alltel, U.S. Cellular Swap Spectrum*, Wireless Week, Feb. 28, 2007, http://www.wirelessweek.com/Archives/2005/09/Alltel,-U-S--Cellular-Swap-Spectrum/; Press Release, *Leap to Exchange Wireless Spectrum in Grand Rapids, MI for Rochester, NY*, May 15, 2006, http://phx.corporate-ir.net/phoenix.zhtml?c=95536&p=irol-newsArticle&ID=856821; Press Release, *Leap to Expand Footprint With Acquisition of Wireless Spectrum Licenses in North and South Carolina*, March 13, 2006, http://phx.corporate-ir.net/phoenix.zhtml?c=95536&p=irol-newsArticle&ID=830727.

confirm, secondary market spectrum partitioning, sales and swaps have become commonplace as each competing wireless carrier continually re-engineers and expands its networks.[216] And the Commission's rules also provide significant flexibility to meet short term demands – for example, AT&T has leased spectrum on a short term basis in areas where it anticipated significant spikes in use, such as occurs during large sporting events and conventions.

The *Notice* asks whether there are circumstances where it should mandate spectrum leasing or transfers. The answer is no. The Commission's current marketplace-driven policies ensure that carriers put their spectrum to the its highest valued use, either by using it, leasing it, or transferring it.[217] If a third party is willing to pay more for the spectrum than the license holder can earn from using it, the spectrum will be leased or transferred to the higher value user. Otherwise, the correct outcome is for the license holder to use it.[218] By contrast, mandatory leasing or transfer requirements would undermine incentives for investment and innovation.[219] A rule providing that spectrum could be taken away at any moment would create substantial

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[216] For example, a search for "Clearwire" on the FCC's Universal Licensing System, Lease Specific Search, returned 312 active Lease IDs. *See* http://wireless2.fcc.gov/UlsApp/UlsSearch/searchLease.jsp (last checked Sept. 22, 2009). Similarly, a search of the ULS for active leases of the Educational Broadband spectrum returned 1192 active Lease IDs. *See id*. More generally, the Commission's records show that the original allocated spectrum has undergone substantial partitioning, which, although not always, is generally done to allow spectrum leasing or transfers. For example, there were originally 1,994 PCS licenses, but today, through partitioning, there are more than 3,725 PCS licenses, according to the Commission's records. *See* http://wireless.fcc.gov/uls/index.htm?job=transaction&page=weekly.

[217] Faulhaber & Farber, at 20-22; Hazlett Decl. ¶¶ 9-10; *see also, e.g.*, *Promoting Efficient Use Of Spectrum Through Elimination Of Barriers To The Development Of Secondary Markets*, 19 FCC Rcd. 17503, ¶ 2 (2004) ("*Secondary Markets Second R&O*"); Spectrum Policy Task Force Report, at 57 ("Because licensees have economic incentives to use spectrum in ways that will yield the highest return for them, they will generally find it advantageous to allow others to use unused portions of the spectrum if they are adequately compensated.").

[218] Faulhaber & Farber, at 20-22; Hazlett Decl. ¶ 48.

[219] Faulhaber & Farber, at 20-22; Hazlett Decl. ¶ 39.

uncertainty, which would impair the ability of licensees to raise the capital required to make long term network investments and provide innovative service over the spectrum.[220] Mandatory leasing or transfers could only result in spectrum being allocated to suboptimal uses.

The *Notice* (¶ 42) also asks whether user fees might encourage more efficient spectrum use by "prompt[ing] [licensees] to sell their licenses to more productive users – or switching themselves to more productive uses – rather than pay a user fee that is high relative to the value generated by the license in its current form." The secondary market for mobile wireless spectrum already addresses this issue; licensees already have every incentive to lease or transfer spectrum to higher valued uses.[221] User fees are nothing more than a tax on licensed mobile spectrum, and it is settled in economics that taxing an input to production can only result in *lower use* of that input and corresponding reduced incentives to invest in innovation for that input.[222] In all events, the Commission has previously acknowledged that it "does not currently have statutory authority to impose spectrum user fees."[223]

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[220] Hazlett Decl. ¶ 24. *See also* Public Notice, *Wireless Telecommunications Bureau Seeks Comment on Petition for Rulemaking to Transition Part 22 Cellular Services to Geographic Market-Area Licensing*, DA 09-5, RM No. 11510 (Jan. 5, 2009). If the Commission were to adopt requirements that license holders meet certain benchmarks in order to retain their spectrum, it is critical that those benchmarks are spelled out prior to auctioning the spectrum, so that bidders can account for such restrictions in determining their maximum bids.

[221] Hazlett Decl. ¶ 39.

[222] Spectrum Policy Task Force Order, at 21 (recognizing that "only in those instances . . . where marketplace forces may be inadequate, *e.g.*, in spectrum that is allocated for government use, alternative mechanisms such as user fees should be considered to stimulate improvements in efficiency").

[223] Notice of Proposed Rulemaking, *Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended*, 14 FCC Rcd 5206, ¶ 76 (1999). Moreover, the winning bidder pays the value for the full use of spectrum at auction, and anything in addition to that would be an unlawful tax. *National Cable Television Ass'n* v. *United States*, 415 U.S. 336 (1974) (finding fee levied by Commission unrelated to the value of the license to be a "tax" and that the Commission lacks authority to levy such taxes). The *Notice* (¶ 42) notes that the United Kingdom has issued certain licenses subject to "Administered Incentive Pricing" (or "AIP").

Auction Procedures. There can be no serious dispute that auctions best ensure that licensed mobile spectrum will be allocated to the highest valued use.[224] To the extent that there have been advances in the technology for conducting auctions, AT&T supports investigating those techniques to the extent they might more efficiently allocate spectrum. As the Commission examines alternative auction procedures, however, it is important to recognize that no single auction mechanism will be appropriate for all spectrum. In most cases, as discussed above, spectrum can be put to its highest value use only when it is made available in larger contiguous paired blocks over larger geographic areas. The Commission should thus continue to auction most spectrum using this approach. The *Notice* asks whether innovators could be better served by allowing them to initiate auctions on their own time-tables or whether the Commission should hold regularly scheduled auctions of unsold spectrum each year. These approaches, by their nature, appear best suited for allocating smaller amounts of spectrum as they become available. AT&T therefore supports investigating the use of these smaller auctions to *supplement*, but not replace, larger spectrum auctions.

B. Forced Spectrum Sharing.

The *Notice* (¶¶ 38-47) asks a series of questions about various types of spectrum sharing arrangements. As to the potential "problem," the Commission appears to be raising the question

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There can be no serious claim that that program has benefitted consumers, as confirmed by recent report by Ofcom, explaining that evaluating the success of the AIP program is "difficult" absent "actual evidence how the spectrum market would have developed in the absence of AIP," and that it impossible to assess the "impacts of AIP" in isolation from Ofcom's "other complementary policies . . . and wider market developments . . . with confidence." And marketplace developments provide strong evidence that settled economic theory applies in the U.K.: the U.S. will be deploying 4G technology well before the U.K. and has provided more innovation under any measure.

[224] *Notice* ¶ 22 ("many licenses are granted through competitive bidding auctions, in part to enhance the likelihood that the spectrum will be put to its highest-value use"); *see also* Hazlett Decl. ¶¶ 33-34.

whether "innovators" who are not wireless carriers have sufficient means to access spectrum today on an unlicensed basis or otherwise. The Commission seeks comment on two possible "solutions," underlays and cognitive radio. In fact, there is no "problem" – innovators have plenty of access to spectrum – but even if there were a problem, neither of these forced spectrum sharing arrangements would be a remotely appropriate solution within licensed spectrum allocated to mobile uses.[225]

First, AT&T is unaware of any serious spectrum access issues facing "innovators" seeking to use unlicensed spectrum (or other spectrum not licensed for mobile use). Today, the U.S. makes more than twice as much unlicensed spectrum available as licensed spectrum, an amount that far exceeds that in other industrialized countries.[226] To the extent that there are spectrum access issues for this class of "innovators," the Commission should consider granting secondary rights in spectrum licensed for broadcasting, point-to-point applications, or similar applications. As the Commission has found in its White Spaces and other proceedings, spectrum sharing through grants of secondary rights may be feasible in these specialized conditions because the primary uses are fixed, discrete and predictable and sharing may not cause significant interference with the services provided by the primary license holders.[227]

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[225] Faulhaber & Farber, at 20-22; Katz Paper ¶¶ 97-98; Hazlett Decl. ¶¶ 40-44.

[226] Hazlett Decl. ¶ 43.

[227] This class of "innovators" also has access to spectrum in the 3650-3700 MHz range, which is authorized for use in point-to-point, point-to-multiple points, and mobile, and available under a non-exclusive licensing scheme. Memorandum Opinion and Order, *Wireless Operations in the 3650-3700 MHz Band; Rules for Wireless Broadband Services in the 3650-3700 MHz Band; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, 22 FCC Rcd. 10421, ¶¶ 1-11 (2007). This free licensed spectrum is thought to be highly underutilized. Hazlett Decl. ¶ 28; Paul Kirby, *Spectrum Experts Debate Reason for Frequencies Going Unused*, TR Daily, June 15, 2007 (citing Prof. Thomas W. Hazlett) ("Mr. Hazlett cited TV spectrum, the 3650-3700 megahertz band, and the 2.5 gigahertz band as examples of frequencies that have been underutilized").

But as described below, that is most emphatically *not* the case for mobile wireless services. Mandated secondary rights in licensed mobile wireless spectrum would cause significant interference issues and cripple wireless carriers' ability to meet the burgeoning demands for their services. These facts have critical importance because there are today more than 270 million mobile wireless customers in the U.S. that are using that licensed spectrum to enjoy the fruits of the innovation delivered by mobile service operators who were willing to take the risk of actually paying for airwaves in which to launch their innovative services as well as traditional emergency voice and other services. These 270 million wireless users depend on their mobile service operators to provide an ever increasing array of important services consistently and reliably. Beyond that, wireless carriers are increasingly enabling services and applications vital to health care, energy efficiency, education, and array of other industries central to the nation. If interference results in even a slight degradation in the quality of mobile wireless services it can have an extraordinarily negative impact on public welfare.[228]

Those who favor mandatory sharing of licensed mobile spectrum typically assert that there is a wealth of licensed mobile wireless spectrum lying fallow and that it can be used without causing significant interference, either through underlays or cognitive radios that can opportunistically identify and use only the fallow spectrum. These arguments are meritless.

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[228] *See, e.g.*, Comments of Cingular and BellSouth, *Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, ET Docket No. 03-237 (filed April 5, 2004) ("AT&T Temperature Interference Comments") ("[I]n modern, well engineered cellular/PCS systems, harmful interference will do more than simply disrupt a single phone conversation of a single user. Increased levels of interference will impact not only the call quality or data throughput, but can affect the entire cell and possibly even the network as a whole through a decrease in network capacity and coverage. It is well known in cellular system engineering principles that coverage, quality and capacity are inter-related and when one is affected then all are affected, thus reducing the overall performance and efficiency of the system.") (citing WCDMA for UMS (Harri Holma and Anti Toskala eds., 2000).

First, there is no evidence that significant licensed mobile spectrum is lying fallow available for sharing. Those who claim otherwise typically point to findings in a 2003 test purporting to find fallow spectrum in the 30MHz to 3GHz range in Washington D.C.[229] But only a small amount of the spectrum in that range is licensed mobile spectrum, and the underlying data for that study show that the mobile cellular spectrum – in sharp contrast to unlicensed spectrum – was highly utilized.[230] A similar test in Chicago confirmed these results, showing near 100 percent fill rates of mobile spectrum in the down-link band (receiver to handset) in PCS spectrum.[231]

This intense utilization of licensed spectrum should come as no surprise. Mobile providers in the U.S. use spectrum extremely efficiently, particularly when compared to other countries.[232] U.S. carriers historically have had only a fraction of the spectrum available in other industrialized countries,[233] but U.S. providers serve more customers and carry vastly more

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[229] *See Notice* n.41, citing M. McHenry and M. Vilimpoc, *Dupont Circle Spectrum Utilization During Peak Hours*, The New America Foundation and The Shared Spectrum Company (2003), http://vilimpoc.org/research/policy/NAF-SSC-Spectrum-Measurement-Results.pdf.

[230] *See* Faulhaber & Farber, at 20-22. The underlying data show that cellular bands at 806-894 MHz had *100 percent* utilization and that the PCS bands at 1850-1990 MHz had at least 64% use, which the authors of the study (and others) have noted significantly understate actual use because the testing equipment often could not detect the very low power signals of mobile handsets. *Id.* at 4 & App. A.

[231] John T. Macdonald, *A Survey Utilization in Chicago*, March 7, 2007, http://www.ece.iit.edu/~wemi/publications/spectrum.pdf. The study explains that signals for the uplink to the receiver could not accurately be measured due to their very low power use.

[232] Faulhaber & Farber, at 21.

[233] In 2001, E.U. countries had issued an average of 266 MHz to mobile licenses, about fifty percent more than in the U.S. Thomas W. Hazlett and Roberto E. Munoz, *Spectrum Allocation in Latin America: An Economic Analysis*, George Mason Law & Economics Research Paper No. 06-44 (Sep. 2006), http://ssrn.com/abstract=928521. The recent 700 MHz auction and reallocation of EBS and BRS to CMRS finally brought the total amount of spectrum in the U.S. to rough parity with the E.U., but much of this spectrum has not yet been commercially deployed.

traffic,[234] and they continue to stretch the use of mobile spectrum to extremes as they will be among the first in the world to upgrade to 4G technology and are leaders in cutting edge new services. The reality is that there is a growing *shortage* of mobile wireless spectrum in the U.S.; existing carriers' spectrum is already bursting at the seams, and the last thing the Commission should be doing is forcing those carriers to try to accommodate forced third-party uses.

Even to the extent that there is occasional fallow mobile wireless spectrum in certain areas or at certain times, mandatory sharing through underlays or opportunistic use still would be inappropriate because such sharing would cause significant interference and degradation of mobile services. Modern mobile wireless networks are increasingly sensitive to interference. The ever increasing demand for mobile wireless services and the shortage of spectrum require mobile providers to transmit increasing amounts of data through the same amount of spectrum, and as the capacity of spectrum approaches its theoretical limits – and carriers continue to reduce the power of handsets to address congestion – so too does the sensitivity to interference.[235] For example, modern mobile networks transmit and receive data using larger blocks of bandwidth today (typically 5 MHz compared to 1 MHz a few years ago), which provides less opportunity for mobile networks to find unused spectrum if there is interference in a particular portion of the spectrum. Moreover, the type of services mobile wireless customers are now using – *e.g.*, video, gaming, health care monitoring, etc. – are far more sensitive to interference than traditional voice

[234] *See* Comments of CTIA, *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation*, WT Docket No. 09-66, Attachment A, at 9 (filed June 15, 2009) (findings by Merrill Lynch and others that "U.S. wireless companies provide consumers with more service for their telecommunications dollar, while maintaining the most spectrally efficient networks in the world.").

[235] *See also, e.g.*, CTIA Comments, *Commission Seeks Comment On Spectrum Policy Task Force Report*, ET Docket No. 02-135, at 12 (filed Jan. 27, 2003) ("CTIA Spectrum Policy Report Comments") ("[T]he Commission should recognize that, as newer technologies attempt to pack in increasing amounts of data, they may become more susceptible to noise at a particular threshold, instead of less"); AT&T Temperature Interference Comments, at 15-17.

service, and the devices used by wireless customers are often designed to transmit at lower power to extend battery life, which creates further increased potential for interference.[236]

The devastating impact of allowing others to share mobile wireless spectrum is illustrated by recent network outages caused by "boosters" and "repeaters." The purpose of these devices is to extend mobile wireless signals and the Commission deemed them safe for use in mobile wireless spectrum bands. They are not. These devices have caused enormous interference problems, widely disrupting mobile wireless communications, particularly when they are installed on mobile homes and boats. When these vehicles come close to a mobile wireless cell site (*e.g.*, when a boat comes close to shore), the booster or repeater can overwhelm nearby cell sites, which both blocks ordinary calls and disrupts public safety systems, 911 calls, and other critical uses. It can take days to triangulate and track down such mobile devices – in one case, a single yacht-based booster caused a two-day mobile wireless outage throughout Key West.[237]

Mandatory spectrum sharing through underlays or opportunistic devices would increase the potential for such problems by orders of magnitude by significantly increasing the number of devices operating in mobile wireless spectrum. Further, it would be extremely difficult – and in many cases impossible – to identify particular devices that cause outages, dropped or blocked calls, or that otherwise degrade mobiles services. Many such devices are mobile and would cause interference primarily to nearby mobile users. Those nearby mobile users would most likely be unaware that it is an underlay or opportunistic device that is causing the degraded

[236] AT&T Interference Temperature Comments at 7 ("In this environment of intensive spectrum use, even brief, momentary increases in noise or interference will adversely affect service").

[237] Complaint Against Digital Antenna, Inc., at 8-9, filed by AT&T, Inc. with the FCC Enforcement Bureau on April 30, 2009; *see also* CTIA, *White Paper On The Harmful Impacts Of Unauthorized Wireless Repeaters* (CTIA-The Wireless Ass'n), May 1, 2006, at 12-13 (when one of these devices is mobile, it "can sequentially impact multiple cell sites as it moves, resulting in a domino effect" and "it typically takes carriers two or more days to identify the source of the interference.").

service and instead will blame the network provider for the poor service quality. As a result, network providers will hear complaints from their customers, but will be unaware of the rogue device that caused the problem. Because carriers would be unable to tie interference problems to particular devices, the Commission's complaint procedures – even if they quickly addressed such disputes – would be ineffective.

It is well documented that similar harms would follow from mandatory underlay requirements. Mandatory underlays would limit a provider's flexibility to use its spectrum when needed, cause significant additional interference, and degrade service.[238] Interference from underlays reduces the capacity and range of wireless signals, results in dropped and blocked calls, and increases error rates in data transmissions. Mandatory underlays also "hamper the emergence of secondary markets" by encumbering licensees' ability to lease or transfer the underlay spectrum.[239] Moreover, once underlays are mandated, it would be extremely difficult to recover that spectrum in the future as users of such spectrum would become entrenched in it. All of these adverse effects would reduce investment and innovation in wireless services.[240]

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[238] *See, e.g.*, Comments of Cingular and BellSouth, *Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, ET Docket No. 30-237 (filed April 5, 2004) ("AT&T Temperature Interference Comments").

[239] William Lehr, *The Role of Unlicensed In Spectrum Reform*, in Internet Policy and Economics, at 8 (William Lehr and Lorenzo Papillo eds. 2009).

[240] Report and Order and Further Notice of Proposed Rulemaking, *Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access*, 19 FCC Rcd. 14165, ¶ 138 (2004) ("We are . . . concerned . . . that because the current state of unlicensed technology does not permit responsible implementation of unlicensed devices in the spectrum, the uncertainty and novelty of unlicensed use would trouble investors, making them less likely to invest in the band."); Report and Order, *In re Allocations and Service rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, 18 FCC Rcd. 23318, ¶ 41 (2003) (prohibiting use of unlicensed devices in 71-76 GHz and 81-86 GHz bands where "an underlay of unlicensed devices here could detrimentally affect the quality, and thus, buildout of service," and where "the 92-95 GHz band will provide adequate spectrum to fill the immediate demand for unlicensed devices in millimeter wave bands"); *In re Allocation and Designation of*

For these and other reasons, proponents of mandatory sharing have shifted to arguing for "opportunistic use" of mobile spectrum using "cognitive radio" technology. The theory behind this technology is that it can sense and use unused spectrum, and then hop to different spectrum when it senses the primary user trying to use that spectrum. It sounds great, but the reality is that this type of ad-hoc approach using cognitive radio technology is still in very early stages of development and it still has clear real-world limitations.[241] The technology is unquestionably promising and AT&T Labs scientists and engineers continue to play a major role in research to address the many remaining technical challenges, but the proper place for continued development and testing of such experimental technology is not in the commercial mobile spectrum relied on by hospitals, first responders, energy companies, homeland security, and more than 270 million consumers, but controlled environments far away from commercial mobile spectrum.[242]

The Commission itself recognized just last year that current cognitive radio technology cannot yet accurately identify unused spectrum even in the much simpler case of television signals: "From our examination of the prototype devices . . ., spectrum sensing with capabilities

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Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz, and 48.2-50.2 GHz Frequency Bands, 13 FCC Rcd. 24649, ¶ 24 (1998) (rejecting proposal to allow underlay licenses in the FSS designated bands where "underlay licensing would be confusing and could undermine the benefits to be derived from providing separate spectrum for satellite and wireless services, including freedom from technical constraints, avoidance of complicated interference problems and the flexibility for technical innovation").

[241] Faulhaber & Farber, at 21-22.

[242] *See, e.g.*, Report and Order, *Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies*, 20 FCC Rcd. 5486, ¶ 3 (2005) ("Some parties envision that the full development of cognitive radio capabilities will, or should, lead to a vastly different model for spectrum use. These 'futurists' see 'smart radios' operating on an opportunistic basis, finding idle spectrum, using it as they need, then vacating the band for others, all without human intervention. . . . While we recognize that this model exists, we also believe that many technical, cost, and business issues will need to be addressed in the marketplace before widespread deployment of such radios may take place").

as presented in the record of this proceeding would not, by itself, be sufficient to adequately protect from interference television and other licensed services that use the TV bands."[243] It is vastly more difficult to sense use in today's mobile networks. Television broadcast stations transmit on fixed known spectrum bands from stationary known locations; mobile signals are broadcast from myriad overlapping and moving locations using numerous spectrum bands that can change from second to second. And if the cognitive device itself is mobile, that simply adds to the challenges.

Scientists and engineers have documented very high error rates in today's cognitive radio sensing of unused licensed mobile spectrum. For example, mobile wireless systems generally use different spectrum bands for the up- (talk/transmit) and down- (listen/receive) links. During a mobile wireless call or data session, one of these bands may appear to be unused – *e.g.*, the up-link band will appear to be unused when the caller is listening, and cognitive radios will choose to transmit on the used spectrum. Similarly, the up-link communications (from the handset) are often transmitted at very low power and thus often cannot be detected by cognitive devices, resulting in the cognitive device attempting to use the same spectrum as the handset and thus interfering with the cell site receiver which was otherwise capable of receiving the signal from the mobile device.[244] There is also the "hidden node" problem, which occurs where a mobile

[243] Second Report and Order and Memorandum Opinion And Order, *Unlicensed Operation in the TV Broadcast Bands*, 23 FCC Rcd. 16807, ¶ 73 (2008). *See also id.* ¶ 71 ("We also find that spectrum sensing, as currently presented in our measurement studies of prototype devices, is not sufficient by itself to enable unlicensed devices to reliably determine the TV channels that are available from use at a location."); *id.* ¶ 74.

[244] John T. MacDonald & Dennis A. Robertson, *Spectrum Occupancy Estimation in Wireless Channels with Asymmetric Transmitter Powers*, Second International Conference on Cognitive Radio Oriented Wireless Networks and Communications, Orlando, Florida, at 1 (August 2007), http://www.wemi.ece.iit.edu/publications/crowncom.pdf ("[i]n GSM phone systems the down-link power may be 100 watts while the up-link power is typically 100 milliwatts" creating "a high probability that an up-link transmitter (mobile device) will not be detected even though the

device is communicating with a cell tower using a signal that is hidden from the cognitive device, such as where the cell tower is located at the top of the hill and the mobile handset and cognitive radio are on opposite sides of the hill. Another problem occurs with the use of cognitive radios on spectrum being used by W-CDMA and LTE technology. W-CDMA and LTE technology are spread spectrum technologies that can transmit multiple signals *below* the noise floor that are recombined to create a transmission above the noise floor. Because cognitive radios typically cannot sense signals below the noise floor, they may be unable to avoid interfering with services using such W-CDMA or LTE technologies. In each of these cases, the cognitive device will try to transmit in spectrum that is *in use*, causing interference, including frame errors, loss of synchronization, packet retransmission, or loss of the desired signal entirely.

And even if today's cognitive radio technology could overcome these issues (it cannot), it still would adversely affect mobile services. Opportunistic uses necessarily increase the noise floor, and that in turn reduces mobile carriers' ability to maximize the efficient use of spectrum. Moreover, the number of handsets and the distance from the nearest cell site from which a handset may operate are both negatively correlated to the noise floor. Increasing the noise floor through the use of cognitive radios, therefore, necessarily would decrease the number of handsets that could make calls and the range of the cells sites.

The *Notice* asks whether these problems can be addressed by creating a database identifying the location and use of existing spectrum users, much like what is being planned for television White Spaces.[245] Such a database would be infeasible in the extreme. Unlike television networks, mobile wireless networks contain literally hundreds of millions of

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down-link side will be detected with high-probability"); *id.* ("Knowledge of the existence of a transmission is insufficient to determine the availability of the channel").

[245] *Notice* ¶ 43.

transmitting devices, a large portion of which (*e.g.*, handsets, netbooks, e-readers, and machine-to-machine devices) are *mobile*. As a result, it would be impossible, using today's technology, to maintain a database accurate enough to facilitate cognitive radio in real time.

For all of these reasons, releasing today's cognitive radios into the wild at this juncture would be a huge mistake that could not easily be undone. Once these devices are in the wild, it would be extremely difficult to re-cage them because they would be in the hands of individual consumers and businesses that have little or no incentive to cease using them.

Rather than foisting experimental cognitive radio devices on the public through mandatory sharing requirements, the better solution is to rely on science, testing and marketplace forces to determine when and how such devices should be available for commercial mobile use. Mobile spectrum license holders already have every incentive to adopt cognitive radio technology when it is ready for prime time in already congested spectrum. As Professors Faulhaber and Farber point out, "cognitive radio . . . can certainly pay its own way; licensees (who are no doubt a profit-making bunch) will be happy to permit truly non-interfering uses for a competitively determined market price. . . . There is no reason that this particular technology should get a free ride on spectrum" through federal mandates.[246] Indeed, AT&T already has been using cognitive radio techniques in its network that allow the wireless base stations to sense and schedule traffic and thus achieve better efficiency, and AT&T and standards bodies (*e.g.*, 3GPP) have continued to improve and extend the uses for these techniques.

It is critical to recognize, however, that current implementation of cognitive radio technology in licensed mobile spectrum today is under the centralized control of the network, so that the cognitive radios have access to the necessary network information to avoid

[246] Faulhaber & Farber, at 21-22.

interference.[247] For this reason, mobile providers are in the best position to harness and maximize the efficiencies that cognitive radio technologies promise. Cognitive radio technology holds the greatest promise when integrated into the network itself so that it is aware of what is happening in other parts of the network[248] and the network can allocate spectrum use in the manner that maximizes its value. By contrast, third parties have no incentive to maximize the efficiency and value of the network as a whole.[249]

In all events, the Commission should be more than a little skeptical of claims that mandatory sharing will produce significant innovation or public welfare benefits. Proponents of mandatory sharing have a history of significantly inflating those expectations. For example, in the Ultra Wideband proceedings, advocates of mandatory underlays argued that underlays would result in substantial new innovative products for consumers. Seven years later, the public is still waiting for those promised benefits. As BusinessWeek put it, in 2008 "the promise of a new networking technology known as ultra-wideband was a living room without wires, where DVD players, set-top boxes, and video accessories could connect with TVs over the air . . . . So far, this dream hasn't materialized."[250]

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[247] As just one example, mobile wireless providers for some specified uses create smaller "subnetworks" on their systems, such as Femtocell networks, in which the subnetwork, which may rely on cognitive technology, is connected to mobile network and its transmissions to and from the main network are managed by the mobile provider. Under this configuration, the main network is protected because it is fully aware of and able to manage the spectrum use of the subnetwork.

[248] *See, e.g.*, John T. MacDonald & Dennis A. Robertson, *Spectrum Occupancy Estimation in Wireless Channels with Asymmetric Transmitter Powers*, Second International Conference on Cognitive Radio Oriented Wireless Networks and Communications, Orlando, Florida, at 1, August 2007.

[249] Hazlett Decl. ¶ 41.

[250] Stacey Higginbotham, *Ultra Wideband On The Ropes*, BusinessWeek, Nov. 6, 2008, http://www.businessweek.com/technology/content/nov2008/tc2008116_771912.htm; *see also* Glenn Fleishman, *UWB Group Shutters, Sends Tech To Bluetooth, USB Groups*, Arstechnica,

C. Enforcing Interference Rules.

Interference is perhaps the most important factor that determines the quality and quantity of mobile service.[251] As AT&T has previously shown, every 3 decibels increase in interference can increase network costs by 400 percent to try to compensate for it.[252] As noted, mobile networks are becoming increasingly sensitive to interference, and even a small amount of interference can have an extraordinarily negative impact on public welfare, given that mobile services are not only widely used but are critical to security, healthcare, energy and other important interests. For these reasons, it is vitally important that the Commission enforce the existing protections against harmful interference. The Commission's current rules and the Communications Act contain significant protections against such harmful interference. Unfortunately, however, the Commission has been unable promptly to resolve complaints seeking to enforce these protections. For example, as discussed above, the uncontrolled use of repeaters and boosters has caused widespread outages of mobile services throughout the U.S., and have drawn multiple petitions and complaints from AT&T and others.[253] Yet the

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March 16 2009 ("UWB . . . has suffered the shuttering of several firms in the last year focused on the technology. Most recently, Tzero, a firm focused on consumer electronics video streaming, halted its principal operations").

[251] *See*, *e.g.*, Spectrum Policy Task Force, Report of the Interference Protection Working Group, Federal Communications Commission, at 3 (Nov. 15, 2002) ("The cumulative impact of the increasing volume and density of radio devices on the RF environment will challenge the Commission's current approaches to interference management"); Spectrum Policy Task Force Report, at 25 ("[t]his challenging issue [of interference] has become even more difficult as a result of the increasingly intensive use of the radio spectrum").

[252] AT&T Temperature Interference Comments, at 8, n.23; V-Comm Temperature Interference Comments, at Section IV. Comments of V-Comm, LLC, *Notice of Inquiry for the Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, ET Docket No. 03-237, at 58 (filed April 5, 2004).

[253] Petition for Declaratory Ruling of CTIA, *Petition for Declaratory Ruling Regarding the Unlawful Sale and Use of Wireless Jammers And Wireless Boosters and Repeaters*, filed by

Commission has not taken action on these issues, resulting in uncertainty and continued harms that undermine investment and innovation. AT&T has been forced to seek protection from such devices in federal court.

The *Notice* commendably recognizes this problem, and asks whether interference complaints can be more efficiently resolved through an alternate dispute resolution ("ADR") process. AT&T notes that binding ADR procedures could raise significant legal issues under the secondary delegation doctrine.[254] Non-binding ADR may not raise legal concerns, but it is likely to just cause delay as the FCC will ultimately be asked to address all issues by the non-prevailing party in the ADR proceeding.

AT&T has no objection to further investigating the use of a panel of experts, such as the Technical Advisory Board ("TAC"), to advise the Commission in these disputes, although the Commission, not the panel must be the final arbiter. What is critical is that the Commission take steps to assure the *prompt* resolution of these issues.[255]

CTIA with the FCC's Wireless Telecommunications Bureau on November 2, 2007; CTIA, *White Paper On The Harmful Impacts Of Unauthorized Wireless Repeaters*, at 12-13, May 1, 2006; Complaint Against Digital Antenna, Inc., filed by AT&T, Inc. with the FCC Enforcement Bureau on April 30, 2009.

[254] The Commission has exclusive authority to ensure that the Act and its rules are enforced. *See, e.g.*, 47 U.S.C. §§ 201, 202, 208, 333 (2006). Any attempt to sub-delegate such authority to private arbitrators would likely be unlawful. *See, e.g.*, *USTA* v. *FCC*, 359 F.3d 554, 565 (D.C. Cir. 2004) ("[I]f anything, the case law strongly suggests that subdelegations to outside parties are assumed to be improper absent an affirmative showing of congressional authorization.").

[255] The *Notice* also asks whether interference disputes may sometimes be better handled through a negotiated rulemaking process. Such an approach can be efficient where there is already general industry agreement, as in the Hearing Aid Compatibility proceeding. *See Notice* ¶ 35, n.34. In these circumstances, there are too many parties with irreconcilable views for this to be efficient.

AT&T also supports proposals to investigate the ever increasing noise floor levels[256] and other ways to reduce interference, including examining ways to reduce general out-of-band spurious emissions limits for new radio transmitters and emissions limits for unlicensed unintentional radiators.[257] Other proposals in the *Notice*, however, would clearly be inappropriate for mobile wireless spectrum. For example, the *Notice* asks whether there is a use for "frequency coordinators" for licensed mobile spectrum. As noted, mobile providers have exclusive rights in the mobile spectrum licenses they hold, and they carefully and meticulously coordinate their spectrum use both within their own network and with other network providers, leaving no role for any frequency coordinators.

Similarly, any attempt to deploy "low-cost standard package of sensors and measurement systems that could be deployed throughout the country . . . [to] create a real-time spectrum monitoring network" would be both unnecessary and futile, at least for mobile spectrum.[258] It is unnecessary, because, as discussed above, mobile spectrum is used extremely efficiently and there is no serious dispute that it is highly congested and in dire need of expansion. The Commission does not need to deploy sensors to confirm what it already knows. In any event, attempting to measure mobile spectrum use with a "low-cost standard package of sensors and measurement systems" would be futile. As explained above, evaluating spectrum use in mobile systems requires extraordinarily sensitive equipment (*e.g.*, to sense the very low signals from handsets, account for up- and down-links, and identify hidden nodes) with state of the art

[256] The increasing wireless noise floor levels are well recognized. *See*, *e.g.*, Spectrum Policy Task Force Report, at 25-26; Spectrum Policy Task Force, Report of the Interference Protection Working Group, at 3-5 ("The cumulative impact of the increasing volume and density of radio devices on the RF environment will challenge the Commission's current approaches to interference management").

[257] *Notice* ¶ 47

[258] *Id.*, n.50.

measuring equipment that can account for the inherent extreme mobility in such networks. AT&T's network already incorporates the best commercially available sensing technologies and such equipment is not low cost, simple to deploy, or easy to operate properly.

The *Notice* (¶ 36) also asks whether the Commission should try to address this high noise level by adopting technical standards for *receivers*, in addition to its current rules governing transmitters. The wireless industry has already established effective receiver standards that have been accepted internationally and that are used by mobile providers. The danger in the Commission adopting its own mandatory receiver standards is that such standards will, presumably, be based on existing equipment, and most likely the prevailing models. As a result, they will be several years behind the current production state of the art and many years behind the development state of the art. Accordingly, any such standards or guidelines would be out of date as soon as they were promulgated, and would actually stifle innovation and adoption of technologies by handset manufactures.[259]

The *Notice* further asks whether the Commission can effectively control interference using a "cap and trade" system, where licenses that are subject to interference limits would contain caps on the signal strength they may impose on receivers (rather than technical rules on transmitted power) and would be permitted to sell or buy those interference rights from others, and whether such a system could facilitate sharing.[260] It is not clear precisely what is being proposed here. To the extent that the *Notice* is asking whether to resurrect the proposals in the "interference temperature" proceedings, under which mobile spectrum might be shared with secondary users that are subject to limits on the amount of interference they are allowed to cause

[259] *See, e.g.*, Comments of BellSouth Corporation And Cingular Wirless LLC, *Interference Immunity Performance Specifications for Radio Receivers*, ET Docket No. 03-65 (filed July 21, 2003).

[260] *Notice* ¶ 37.

to receivers, AT&T strongly opposes this proposal. As demonstrated above, and as AT&T and dozens of others showed in the Commission's Interference Temperature docket, ET Docket No. 03-237 (which the Commission terminated with no action taken), such a system would significantly *add* to the amount of interference in mobile networks and substantially degrade the quality and quantity of mobile services.[261]

Finally, the *Notice* asks about the success of Special Temporary Authority ("STAs") to test new uses for spectrum and spectrum sharing. AT&T strongly supports the allocation of spectrum for testing new innovations (including new uses and sharing) as well as monitoring by academics. As a matter of course, AT&T approves and coordinates STA applications to allow testing of systems and devices by third parties. Most recently, AT&T supported STAs for Tecore, Inc. in Maryland to test managed access systems as alternatives to cell phone jamming devices in prisons.[262] However, such testing should be done only within spectrum that is far from commercial spectrum to avoid harmful interference or in severe circumstances when it is in the public interest (as in blocking illegal calls within prisons). If it is critical that the test occur within or near commercially used spectrum, it should be done in a highly coordinated fashion.

[261] The *Notice* notes that a cap and trade system was deployed for L-band spectrum in a U.K. auction where all such spectrum was purchased by a single company (Qualcom). A comprehensive set of case studies by the U.K. regulatory agency, Ofcom, found numerous difficulties in implementing that system on a more widespread basis, and that implementation would be costly to licensed spectrum holders. It is thus premature to make any determinations as to the success of that test. Ofcom, *Spectrum Usage Rights, Final Report – Case Studies*, Feb. 10, 2006, www.aegis-systems.co.uk/download/1721/casestudies.pdf.

[262] FCC News, *Office Of Engineering And Technology Grants Experimental License For Demonstration Of Cellphone Managed Access Technology At Maryland Correctional Facility* (Sep. 1, 2009).

IV. NETWORK INFRASTRUCTURE EQUIPMENT, DEVICES AND APPLICATIONS.

Finally, the *Notice* (¶ 48) seeks comment on the developments and innovations that are promoting investment in wireless network infrastructure, end-user devices, and applications and services and asks if there are any "deterrents or major barriers" to these innovations and investments. Investment and innovation have flourished in all of these areas precisely because there have been no barriers and because the Commission's policies have fostered the research and development, the investments, and the experimentation that is essential to innovation.

A. Network Infrastructure And Systems.

As demonstrated in Section I above, the innovations and investments that have occurred in network infrastructure in the last two decades have been breathtaking. These profound changes in wireless networks and their architectures were fueled by R&D from carriers and manufacturers, by the innovative work of carriers and manufacturers in standards setting bodies, by innovations of carriers in designing, engineering, and assembling networks that allow an array of different services and applications, and by the innovative business relationship that carriers have formed with device manufacturers and others. AT&T and others remain engaged in these efforts because the Commission's policies provide them with the incentive to do so: under the Commission's current policies, AT&T can participate in all levels of the wireless ecosystem and can enjoy the fruits of such efforts.

Rather than trying to predict the transformative changes that will occur in the future in wireless infrastructures and architectures, the Commission should focus its energies on maintaining and enhancing the policies that provide the incentives for the R&D that fuels the innovative process. It would be unwise in the extreme for the Commission to attempt to predict the standards and architectures that may evolve to best meet consumer needs and to adopt

policies designed to steer the industry in one direction or another at the expense of the healthy experimentation and standards competition that has served consumers so well. Against this background, AT&T will address the Commission's more specific questions.

Internet Protocol. The *Notice* notes the fact that wireless carriers are increasingly deploying IP-based networks and asks how this will affect innovation and wireless business models. *Notice* ¶ 49 & nn.51-53. Without doubt, the increasingly uniform adoption of IP throughout wireless networks will create efficiencies and flexibility that may further promote innovation, because innovators can more easily design services that integrate voice, video, and data capabilities in a common, IP format. The flip side of that convergence, however, is that it *increases* the importance of active management of wireless networks to prevent congestion and to protect quality of service so that all services receive the appropriate network performance to meet their particularized needs.

In that regard, any suggestion that the migration of wireless networks to IP-based standards would make it easier to require wireless networks to become "dumb pipes" reflects a misunderstanding not only of wireless IP-based networks but also the publicly accessible Internet. "Net neutrality" advocates continue to peddle the myth that the Internet has historically been a paradise of "dumb pipes" that regulators must act to "preserve," but in fact that has never been true. From the very beginning, the Internet Protocol itself established a mechanism for labeling packets by handling class so that networks carrying the traffic could prioritize delivery in ways that maintained appropriate quality-of-service levels for different categories of traffic.[263] The need for this sort of prioritization has only increased with the rise of multimedia IP

[263] Information Sciences Institute, *IP DARPA Internet Program Protocol Specification*, RFC 791, Sept. 1981, http://www.ietf.org/rfc/rfc0791.txt; *see generally* Comments of AT&T, *Broadband Industry Practices*, WC Docket No. 07-52, at 37-39 (June 15, 2007).

networks, because the types of traffic that are becoming more prevalent today, including VoIP, video, gaming, and telemedicine, are much more sensitive to latency issues (*i.e.*, delays in packet transmission) and have a greater potential to cause, and be negatively affected by, network congestion. Because of these realities, it is becoming *more* important, not less, for both the publicly accessible Internet and wireless networks to increase network intelligence and management, so that these highly varied multimedia services can coexist appropriately on the same airwaves. Indeed, Congress recognized this fundamental need for *smarter* networks in the Recovery Act, when it directed the Commission to formulate a national broadband plan that, among other things, achieves the "maximum utilization of broadband infrastructure."[264] Even some of the most ardent net neutrality advocates have acknowledged this need to actively manage IP-based networks,[265] and as one commentator has said, no one could seriously advocate radical net neutrality measures that would prevent a network owner from "favor[ing] traffic from, say, a patient's heart monitor over traffic delivering a music download."[266]

4G Networks And Tower Siting. The Commission should take two important steps to help facilitate the deployment of 4G technology and remove regulatory barriers to investment and innovation in wireless infrastructures. *Notice* ¶¶ 50-54. First, as discussed above, the

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[264] American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, div. B, tit. VI, § 6001(k)(2)(B) (Feb. 17, 2009).

[265] *See, e.g.*, Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. Telecomm. & High Tech. L. 141, 148-49 (2003).

[266] *See, e.g.*, Farber and Katz, *Hold Off on Net Neutrality*, Washington Post, Jan. 18, 2007. The Notice's suggestion (¶ 49) that machine-to-machine applications have been enabled by the existence of IP-based networks is not correct; these applications historically developed using other data transmission standards, although many transmit using TCP/IP standards today. And where the machine to machine applications do run on TCP/IP protocols, the development of the machine to machine applications has required extensive, closely coordinated work between carriers, device manufacturers, and customers. Further, carriers have had to modify their equipment and systems to enable the machine to machine applications to work optimally.

Commission should strengthen is existing spectrum policies by increasing the amount of spectrum licensed for mobile wireless use and by establishing procedures that assure prompt resolution of interference disputes.

Second, as the Commission correctly notes, "[t]owers are the backbone of our wireless infrastructure." *Notice* ¶ 52. As AT&T and others have detailed in other Commission proceedings,[267] one of the most significant impediments to the deployment of next generation networks is the unreasonable delays that some local authorities routinely impose on requests for zoning or other approvals required to install or upgrade cell sites and other radio towers.

These delays pose severe threats to 4G network deployment. Full 4G deployment requires modifications to every cell site in the network and the construction of new cell sites. In addition, in some areas, full, efficient employment of 4G networks may eventually require deployment of a number of "neighborhood areas networks" or "NANs" that are each comprised of a number of radio transmitters that are much smaller in size than existing cell sites – with up to approximately 125 NAN transmitters serving the area now served by a single cell site. Further development is required before NANs can be deployed broadly.[268] But if and when they are

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[267] *See, e.g.*, Comments of CTIA – The Wireless Association, *A National Broadband Plan for Our Future*, GN Docket No. 09-51, at 15-19 (filed June 8, 2009); Comments AT&T, *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, at 25-29 (filed June 15, 2009).

[268] Neighborhood Area Networks ("NANs") are a form of Distributed Antenna System (DAS), which provide service over spatially separated antenna nodes that are much smaller than traditional cell sites. *See Notice* ¶ 53. The Commission is correct that if and when the necessary development work is done to make this technology cost-effective, it may avoid some expenses associated with tower construction. The Commission is also correct that those savings could be entirely offset by the greater regulatory and other costs that arise because of the greater number of transmitters. *Id.* n. 53. Plainly, these systems will be deployed more generally (today the technology is economically and technically suited only for serving small areas with substantial demand, such as sports stadiums) only if they are cost-effective, and the key step that the Commission can take to affect this calculus is to exercise its authority to eliminate the unreasonable regulatory burdens that have been imposed by local zoning and other authorities.

deployed, the ability of local authorities to introduce crippling delays will be magnified. While the smaller size of these transmitters should eliminate or obviate the issues under many local ordinances, there will be many more of them, so where local approvals are required, the potential for unreasonable delays is much greater. *See Notice* ¶ 53 n.63.

The Commission has the authority to remedy this situation. It has the power to adopt rules implementing each provision of the Communications Act, and Section 332(c)(7)(B) of the Act requires local authorities to act on a request to install wireless facilities "within a reasonable period of time" and provides that a "failure to act" is unlawful. 47 U.S.C. § 332(c)(7)(B). Further, there is a pending proceeding in which the Commission has obtained comments on the rules required to implement these requirements. The Commission should promptly enter an order in that proceeding that authoritatively construes the key terms in that statute, such as "reasonable period of time" and "failure to act." In particular, AT&T supports the proposal of CTIA that these phrases be construed to require local authorities to take final action on a collocation application within 45 days and act on other applications for siting authority within 75 days from submission of the application. If a local authority does not act within those reasonable periods of time, the application should be deemed granted.[269]

Wireless Network Architectures And Backhaul. The *Notice* asks about "innovations that might lead to alternative technologies to meet the backhaul and transport needs of wireless networks." *Notice* ¶ 51. That innovation is already occurring today in spades. The transport capacity needs of wireless networks are exploding, as most carriers are currently upgrading their networks to 3G technology and will soon deploy 4G. With this dramatic increase in radio bandwidth, there will be an equally dramatic increase in the need for higher-capacity backhaul.

[269] *See* Comments of CTIA – The Wireless Association, *A National Broadband Plan for Our Future*, GN Docket No. 09-51, at 15-19 (filed June 8, 2009).

Accordingly, these industry-wide changes have created a compelling business case for the widespread deployment of high-capacity backhaul, and providers of all types – LECs, cable companies, and wireless carriers – are working overtime to meet that demand.[270]

AT&T experienced 4932% growth in wireless data traffic over the 12 quarters from 3Q06 to 2Q09.[271] T-Mobile recently indicated that its G1 customers use 50 times the data of the average T-Mobile customer, and that wireless laptops will use 450 times the amount of data.[272] One analyst recently estimated that "mobile traffic will have a CAGR (Compound Annual Growth Rate) of 130 percent from 2008 through 2012 – that is, 1 MB of traffic in 2008 will equal 28 MB of traffic in 2012."[273]

Given this enormous increase in traffic, participants in the Commission's broadband workshops have been unanimous that in the immediate future the industry is going to need more backhaul – a *lot* more backhaul. Today, 80 to 90 percent of all wireless cell sites are served by legacy copper T1s.[274] "[W]ith [the move to] LTE and some of the other technologies," however,

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[270] These developments have been documented at length in other Commission proceedings. *See Ex Parte* Letter from Glenn T. Reynolds (USTelecom) to Marlene H. Dortch (FCC), WC Docket No. 05-25, GN Docket No. 09-51 (filed Aug. 31, 2009); Letter from James W. Cicconi (AT&T) to Marlene H. Dortch (FCC), WC Docket No. 05-25, at 2-4 (filed June 22, 2009); Supplemental Comments of AT&T Inc., Supplemental Declaration of Parley C. Casto, ¶¶ 40-54, WC Docket No. 05-25 (filed Aug. 8, 2007) (showing that backhaul is a many billion dollar growth industry that is attracting robust competition).

[271] Kris Rinne (AT&T), *The Fast Track to 4G Using HSPA and 700 MHz Spectrum*, Sept. 16, 2009.

[272] *See* Letter from Kathleen O'Brien Ham (T-Mobile) to Marlene H. Dortch (FCC), Attachment at 9-10 (dated August 6, 2009).

[273] Yankee Group, *Mobile Backhaul: Will the Levees Hold?*, Anchor Report, June 2009.

[274] *See* Hunter Newby, *National Broadband Plan Workshop*; Deployment – Wired Transcript , at 23, Aug. 12, 2009 ("There is less than 10 percent of the towers in the U.S. have fiber"); *id.* at 45 (David Armentrout) ("the majority of the towers in our markets are T1-fed today"); Tom Swanobori, *National Broadband Plan Workshop*; Wireless Broadband Deployment – General Transcript, at 44, Aug. 12, 2009 ("regarding the number of cell sites with fiber backhaul, "it might be even less than that [10 percent]"); *see also* Yankee Group 4G Network Backhaul

"T1s are out."[275] There is simply no way that copper T1s can support the huge increases in wireless traffic that are already under way.[276]

This increase in traffic and bandwidth creates an enormous opportunity for innovation in backhaul, and various types of providers are responding. With respect to traditional carriers, it is clear that fiber will replace traditional T1s in urban areas.[277] Virtually all wireless carriers are currently mounting major campaigns to upgrade backhaul facilities to fiber.[278] Cable companies

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Summit, *Powerpoint Presentation of John Saw, CTO Clearwire*, at 4, Sept. 15, 2009 (">80% of US cell sites are still fed with copper based TDM circuits"); Yankee Group, *Mobile Backhaul: Will the Levees Hold?*, Anchor Report, at 6, June 2009 (chart showing between 85 and 90 percent of backhaul comes from leased T1s or E1s).

[275] David Armentrout, *National Broadband Plan Workshop*; Deployment – Wired Transcript, at 45, Aug. 12, 2009.

[276] *See* Craig Moffett, *National Broadband Plan Workshop*; Deployment – Wired Transcript, at 25-26, Aug. 12, 2009 ("the 4G plan obviously carries with it an expectation of providing more than T1s in and out of the towers. . . . It's a foregone conclusion you're going to have to bring fiber [to towers as you're planning LTE]"); Yankee Group, *The Inevitable Transformation of the Mobile Internet*, Anchor Report, at 3, April 2009 ("Backhaul networks, which in most cases continue to be based on TDM and Frame Relay technologies, cannot support the massive growth in broadband traffic demands"); Yankee Group, *Mobile Backhaul: Will the Levees Hold?*, Anchor Report, at 4, June 2009 (in 2008 there were 228,000 cell sites served by between 5 Mbps and 10Mbps of backhaul capacity, on average; "[b]y 2012, we expect to see more than 300,000 cell sites in the U.S., each supporting between 50 Mbps and 100 Mbps in backhaul capacity. . . . If we were to keep throwing T1s at the problem, this would result in a backhaul bill of $82 billion by 2012 and the monthly average cost per site would be about $23,000 compared to today's average of $2,100"); Yankee Group 4G Network Backhaul Summit, *Powerpoint Presentation of Dan Graf, Leap Wireless*, at 4, Sept. 15, 2009 ("4G will require bandwidth that current TDM networks cannot provide economically").

[277] *See* David Armentrout, *National Broadband Plan Workshop*; Deployment – Wired Transcript, at 31, Aug. 12, 2009 ("obviously more and more of the towers will require fiber backhaul").

[278] *See* Neville Ray, *National Broadband Plan Workshop*; Wireless Broadband Deployment – General Transcript, Aug. 12, 2009 ("the T-Mobile plan is to get fiber to everything we can because we think that future-proofs the network and moves us into a cost structure very early on which enables us to grow our customer base"); *id.* at 47 (Jake Macleod. Bechtel Telecom) ("the ultimate solution is fiber to the cell site. If you look at some of the foreign countries we deal with a lot, they're north of 90 percent fiber to the cell sites"); Yankee Group 4G Network Backhaul Summit, *Powerpoint Presentation of CFN Services*, at 4, Sept. 15, 2009, ("ILECs and MSOs are aggressively building out the fiber infrastructure; Verizon (ILEC) will have fiber to

are also investing and innovating to offer fiber and Ethernet connectivity, to seize the opportunity to capture some of this backhaul traffic.[279] Microwave backhaul is also going to be much more prevalent: Clearwire recently indicated that 90 percent of its wireless network is served by microwave backhaul (confirming what has been obvious in the rest of the world for many years – that microwave backhaul is not only economically viable, but often the most efficient backhaul technology),[280] and participants in the Commission's broadband workshops uniformly noted that microwave is rapidly becoming a commonly used option outside of major metropolitan areas.[281]

80%+ of all sites in region by 2012; AT&T (ILEC) has fiber deployed or planned to most high capacity sites; . . . CLECs, Utilities, and other Alternative Access Vendors, More limited fiber footprint than incumbents but better economics").

[279] *See* Dallas Clement, *National Broadband Plan Workshop*; Deployment – Wired Transcript, at 35, Aug. 12, 2009 ("Relative to wireless back haul from cell sites . . . in our commercial business it's a growth area. We're getting calls in our franchises from wireless providers who are preparing for their 4G networks and they're looking for lower cost alternatives for back haul. And because we're there and we can do sort of spurs off of our network, we feel as though it's a big growth area and we're deploying capital to that area to be able to satisfy that demand"); Neville Ray, *National Broadband Plan Workshop*; Wireless Broadband Deployment – General Transcript, at 45-46, Aug. 12, 2009 ("And, you know, be that fixed Ethernet delivery in one form or another over fiber, over coax, whatever it might be, you know, we are seeing economic forces at work in major metro areas where that is starting to change. So if I look at our 3G footprint today, we are certainly moving to, you know, a fiber back haul solution environment which is significantly higher than 10 percent. And I think that competitive forces work in metro areas where there's a lot of fiber, be that from the utility company, from the cable company, from the existing, you know, telco provider"); Yankee Group 4G Network Backhaul Summit, *Powerpoint Presentation of CFN Services*, at 4, Sept. 15, 2009 ("Time Warner, Comcast, Cox and other MSOs are adding cell sites to their existing (typically Ethernet) fiber networks").

[280] Yankee Group 4G Network Backhaul Summit, *Powerpoint Presentation of John Saw, CTO Clearwire*, Sept. 15, 2009 ("90% of Clearwire cell sites use microwave backhaul; Largest wireless backhaul network in North America"; "Rapid rollout," "Very low recurring costs," "Tremendous scalability, 50 Mbps – 1 Gbps of backhaul per site").

[281] *See* Neville Ray, *National Broadband Plan Workshop*; Wireless Broadband Deployment – General Transcript, at 45-46, Aug. 12, 2009 ("as you move to suburban fringe and rural areas, those [fiber] opportunities are much tougher to find, but there are good microwave solutions, as Ed [Evans, Stelera Wireless] mentioned, and some carriers are totally deploying their back haul solutions on a microwave basis"); Newby Hunter, *National Broadband Plan Workshop*;

If innovation is to flourish across the wireless ecosystem, however, and if consumers are to realize the full benefits of the innovation unleashed by the transition to 3G and 4G networks, the Commission must take care that its policies encourage – and do not actively discourage – competing suppliers to build the high-capacity fiber and microwave backhaul that will be needed to support these networks. In that regard, the *worst* thing the Commission could do would be to mandate rate reductions on DS1 and DS3 special access services. The real key to next-generation networks will be newly-deployed fiber and microwave backhaul, not legacy copper facilities, and artificial rate reductions for DS1s and DS3s would distort and reduce investment incentives, thereby prolonging dependence on legacy facilities in lieu of the higher-capacity backhaul that will be necessary. That is particularly so given that proponents of increased regulation of DS1s and DS3s have consistently offered only unsupported, bogus arguments that reflect blatant misuse of Commission data – in furtherance of their claims – while steadfastly refusing to produce the relevant data in their possession. Indeed, in a moment of candor, a Sprint executive has already conceded that the United States has fallen behind Europe in high-capacity backhaul because T1s here are *already* so inexpensive.[282]

Deployment – Wired Transcript, at 30, Aug. 12, 2009 ("it's the combination of fiber and microwave, which for backhaul from towers that don't have much fiber can cover a much larger swath of the country along this way"); Swanobori, *National Broadband Plan Workshop*; Wireless Broadband Deployment – General Transcript, at 47, Aug. 12, 2009 ("There are microwave solutions of significant bandwidth that will support LTE and other fourth generation technologies"); *id.* at 46 (Jake Macleod, Bechtel Telecommunications) ("Obviously, a lot of carriers are now moving to Ethernet, and wireless is definitely a solution, but typically only where you can't get fiber or high-speed Ethernet solution"); Yankee Group 4G Network Backhaul Summit, *Powerpoint Presentation of CFN Services*, at 3, Sept. 15, 2009 ("The higher your bandwidth requirements the more fiber you'll need; A 90% microwave architecture can safely support 50-100Mbps per site today").

[282] Stephen Lawson, *Sprint Picks Wireless backhaul for WiMAX*, The Industry Standard, July 9, 2008, http://www.thestandard.com/news/2008/07/09/sprint-picks-wireless-backhaul-wimax (Sprint CTO quoted as saying the reason microwave backhaul not as prevalent here as it is in the rest of the world is that "relatively abundant and *inexpensive* T-1s have stifled the technology

The *Notice* (¶ 51) also seeks comment on possible alternative network architectures. Virtually every large network in the world operates as a hierarchical model "characterized by a backbone structure coupled to a distribution structure, all under the control of a single service provider" (¶ 51 & n.55) because it is highly scalable, and places a single entity in charge of managing devices within the network and responding to unexpected volumes and other issues through management of the network. Because they are centrally managed, these networks are able to use spectrum extremely efficiently.[283]

By contrast, although the question whether "mesh networks" that reuse licensed spectrum to provide backhaul and femtocells are viable in rural areas is certainly an issue worth exploring (*Notice* ¶ 51 n.57), these architectures are far less efficient than traditional architectures in their use of spectrum and otherwise.[284] They are less scalable, they are far less capable of protecting against interference (both from devices operating on the network and outside of the network), they have much higher latency rates, and there is little or no capability to manage unexpectedly high traffic volumes on the network, resulting in dropped, delayed and blocked traffic. Although the proponents of these architectures have greatly exaggerated their benefits,[285] carriers can,

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here" (emphasis added)); *see also* Yankee Group, *Mobile Backhaul: Will the Levees Hold?*, Anchor Report, June 2009 ("[w]hen mobile networks were being deployed in the U.S. in the 80s and early 90s, T1 was comparatively inexpensive and spectrum was scarce. In Europe, the dominant technology is microwave because when MNOs were deploying their networks in Europe, spectrum was plentiful and DS1 pricing . . . was extortionary").

[283] *See also*, *e.g.*, Thomas W. Hazlett, *The Spectrum Allocation Debate: An Analysis*, at 5, Sept./Oct. 2006.

[284] For example, many of these networks rely on 802.11a or 802.11g standards, which means that they must use bandwidth of approximately 16 to 20 MHz per channel. That is approximately 3 to 4 times more than the spectrum used for the downlink in AT&T's HSPA/UMTS network.

[285] *See especially* George Ou, *Digital Society, Mesh myths pop up at FCC wireless workshop*, http://www.digitalsociety.org/2009/08/mesh-myths-pop-up-at-fcc-wireless-workshop (discussing the limitations of mesh networks and refuting claims that they are scalable).

should, and will invest in building these networks in rural areas if they become cost-effective and can offer the quality of service needed for the desired applications.

"Green" Wireless Technologies. AT&T was recently ranked as "the greenest" wireless operator in North America by ABI Research, which evaluated "innovation in green technologies and practices by focusing on operators' innovative applications or uses of technology for green networks; the direct or indirect impact on green innovations for the supplier value chain; innovative metrics used by the operators for the measurement of carbon/energy reduction, their activities in smart grid networks, their green networks R&D, and other green R&D."[286] AT&T topped the list in part due to its "its focus on green innovation and R&D."[287] AT&T specifically "scored points for its work in smart grids across the country, and through its research work at Bell Labs on technologies related to saving energy."[288]

AT&T is one of the leading voices in the move to develop and deploy innovative ways to conserve energy. President Obama has made clear that energy efficiency, energy independence, and reducing carbon emissions are critical to our environmental health and necessary for national security and economic stability.[289] The foundation for this strategy has already been laid by groups like the Global Sustainability Initiative, which, with AT&T's participation, recently

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[286] ABI Research Scorecard, ABI Research, *AT&T Wireless Tops New "North American Green Carriers"*, Sept. 16, 2009, http://www.abiresearch.com/press/1491-AT&T+Wireless+Tops+New+%E2%80%9CNorth+American+Green+Carriers%E2%80%9D+ABI+Research+Scorecard.

[287] *Id.*

[288] *AT&T Wireless tops ABI North American green mobile operator research*, Green Telecom Live, Sept. 21, 2009, http://www.greentelecomlive.com/?p=1201.

[289] The White House, Issues: Energy & Environment, http://www.whitehouse.gov/issues/energy_and_environment/.

published a report detailing how broadband networks and technology can help the United States lower its annual CO2 emissions by 13 to 22 percent by 2020.[290]

Among other contributions, AT&T is, as noted above, heavily involved in projects that provide cost-effective and secure two-way wireless connectivity between "smart meters" and the electric utility grid infrastructure that will help consumers and utility companies better manage electricity usage. AT&T is bringing information and communication technology to transportation as well, offering "Fleet Management" – a central component of which are wireless devices installed in the automobiles that comprise the fleet – to improve routing, scheduling, mileage, and reporting for business vehicles, all of which save money, time, and energy. To improve the ability to telecommute and conduct remote meetings, AT&T offers business end-to-end managed telepresence services, including wireless solutions, that can save money and cut energy consumption. And, as discussed above, AT&T is working on numerous other energy-saving wireless technologies.

AT&T has also been recognized for its focus on innovative efforts to reduce its own carbon footprint.[291] AT&T now uses wind power for ten percent of our electricity consumption in all AT&T facilities in Austin, it has installed 3,700 solar panels on its facility in San Ramon, CA, and to address fuel consumption for its fleet vehicles (AT&T operates one of the largest commercial fleets in the United States), it has been upgrading to alternative-fuel vehicles. AT&T will invest more than half a billion dollars on alternative fuel vehicles over the next ten

[290] Global e-Sustainability Initiative, *SMART 2020: Enabling the low carbon economy in the information age: United States Report Addendum,* 2008, http://www.gesi.org//index.php?article_id=210&clang=0 ("*GeSI Report*").

[291] *Id.*

years.[292] We have also equipped nearly two-thirds of our fleet vehicles with GPS devices to provide increased visibility into business operations, which has uncovered opportunities to improve efficiency and further reduce use of fuel.[293] At cell sites, AT&T locks thermostats to keep temperature settings at optimal levels, and we are installing technologies on the cooling equipment to help cycle the equipment on and off and reduce run time and peak demand, equipping light switches with an occupancy sensors to allow lights to shut off if no one is in the space, and testing small wind and solar-powered technologies for powering those sites. AT&T is also swapping out tower light controllers and incandescent bulbs with LED solutions that require far less power, and we have deployed software that automatically turns off company computers that are connected to AT&T's internal network each night. This is just the tip of the iceberg. These and other AT&T environmentally friendly initiatives are discussed in detail in AT&T's reports on citizenship and sustainability, available at http://www.att.com/gen/corporate-citizenship.

B. Devices, Smart Phones, And Machine To Machine Applications.

The *Notice* correctly states that the "ever-increasing sophistication of new wireless devices is one of the most striking trends in modern telecommunications today," *Notice* ¶ 55, and certainly the advent of the multi-function smart phones has had a revolutionary effect on wireless innovation. But as the Commission recognizes, that is just the beginning, because the wireless industry is on the verge of another leap forward with "devices that are tailored to perform specialized functions – such as those used for machine to machine communications." *Notice* ¶ 56. As explained in more detail above, the possibilities are unlimited. Within the next few

[292] *See* AT&T Citizenship and Sustainability Report 2008, *Connecting for a Sustainable Future*, at 57-58, Dec. 2008, http://www.att.com/gen/corporate-citizenship?pid=13878.

[293] *Id.*

years, wireless capabilities will likely be incorporated into a vast range of consumer electronics products and machines used in the manufacture of goods or the delivery of services by businesses, professionals, and others.

While the *Notice* states that its "particular" interest is M2M communications, there are a vast array of consumer products that have been or are now being developed with wireless communications capabilities. With respect to consumer products, one now-familiar example is the Amazon Kindle and other e-readers, but other examples include (1) GPS navigation devices, (2) wireless tracking devices (*e.g.*, dog collars or belt clips or shoe inserts used to track the location of Alzheimer patients), and (3) gaming devices. On the industrial side, businesses already use machine-to-machine capabilities to track and monitor inventory as it passes through trucks, warehouses, and retail distribution outlets. In healthcare, devices and services are being developed to, among other things, remotely monitor patients and to identify, diagnose, and repair healthcare products remotely, thus reducing overall healthcare costs. AT&T is also working on energy and other conservation products that allow coordinated control of HVAC systems, irrigation systems, and other systems that reduce consumption of natural resources. AT&T is working on many applications for network security, national security, and homeland security. For example, AT&T has developed applications designed to prevent persons from sabotaging telecommunications networks and other infrastructure by gaining access through manholes.

The *Notice* asks whether the Commission should modify the certification process for new wireless devices. The Commission's current certification policies are clearly no barrier to the development and deployment of innovative devices, and AT&T urges the Commission not to take any steps that would lead to the approval of a device before there has been testing adequate

to ensure that the device will not unduly increase noise levels or otherwise interfere with existing wireless services, including mobile wireless broadband.

C. Applications, "Openness," and Technical Standards.

Finally, the *Notice* (¶ 59) asks how "open" the applications marketplace is and whether the Commission should take any "openness" action to foster innovation. *Id.* As the veritable explosion of new wireless applications – more than 100,000 new applications in little more than a year – starkly confirms, the wireless applications space is both red hot and wide open. As detailed above, numerous (and rapidly increasing) distribution channels exist, and anyone, from a teenager working out of his home to a small business or the largest corporation, can design wireless applications that consumers can easily obtain and use on one or more wireless devices (and often on many such devices). Competing carriers, operating system providers, and wireless device manufacturers are beating the bushes to encourage and promote the development of more and better wireless applications that improve the customer experience and thus the attractiveness of their service offerings.[294]

Some nonetheless suggest government intervention is necessary and Chairman Genachowski recently announced a planned rulemaking in which the Commission would propose to convert the four existing principles in the *Internet Policy Statement* into Commission rules that would apply to all broadband services, including wireless, and to add two new principles (including a "nondiscrimination" principle).[295] Although AT&T will discuss these

[294] *See, e.g.*, *Which Mobile App Platform Deserves Your Software*, Yankee Group, Aug. 29, 2009 (describing the variety of ways mobile OS operators are competing for developers and customers and finding that "[n]o one size fits all forms of software development).

[295] *See* Prepared Remarks of Chairman Julius Genachowski, *Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity*, Brookings Institution, Sept. 21, 2009.

proposals in more detail in the upcoming rulemaking proceeding, a few brief observations with respect to wireless innovation are appropriate here.

Applying New "Net Neutrality" Rules to Wireless Would Retard Innovation. At the outset, it must be recognized that any attempt to specify precisely what wireless carriers must, can and may not do in the name of "openness" regulation is neither possible nor desirable – all serious commenters now concede that network security and management concerns and the reality that different applications have different latency tolerances cannot be ignored, that specialized uses and devices should be encouraged, and that all of these issues may require dynamic reactions to particular circumstances in a rapidly evolving environment. Any attempt categorically to prohibit or cabin the business model experimentation that has produced the most innovative wireless industry in the world would necessarily *reduce* innovation, investment and customer choice.[296]

But converting vague "principles" into vague rules to be enforced on a case-by-case basis in after-the-fact adjudications, would also impede innovation, investment and consumer choice.[297] Wireless providers, device manufacturers, and applications developers would be constrained in their ability to experiment with innovative new ways to improve the customer experience, not only because such principles would set boundaries but because the contours of those boundaries would inevitably be less than clear.[298] Accordingly, innovators would

[296] *See* Faulhaber & Farber, at 24-27; Katz Paper ¶¶ 76-96.

[297] *See* Genachowski Speech at 5 ("I will propose that the FCC evaluate alleged violations of the non-discrimination principle as they arise, on a case-by-case basis, recognizing that the Internet is an extraordinarily complex and dynamic system").

[298] *See* Faulhaber & Farber, at 24-27; Katz Paper ¶¶ 89-91. *See also, e.g.*, Dylan F. Tweney, *FCC Position May Spell the End of Unlimited Internet*, Wired.com, Sept. 21, 2009 ("the new regulations create an additional layer of government bureaucracy where the free market has already proven its effectiveness . . . Now the FCC is proposing taking a free market that works, and adding another layer of innovation-stifling regulation on top of that? . . . Free, unfettered

increasingly be driven to "safe" choices based upon their guesses about how to stay well away from the undefined line between legal and illegal conduct, at great cost to American consumers that would have benefited from what might otherwise have been successful innovations.[299]

Providing Consumers with Access to Devices, Content, and Applications/Services of their Choice. The *Internet Policy Statement* has never before been applied to wireless services,[300] and thus the Commission has never even considered how the *Internet Policy Statement* principles could responsibly be applied in the wireless context with dramatically more complex network management constraints and legitimate customer expectations of choice among devices, including specialized devices, that provide a wide range of experiences. But if the concern is that the wireless industry provide consumers access to the devices, content, and applications/services of their choice, consistent with the principles embodied in the *Statement*, that is something the competitive marketplace is already delivering, which obviates the need for any Commission action. But if the Commission nonetheless believes that it must codify the principles in the wireless context, the only sensible reading of those three principles (devices, content, applications/services) is that they are satisfied if a wireless provider (i) allows customers to connect a network-compatible device of the customer's choosing to the provider's network (*i.e.*, the provider has a "bring-your-own device" policy), and (ii) allows customers to access any

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innovation has been the secret to the internet's explosive growth over the past two decades. . . . As [David] Farber says, 'Whatever you do, you don't want to stifle innovation'").

[299] *See* Faulhaber & Farber, at 24-27; Katz Paper ¶ 91.

[300] *See* Notice of Inquiry, *National Broadband Plan For Our Future*, GN Docket No. 09-51, ¶ 24 n.28 (April 8, 2009) ("The extent to which the principles in the Internet Policy Statement apply to wireless service providers is currently before the Commission"); Second Report and Order, *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, 22 FCC Rcd. 15289, ¶ 202 n.463 (2007) ("*700 MHz Second Report and Order*") ("the Commission has not yet made a finding regarding whether to apply open access requirements to wireless broadband services generally, and in this *Order*, defers that determination to the appropriate pending proceedings").

lawful website on the Internet and run the applications/services of their choosing that are available for, and compatible with, that device.[301]

Such a reading of the principles in the mobile wireless context would ensure that consumers have the *option* of a "do-it-yourself" model, while also enabling wireless providers to offer a range of different *options* to customers who prefer a more protected or specialized experience, thereby maximizing consumer choice.

It would, for example, enable consumers to choose a device like the Amazon Kindle. The Amazon Kindle is a device that runs on a wireless broadband Internet access connection (provided by Amazon as part of the one-time fee for the device).[302] The device is optimized to permit users to read books selected and wirelessly downloaded from Amazon's website. The Kindle, however, *could* be used to perform any Internet access function, but the Kindle's users agree in Amazon's Terms of Service *not* to use the wireless connectivity for non-Amazon purposes (and Amazon reserves the right to charge fees or terminate the connectivity if these terms are breached).[303] In other words, Amazon has made market-driven trade-offs: the fact that there is no extra charge for connectivity goes hand-in-hand with the limitations on the Kindle's uses, and those limitations are part and parcel of the Kindle's unique value proposition. It would be absurd to adopt a net neutrality requirement that in the purported name of "openness" would force Amazon to turn the Kindle into the equivalent of a portable desktop computer (and

[301] *See* http://choice.att.com/flash/customersdevices.aspx.

[302] *See, e.g.*, Johna Till Johnson, "What's an ISP? (That's Not a Trick Question)," Network World, November 24, 2008 ("*What's an ISP?*").

[303] *See* Amazon Kindle Terms of Service § 2 ("You agree you will use the wireless connectivity provided by Amazon only in connection with Services Amazon provides for the Device. You may not use the wireless connectivity for any other purpose"; "You may be charged a fee for wireless connectivity for your use of other wireless services on your Device, such as Web browsing and downloading of personal files, should you elect to use those services," and Amazon reserves the right to change those fees at any time).

similarly force providers of other specialized devices to do the same).[304] That would kill the value proposition offered by the product and reduce consumer choice. The only way to ensure the continued availability of such specialized or limited purpose devices is to read the device, content and applications/services principles as requiring providers to comport with the practices described above – allowing consumers to connect network-compatible devices and permitting them to access the lawful content and applications/services of their choice with those devices – not as requiring that all devices be open to all applications.

To be sure, for any parties that truly believe consumers might be better off if regulators required a carrier to comply with a strict "any application on any device" rule, the Commission is already conducting a marketplace experiment with that particular business model in the 700 MHz C Block. Under the Commission's C Block rules, Verizon Wireless may not offer C Block customers the *choice* of a device that limits the applications that a customer can load. Moreover, although the C Block rules permit Verizon to reject applications for reasons of network management, those rules do *not* permit Verizon to take network congestion into account. Accordingly, the Commission already has an experiment in progress in which the licensee will be required not only to accept any compatible device, but to ensure that any device used on that spectrum (including the ones it offers) allows any application (consistent with minimal network management concerns).

If it is true – as "openness" advocates contend – that consumers uniformly want to take on the responsibility for every part of their wireless experiences, then the iPhone, the Amazon Kindle, and other managed products will fail and other "do-it-yourself" products will be the only

[304] *See "What's an ISP?"* ("So if you support net neutrality, you'll need to tell Amazon to close up shop, at least for the Kindle. (And I'll probably have to come whack you with my now-useless book reader.)").

winners. If, as is more likely the case, different customers prefer different levels of customization, all will find their niche and succeed. Wireless carriers have made investments of hundreds of billions of dollars and they face intense competition, and these factors assure that they will offer customers the full range of products and services that customers want under competitive rates and terms.[305]

Nondiscrimination. Although opportunities exist for the Commission to clarify its existing open device, open application principles in a manner, as described above, that promotes true customer choice and does the least damage possible to innovation and investment, the proposed new fifth principle of "nondiscrimination" is more problematic. As an initial matter, it should be obvious that the Commission could not adopt a true "nondiscrimination" policy with respect to applications, because (as explained above), there are a multitude of different types of applications, and some place more demands on wireless networks than others and some are more sensitive to latency than others. Requiring carriers to convert their networks into an unfettered free-for-all that indiscriminately carries phone calls, emails, music downloads, pornography, and malicious software side by side with life-critical telehealth applications, public safety

[305] Faulhaber & Farber, at 25-27; Katz Paper ¶ 84. While AT&T did not oppose the C Block experiment, it is worth noting that, if the restrictions applied universally, Apple would have had far less incentive to develop and deploy the iPhone because such restrictions would have significantly undermined Apple's ability to manage its brand image, including its iconic interface, reputation for having everything "just work," and family-oriented content. While the Notice (¶ 59) asks whether the C Block restrictions have "demonstrably led to expansion or innovation in the mobile wireless marketplace," the service has not even been introduced on this spectrum, so it is far too early to assess whether these regulations could result in benefits that exceed the risk of delayed innovations and the costs of enforcing the open access requirements. The only clear measure of success would be if the result of the experiment is that competition leads all competing carriers to adopt identical policies.

information, and latency-sensitive applications like gaming would be a recipe for rampant public interest harms and customer dissatisfaction.[306]

At the same time, a blanket nondiscrimination principle stricter even than the section 202 standard, designed for franchised monopoly common carriers, would be bizarre and patently indefensible. Yet a more subjective Internet principle that attempted to distinguish between "reasonable" and "unreasonable" discrimination would create its own problems. Any such principle would necessarily and quite substantially stifle investment and innovation as carriers (and their lawyers) struggled to balance the desire to innovate and win in the competitive marketplace with the vast uncertainties posed by subjective legal standards in a fast-moving and dynamic industry.[307]

There Has Been No Demonstrated Need For New Wireless Net Neutrality Rules.

In all events, there is simply no *need* for any new net neutrality rules. There has never been any demonstration that there is a wireless net neutrality "problem;" rather, support for government Internet regulation has always rested on speculation and baseless predictions that harms may occur in the future. Indeed, in many respects, the current debate echoes the questions that were debated two years ago in comments on the Skype petition to extend the *Carterfone's* purported open access requirements to wireless.[308] In that proceeding, Skype and its allies claimed that radical C-Block-type obligations were urgently necessary, because in the absence of "*Carterfone*"-like open access regulations, wireless carriers would prevent the offering of

[306] Faulhaber & Farber, at 26.

[307] Katz Paper ¶¶ 85-87.

[308] *See* Skype's Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, RM-11361.

Bluetooth services, photosharing, WiFi, music and video downloads, and other services.[309] None of these predictions has come true. All of these features are now widely available from – and actively promoted by – virtually all mobile wireless service providers. Indeed, AT&T alone currently offers ten different handsets and two netbooks with built-in Wi-Fi capability.

To advance their agenda today, "openness" advocates have thus been reduced to seizing on claims that are both false and trivial. The recent dust-up over Google Voice is good example. Newspapers reported that Apple had rejected Google's attempt to place a Google Voice app in Apple's App Store. There immediately followed a spate of editorials and newspaper articles in which "openness" advocates confidently proclaimed that, of course, it *must* have been AT&T that "made" Apple reject the app, in order to prevent competition with AT&T services. The Commission, following their lead, sent letters to AT&T, Apple, and Google asking what happened. And as the three companies' answers revealed, the openness advocates were once again wrong: AT&T had nothing to do with it. As Apple explained in its letter to the Commission, Apple has yet to approve the Google Voice application because it appeared to commandeer the iPhone's iconic interface and replace it with one created by Google for telephone calls, text messaging and voicemail.[310] Apple stated that it has devoted a lot of time and resources to developing the interface and expressed justifiable concern about being denied the fruits of its innovation.[311] In all events, Google Voice *is* available to AT&T's iPhone customers, through the iPhone's web browser. In addition, there is a Google Voice application available for Blackberry devices that operate on AT&T's network.

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[309] *See, e.g.*, Skype Petition, at 14-15 & n. 25, 23.

[310] *See Apple Answers the FCC's Questions*, http://www.apple.com/hotnews/apple-answers-fcc-questions/; Letter from James Cicconi (AT&T) to Ruth Milkman (FCC), DA 09-1737; RM-11361; RM-11497, at 5 (filed Aug. 21, 2009).

[311] Katz Paper ¶ 84.

The other claim that has been advanced is that AT&T has blocked use of Skype's VoIP application on AT&T's 3G network. That, too, is false. AT&T allows Skype to be used on its 3G network, for example through Windows Mobile devices. The basis for Skype's contrary claim is that AT&T's agreement with Apple precludes Apple from enabling the installation of VoIP applications onto the iPhone without AT&T's approval, and AT&T has not given its approval to a VoIP iPhone application that uses AT&T's 3G network (although millions of iPhone users do use Skype's application on Wi-Fi networks).

But, AT&T offers the iPhone to consumers at a uniquely subsidized price that represents the largest subsidy AT&T has ever provided on a wireless handset, on both a per-unit and aggregate basis. While this subsidy has made the iPhone accessible to millions of consumers, this pricing strategy is predicated on certain assumptions about the monthly mobile voice service revenues that would be generated by iPhone users, including from AT&T voice plans. In particular, both parties required assurances that the revenues from the AT&T voice plans available to iPhone customers would not be reduced by enabling VoIP calling functionality on the iPhone. The reasonableness and targeted nature of this restriction is underscored by the fact that AT&T now permits iPhone customers to use VoIP applications (including Skype's) over WiFi connections. Moreover, as AT&T recently indicated, the company is taking a fresh look at the possibility of authorizing VoIP capabilities on the iPhone for use on AT&T's 3G network.[312]

The limited restrictions that have been adopted by Apple and AT&T serve legitimate business purposes and are ancillary to the vertical business relationship that led to the introduction of the iPhone, which is the "game changing" development that led to the explosion in the availability of smartphones and today's vibrant applications market. As well-established

[312] Katz Paper ¶¶ 85-87.

precedent from the Supreme Court makes clear, the restrictions are plainly not anticompetitive.[313] Because the Commission's longstanding policies grant wireless carriers flexibility to provide services through whatever arrangements they believe efficient, the Commission's policies fostered the extraordinary innovations and investment that the iPhone has generated.

In essence, advocates of extreme versions of "open access" are objecting to the fact that carriers today offer customers the *choice* to use a wide range of devices that, to varying degrees, offer a range of tradeoffs between customization and a more managed experience. But the provision of these choices is an important example of innovation that spurs competition.[314] In the case of the iPhone, for example, the more managed nature of the customer experience reflects the business judgment and business model of Apple, which based on its success in other markets, has concluded that there are many customers who prefer the environment that it offers. (The sale of 30 million iPhones worldwide to date strongly validates that view). Similarly, the Amazon Kindle and other special purpose devices reflect the judgment that many customers and

[313] *See*, *e.g.*, *Continental T.V.* v. *GTE Sylvania*, 433 U.S. 36, 54-55, 57-58 (1977) ("Vertical restrictions promote interbrand competition by allowing the manufacturer to achieve certain efficiencies in the distribution of his products. These 'redeeming virtues' are implicit in every decision sustaining vertical restrictions under the rule of reason. Economists have identified a number of ways in which manufacturers can use such restrictions to compete more effectively against other manufacturers," including inducing retailers to make "investment of capital and labor" or to "engage in promotional activities," as well as ensuring product quality and preventing free riding); *see also, e.g.*, Gregory L. Rosston and Michael D. Topper, *An Antitrust Analysis of the Case for Wireless Network Neutrality*, at 29, July 2009 (prohibiting vertical restraints in the wireless industry "would not be in consumers' interests" because "there are plausible efficiency justifications for many vertical restraints on equipment and application providers"); *id.* at 13 (wireless providers "have a scarce resource – network bandwidth – that they need to manage" to ensure that "all users . . . receive good quality of service" and to prevent some users from consuming "disproportionate amounts of bandwidth"); *id.* at 25 (even though vertical restraints can also facilitate anticompetitive conduct, this is unlikely in industries, such as the wireless industry, that are marked by a high degree of competition).

[314] Katz Paper ¶¶ 15, 39-42, 56-60.

businesses will want entirely managed products to serve discrete needs. But carriers offer many other choices for customers that prefer a greater degree of self-management: for example, Google Android devices enable greater customization and correspondingly place more of the burden of security, reliability, and protection of children on the user; Google screens applications only after the fact based on customer complaints, rather than employing a pre-certification process to ensure security and appropriateness, as Apple does. And AT&T's "Bring Your Own Device" policy allows customers to connect compatible phones into our network and create their own user experience from scratch.

So while these arguments are offered as models for "openness" and "net neutrality," and thereby make effective sound bites, their proponents are not really furthering the cause of "openness." They would deny carriers and device manufacturers the ability to meet the needs of those with no interest in a fully customizable product and a strong interest in relying on vendors to provide experiences that are more managed and simpler to use.[315] They would eliminate innovations that provide choice in the wireless marketplace, would force all consumers to build their own wireless experience, and would impose a "one size fits all model" on a burgeoning competitive market.

AT&T also notes that experience elsewhere in the world refutes any notion that systems that are less than fully "open" are less innovative. For example, the model adopted by the leading cellular carrier in Japan, DoCoMo, has been described as a "walled garden" that is "managed so carefully that nothing is left to chance."[316] Critics charged that the walled garden limited choice, but in fact, it produced a wave of new innovative content, proving popular with developers and consumers alike. Its success came "less from being walled than from being

[315] Faulhaber & Farber, at 24-27.

[316] Frank Rose, *Pocket Monster*, Wired, Sept. 2001.

obsessively tended."[317] In response, Japan's other wireless carriers initiated competing platforms, and as result Japan has been recognized as one of the leading wireless data services markets globally.[318] The simple reality is that the offering of more managed experiences both represents and facilitates innovations, and have led to the most dramatic recent developments in the U.S. wireless industry. It would be antithetical to the Commission's policies to prohibit them by mandating draconian versions of "openness" policies.

Wireless Net Neutrality Rules Would Be Unlawful. Finally, the imposition of new wireless net neutrality requirements would be illegal. First, the Commission has no authority to adopt a new "nondiscrimination" principle for wireless broadband services. The Commission has properly classified wireless broadband services as information services under the Act.[319] Accordingly, such services are *not* common carrier services, and Section 202 and its nondiscrimination requirement do not apply. The Act is clear that telecommunications carriers are to be treated as common carriers "*only* to the extent that [they] are engaged in providing telecommunications services."[320] Section 202's nondiscrimination requirement has long been deemed a core feature of common carrier regulation, and therefore the Act squarely prohibits the Commission from applying or enforcing such a requirement against wireless providers when then are providing wireless broadband Internet services.[321]

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[317] *Id.*

[318] *See* http://www.chetansharma.com/Worldwide%20Wireless%20Data%20Trends.doc.

[319] Declaratory Ruling, *Appropriate Regulatory Treatment for Broadband Access to the Internet over Wireless Networks*, 22 FCC Rcd. 5901 (2007).

[320] 47 U.S.C. § 153(44); *National Cable & Telecommunications Ass'n* v. *Brand X Internet Services*, 545 U.S. 967, 975 (2005) ("[t]he Act regulates telecommunications carriers, but not information-service providers, as common carriers").

[321] *See, e.g., Personal Communications Industry Ass'n 's Broadband Personal Communications Services Alliance's Petition for Forbearance for Broadband Personal Communications Services*, 13 FCC Rcd. 16857, ¶ 15 ("Sections 201 and 202, codifying the bedrock consumer protection

Similarly, the Commission would violate core principles of administrative law if it were to extend the C Block experiment to other spectrum, be it spectrum auctioned in the past or spectrum to be auctioned in the future. In the *700 MHz Second Report and Order*,[322] the Commission made a determination to apply the expansive "any device/any application" condition only to a single block of spectrum (and to a licensee that knew such regulation would apply when it made its bid for that spectrum) and then observe the real-world effects before considering broader regulation. Indeed, the Commission made precedential findings that it would *not* be in the public interest to impose such a condition more broadly because of the potential for "unanticipated drawbacks."[323]

In light of the Commission's unequivocal findings, the Commission cannot legally reverse course and impose "openness" regulation on previously-auctioned or newly-auctioned mobile spectrum now, before the C Block experiment has occurred. Under settled case law, it would be arbitrary and capricious for the Commission to "chang[e] its course" from the approach announced in the *700 MHz Second Report and Order* unless it provided a "reasoned analysis" for the change.[324] Nothing has changed since the *700 MHz Second Report and Order*. Verizon has

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obligations of a common carrier, have represented the core concepts of federal common carrier regulation dating back over a hundred years"); *see also Orloff* v. *FCC*, 352 F.3d 415, 420-21 (D.C. Cir. 2003).

[322] Second Report and Order, *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, 22 FCC Rcd. 15289 (2007).

[323] *Id.* ¶ 205 (Commission recognizing that it could not "rule out the possibility that such a requirement may have unanticipated drawbacks," and therefore imposing the requirement only "on a limited basis" as a controlled experiment so that it could "observe the real-world effects of such a requirement"); *id.* ¶ 196 ("We conclude, however, that it would not serve the public interest to mandate, at this time, requirements for open platforms for devices and applications [even] for all unauctioned commercial 700 MHz spectrum").

[324] *Motor Vehicle Mfrs. Ass'n of United States, Inc.* v. *State Farm Mut. Automobile Ins. Co.*, 463 U.S. 29, 42 (1983); *see also Williams Gas Processing-Gulf Coast Co.* v. *FERC*, 475 F.3d 319, 326 (D.C. Cir. 2006) ("it is axiomatic that agency action must either be consistent with prior

not even deployed services under the new rules, and there has been no opportunity to observe the "real-world effects" of this experiment. There has been no chance to assess the factors which the Commission deemed important, particularly whether the benefits of the "openness" requirements exceed the costs and "unanticipated drawbacks." And despite rhetoric about "gathering clouds," there has been no evidence of any market dysfunction that would warrant an abandonment of the "experiment" before it even begins. Accordingly, the Commission would have no way to provide a "reasoned" basis for changing course that could be reconciled with its prior precedents and which could survive judicial review.

In addition, the Commission would violate the Administrative Procedure Act's prohibition against retroactive rulemaking if it were to spring a bait and switch trap by extending the C Block requirements to previously auctioned spectrum.[325] This prohibition is grounded in the notion that "settled expectations should not be lightly disrupted" because "[i]n a free, dynamic society, creativity in both commercial and artistic endeavors is fostered by a rule of law that gives people confidence about the legal consequences of their actions."[326] The Supreme Court has held that new rules suffer from impermissible primary retroactivity when they "impair rights a party possessed when he acted, increase a party's liability for past conduct, or impose

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action or offer a reasoned basis for its departure from precedent") (internal quotation marks and brackets omitted).

[325] *See Nat'l Cable & Telecom. Ass'n* v. *FCC*, 567 F.3d 659, 670 (D.C. Cir. 2009) (the APA requires that "legislative rules . . . be given future effect only") (internal quotation marks omitted); 5 U.S.C. § 551(4) (a "rule" means "the whole or a part of an agency statement of general or particular applicability *and future effect* designed to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of an agency . . . " (emphasis added).

[326] *Landgraf* v. *USI Film Products*, 511 U.S. 244, 265-266 (1994); *see also id.* at 271 ("[t]he largest category of cases in which we have applied the presumption against statutory retroactivity has involved new provisions affecting contractual or property rights, matters in which predictability and stability are of prime importance").

new duties with respect to transactions already completed."[327] In addition, even where new rules have only future effects, courts have recognized that the rules can be arbitrary and capricious if they have "unreasonable secondary retroactivity," *i.e.*, if they "alter[] future regulation in a manner that makes worthless substantial past investment incurred in reliance upon the prior rule." *Bowen* v. *Georgetown University Hospital*, 488 U.S. 204, 220 (1988) (Scalia, J., concurring); *see Celtronix Telemetry, Inc.* v. *FCC*, 272 F.3d 585, 588 (D.C. Cir. 2001) (noting that the D.C. Circuit has treated Justice Scalia's concurring opinion in *Bowen* as "substantially authoritative") (citing *Bergerco Canada* v. *U.S. Treasury Department*, 129 F.3d 189, 192-93 (D.C. Cir. 1997)). In particular, courts have recognized that rules which impair investment-backed expectations are "valid only to the extent that [they are] reasonable – both in substance and in being made retroactive." *U.S. Airwaves Inc.* v. *FCC*, 232 F.3d 227, 233 (D.C. Cir. 2000).

Here, extending the "openness" requirements to previously auctioned spectrum would give rise to impermissible secondary retroactivity because such action would fail both prongs of the "reasonableness" test. With respect to substance, it would be unreasonable for the Commission to *extend* the requirements at this time because, as noted, the C Block experiment has not yet begun and, therefore, the Commission does not yet have answers to its own questions about the real-world effects of these requirements and whether they have "unanticipated drawbacks." As to retroactivity, it would be patently unreasonable to extend the C block requirements to license holders who have made enormous investments and formulated their business models in reliance on existing requirements. As demonstrated, different carriers have deliberately offered a choice of devices with more "managed" or "open" models in order to provide varied customer experiences, and have devoted enormous resources to optimizing their

[327] *Id.* at 280.

networks for those purposes. Imposing a comprehensive set of "openness" requirements on existing licensees would fundamentally alter the ways in which they could use the spectrum and, as a result, undermine "substantial past investment incurred in reliance upon the prior rule." *Bowen*, 488 U.S. at 220.

Indeed, such new requirements would vitally affect the nature and value of the asset that licensees acquired in previous auctions. The C Block auction provides dramatic market-based proof of this point because the 700 MHz C Block spectrum, which was burdened with rigid open access requirements, was auctioned at a substantial discount compared to similar spectrum without such regulatory requirements.[328] Accordingly, a comparison of the auctions for encumbered and unencumbered licenses leaves no doubt that if the Commission were to impose an "openness" regime on licenses purchased at the unencumbered price, the value of the licenses will be reduced by *billions* of dollars in value. Such "unreasonable" injury to investment-backed expectations is precisely the harm that the doctrine of "secondary retroactivity" prohibits. *See U.S. Airwaves*, 232 F.3d at 235 ("an agency cannot, in fairness, radically change the terms of an auction after the fact").

[328] *See* Robert Poe, *Did Google Do Verizon Wireless a $5 Billion Favor at the Spectrum Auction?*, Mar. 24, 2008, http://www.dailywireless.com/features/google-verizon-favor-auction-032408 (reporting that the C Block spectrum at the 700 MHz auction went for "just over" its minimum reserve price while the A and B Blocks went for "multiples" of their minimum reserve prices and noting that "the variations between the ratios of reserve prices to winning bids is so striking that one can assume the open-access provision depressed the C Block price to some extent").

CONCLUSION

For the foregoing reasons, the Commission should adopt the proposals set forth herein.

Respectfully Submitted,

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