The American Consumer Institute
Center for Citizen Research

November 24, 2009

Ex Parte

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

Re: In the Matter of Preserving the Open Internet, GN Docket No. 09-191 and Broadband Industry Practices, WC Docket No. 07-52

Dear Ms. Dortch:

On November 11, 2009, the American Consumer Institute released the book "The Consequences of Net Neutrality Regulations on Broadband Investment and Consumer Welfare: A Collection of Essays" with contributions from 14 prominent telecommunications policy experts. We are filing this book with the FCC in response to the NPRM's request for public input. This book serves to refresh much of the research on this issue over the last several years, including empirical studies on the effects of net neutrality on consumer welfare and the effects on network investment. Because there have been no empirical studies showing net neutrality regulation as increasing consumer welfare, a least to our knowledge, we consider the studies referenced in this book's essays as unrefuted findings and urge that you include them as part of the public record in this NPRM.

Respectfully yours,

Stephen Pociask

ATTACHMENT

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The Consequences of Net Neutrality Regulations on Broadband Investment and Consumer Welfare

A Collection of Essays

Released by

The American Consumer Institute
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November 19, 2009

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About this Report

A Federal Communications Commission (FCC) Notice of Proposed Rulemaking (NPRM) seeks to codify four existing principles on net neutrality and adopt two additional rules in order to maintain an "open Internet." However, many observers say additional rules are not necessary and may, in fact, harm consumers. Others assert that there is no evidence of market failure that requires correction by regulatory intervention. The NPRM will provide an important opportunity to collect facts about the necessity of additional regulation and its likely impact. It is also important to review the extensive quantity of existing public policy research on net neutrality and its consequences.

To that end, this report is a collection of essays from top economists and public policy experts on telecommunications and broadband issues, including a number who have worked at senior positions at the FCC and other government agencies. This report refreshes the record on this past research, which considers the likely impact of potential regulation on consumers and network investment. The authors have freely donated their time and essays for inclusion into this report.

About The American Consumer Institute

The American Consumer Institute Center for Citizen Research is an independent nonprofit 501c3 educational and research institute founded in 2005. The Institute's mission is to identify, analyze and project the interests of consumers in legislative and regulatory proceedings in information technology, health care, insurance and other matters. Recognizing that a variety of groups seek to speak for consumers, ACI seeks to differentiate itself by consistently and rigorously applying the tools of economic and consumer welfare analysis, and by assuring that its policy recommendations are based on the resulting assessment of costs and benefits to consumers.

The Consequences of Net Neutrality Regulations on Broadband Investment and Consumer Welfare:
A Collection of Essays

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Foreword

Over the past few years a debate, sometimes with more heat than light, has grown up over the meaning and merits of net neutrality regulation. Opinions clog the blogs, op-eds have made their way to the most prominent national media and "net neutrality" sessions at academic conferences across the country have proliferated. All too often, however, the quality of the debate has not matched its volume. One side's banal argument that "the Internet should be free and democratic" is met with the other side's ideological proffer that any government intervention in matters related to the Internet can only harm social welfare. An unfortunate victim of such hyperbole is the voice of sound economic analysis. The fact is that the Internet is not immune from economic principles and forces, and such analysis can and should serve to shape policymaking in this arena.

While not convenient for those who seek to make policy on the basis of sound bytes, economic policy for the future of the telecommunications industry and the Internet requires that we first explore the industry's fundamentals. What is working, and what is not? And what dynamics can or might be put in play to assure a healthy future in which consumers and firms are able to fully exploit the Internet to improve the quality of their lives and enterprises?

So where does the analysis begin? From an economic perspective, we can begin with no firmer foundation than with an exploration of the demand for and supply of "things Internet." At the risk of modest oversimplification, but with no real injustice, the demand side consists of legitimate, growing and seemingly insatiable demands by consumers – both households and firms – for information. This information may be sent or received in the form of voice, data, or, increasingly, video. This latter area of growth is ravenous in its consumption of network capacity. For example, downloading a one hour television show consumes 1,700 times the Internet bandwidth as downloading a typical website. And, downloading a single high definition movie consumes more bandwidth than does the downloading of over 35,000 web pages. While Internet infrastructure firms such as AT&T and Verizon will typically view content and applications providers as enhancing the demand for, and value of, their networks, the prospect of applications providers' high-end offerings outstripping the available capacity has become a bona fide risk.

This means that, on the supply-side, in order for the Internet to continue to flourish the network must be expanded and managed. To date, this network expansion has largely been funded in Adam Smithian fashion by private firms, which have anticipated profits from building networks that will be demanded by consumers. The resulting expansion of broadband facilities in the United States has been laudable. In 2000, there were less than 5 million broadband lines in the United States. In contrast, by the first half of 2008 there were over 132 million broadband lines in service; a remarkable diffusion rate for virtually any new technology. Beyond the growth of broadband deployment, this period has also witnessed continued declines in the price of broadband for consumers and more choice as consumers increasingly may choose from among competing broadband that include not only wired but now wireless networks.

The expansion of the network of networks, which collectively constitutes the infrastructure for carrying Internet content is, however, anything but cheap. Deployment of the

broadband infrastructure has required providers such as AT&T, Verizon, Comcast and others to spend tens of billions of dollars to deploy the facilities to carry broadband content. Moreover, even with the rapid expansion in network capacity that will be enabled through planned investments, the rapidly growing and increasingly sophisticated nature of consumer demands for content and applications that will run over the network infrastructure will require increased network management. In a world of digital packet switching, some Internet applications (e.g., email) may be simply "tossed" into the network and arrive without quality degradation, while other applications (e.g., video streaming) requires active network management to assure that the video arrives "unscrambled."

Another relevant dimension of the analysis is whether the supply of broadband is now, or is likely to be, subject to anticompetitive activity. A dispassionate reading of either the history or current status of the telecommunications industry suggests that we ought not to rely solely on laissez faire ideology to assure that the benefits of competition are fully realized. At the same time, the present trends that include rapidly rising output and declining prices are reassuring. It is also should be calming that no less than three federal agencies (the Department of Justice, the Federal Trade Commission and the Federal Communications Commission) have telecommunications industry oversight responsibilities under existing laws. Collectively, these agencies may, and ought to, set regulatory requirements that are "in the public interest," prevent "contracts, combinations or conspiracies in restraint of trade," and prevent "unfair methods of competition."

Finally, do firms have adequate incentives to continue to deploy these broadband, Internet-enabling networks and the freedom to manage them efficiently? For the moment, the answer seems to be "yes." Public policy cannot, however, simply take these incentives for granted. Indeed, basic economic principles suggest that the government actively look for ways to reduce barriers to intermodal competition. Such efforts will create and assure greater rivalry and competition between the telephone, cable and wireless companies. This, in turn, will stimulate suppliers to provide the highest possible quality network services at the lowest possible rates. Additionally, the viability of wireless broadband rests in no small measure with the ability of firms to secure adequate spectrum to enable wireless firms to fully support higher levels of future consumer demand.

Similarly, and importantly, these same principles suggest that the government tread lightly -- and only as far as is required to correct palpable market failures -- in the operations and business models of these companies. In this spirit, policymakers may wish to substantively explore ways in which regulatory and antitrust oversight can be fashioned to be as unobtrusive as possible, but both swift and effective in the event of market failures. Thus, any consideration of new regulation must consider the potential for complementary policy efforts that are "competition-enabling" rather than "firm-restricting" in nature.

In the whirlwind of the debate over net neutrality regulation, with a landscape that has been (and is likely to continue to be) subject to constant flux, it is tempting to see the debate only in the light of the most recent utterance. But as time draws closer to establishing policy, it is critical that the scales not tip to those who offer the latest opinion but the most thoughtful. In this regard, policymakers will be well-served by returning at this moment to the roots of economic analysis. In the volume of essays that follow, the authors speak to the forces of demand-side and supply-side issues that impact the net neutrality debate. They remind us of

basic economic principles and explore the implications of those principles for policymaking. While they surely do not represent the complete spectrum of opinions, they do represent important, substantive perspectives that are most often rooted in the economics of the Internet. As such, I heartily commend them to your reading.

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The Role of Pricing Flexibility in Achieving Universal Broadband[1]

Robert J. Shapiro and Kevin A. Hassett

President Obama and other public officials today support efforts to actively promote universal access to broadband Internet service, as a way of advancing economic growth and opportunity, greater access to public services, and social and economic innovation. During his campaign, the President proposed explicitly that every American should have the opportunity to connect to broadband service;[2] and the American Recovery and Reinvestment Act of 2009 provided $7.2 billion to advance broadband's spread and directed the Federal Communications Commission (FCC) to develop a national strategy to achieve this universal access.

By historical standards, access to broadband already is expanding quickly. Just ten years after broadband service was first introduced, 63 percent of American households in spring 2009 subscribed to some form of the service in their homes.[3] Businesses also have adopted broadband at rapid rates, and millions of consumers also use wireless broadband to connect to the Internet through their mobile devices.

The data also show, however, that this progress has not been equal across demographic groups. More than a decade after the Commerce Department first analyzed a "digital divide" in Internet connectivity between black and white Americans and between less affluent and wealthier households, significant gaps remain.[4] While these divides narrowed from 2000 to 2007, the difficult economic times since then have reversed this trend: The broadband access gap between African-Americans and white Americans widened in 2008 and 2009, and was greater in 2009 than in 2005[5] (Table 1, below).

Table 1. Home Broadband Adoption by Race, Percentage[6]

Ethnicity	2005	2006	2007	2008	2009
White	31	42	48	57	65
African-American	14	31	40	43	46

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[1] This essay is based on a study conducted by the authors for the Georgetown University Center for Business and Public Policy, "Towards Universal Broadband: The Impact of Pricing Flexibility by Broadband Providers on the Digital Divide," the original study available online at: http://www.gcbpp.org/files/Academic_Papers/AP_Hassett_Shapiro_Towards.pdf.

[2] BarackObama.com, "Organizing for America: Technology." http://www.barackobama.com/issues/technology/index_campaign.php.

[3] John Horrigan, "Home Broadband Adoption 2009," Pew Internet & American Life Project, June 2009. http://www.pewInternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf.

[4] U.S. Department of Commerce, "Falling Through the Net: A Survey of 'Have Nots' in Rural and Urban America," July 1995. http://www.ntia.doc.gov/ntiahome/fallingthru.html.

[5] Horrigan 2009.

[6] Horrigan 2009 and John Horrigan, "Home Broadband Adoption 2008," Pew Internet & American Life Project, July 2008 http://www.pewInternet.org/Reports/2008/Home-Broadband-2008.aspx.

Gaps also persist in access to broadband service across income categories. The Pew Survey found that eight in ten Americans with incomes ranging from $75,000 to $100,000 had home broadband access in the spring of 2009, as did 88 percent of those with incomes of $100,000 or more. By contrast, just over one-third of households with incomes of less than $20,000 reported a home broadband connection, as did only slightly more than half of households with incomes in the $20,000 to $30,000 range. Of course, the gaps across racial and income classes are interrelated; and studies show that uptake rates also correlate with education and the need for high-speed Internet at work.

Table 2. Home Broadband Adoption by Income, Percentage[7]

Household Income	2005	2006	2007	2008	2009
Under $20,000	13	18	28	25	35
$20,000-$30,000	19	27	34	42	53
$75,000-$100,000	51	67	70	82	82
Over $100,000	62	68	82	85	88

Given the growing movement by most public and private institutions to shift delivery of many of their services to the Internet, these gaps present an important challenge to policymakers. The encouraging news is that setting aside the impact of the recent economic downturn, broadband usage has continued to spread steadily among all income and racial groups as its price has fallen and its utility has increased, a pattern seen in other new information technologies.[8] Respondents to the Pew survey report that their average bills for broadband service fell from $39 to $34.50 between 2004 and 2008. Interestingly, adoption continued to rise in 2009 despite a jump in prices back to the 2004 level, but the higher 2009 price levels may reflect willingness by a growing number of Americans to pay more for premium services that provide even higher speeds.[9]

Economic studies also have found that prospective adopters and lower-income households are more price sensitive or "price elastic" than more affluent households that have adopted broadband.[10] While small price increases for current broadband subscribers, especially middle and high income subscribers, are unlikely to push them back to dial-up service, higher prices can have a significant impact on the choices of lower-income households that currently use dial-up to upgrade or those who have no Internet access. These conclusions are supported by Pew reports that almost one in ten Americans either cancelled or cut back Internet service for financial reasons between April 2008 and April 2009; and these cutbacks

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[7] *Ibid.*

[8] Robert J. Shapiro, "Creating Broad Access to New Communications Technologies: build-out requirements versus market competition and technological progress," Sonecon, LLC, April 2006. http://www.sonecon.com/docs/studies/broadaccess_042406.pdf.

[9] The average monthly cost of basic service stood at $37.10 in 2009, with premium subscribers paid an average of $44.60.

[10] Kenneth Flamm and Anindya Chaudhuri, "An Analysis of the Determinants of Broadband Access," *Telecommunications Policy* 31, 2007, pp. 312-326.

were greatest at the bottom of the income scale: some 17 percent of households earning $20,000 or less reported that they reduced or gave up service during 2008.

These findings are confirmed by studies which find that price is the strongest determinant of broadband subscription. One study found that at $20 per-month, a 10 percent increase in price reduces demand by 5.3 percent (a price elasticity of demand of -0.53); while at $50 per-month, roughly the then-actual market price, a 10 percent price increase reduces demand by 9.8 percent.[11] Another analysis conducted by Austan Goolsbee, now a member of the President's Council of Economic Advisors, found that significantly larger shares of affluent people were willing to pay higher prices for broadband than less-affluent people.[12] Other research found that a 10 percent increase in the price of high-speed connections in 2000 reduced demand for those connections by 10.8 percent overall and by 15.9 percent among those with incomes below $25,000.[13] The research broadly concludes that demand for broadband is substantially price-driven, with estimates of price sensitivity ranging from 8 percent to 27.5 percent for every 10 percent increase in price, and that lower-income, rural and less-educated people are more price sensitive than higher-income, urban and better-educated users. [14]

The dominant model of broadband pricing applies a flat monthly fee to all users that allows unlimited usage. The fee may vary depending on the speed of the connection, but there is no limit on the time a user may spend online or the bandwidth capacity he or she may consume. This model worked well during the Internet's early years, when web access involved mostly static, text-based sites that did not require substantial bandwidth. The cost of providing service to each subscriber could be calculated with relative certainty, enabling network operators to set prices at levels that covered their costs while enabling more Americans to sign up for service. In effect, the fees from the rapidly-increasing numbers of new subscribers could finance the expansion of the network to serve them.

As the range of Internet-based applications and content has expanded, consumers are using an increasing amount of bandwidth, and differences between various customers' bandwidth use have increased. The popularity among some users of Internet video, radio and other music sites, along with the peer-to-peer networking, has driven up overall bandwidth demand at nearly very rapid rates. While one minute of Internet text browsing requires an average of 2-200 KB of bandwidth, one minute of audio requires about 1,000 KB, and 60 seconds of video consumes 9,000 KB.[15] With the growing use of mobile broadband devices such as Blackberrys and iPhones, the use of high-bandwidth applications also is not limited to

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[11] Paul Rappoport, Lestor D. Taylor and Donald J. Kridel, "Willingness to Pay and the Demand for Broadband Service," mimeo, 2003. http://www.economics.smu.edu.sg/events/Paper/Rappoport_3.pdf

[12] Austan Goolsbee, "The Value of Broadband and the Deadweight Loss of Taxing New Technology," Discussion Paper, University of Chicago, 2006. http://faculty.chicagobooth.edu/austan.goolsbee/research/broadb.pdf.

[13] Kevin Duffy-Deno, "Demand for High-Speed Access to the Internet among Internet Households," ICFC 2000, Seattle, 27 September 2000, at http://www.icfc.ilstu.edu/icfcpapers00/duffy-deno.pdf.

[14] Goolsbee, 2006.

[15] Robert J. Shapiro, "The Internet's Capacity to Handle Fast-Rising Demand for Bandwidth," US Internet Industry Association, 14 September 2007. http://www.usiia.org/pubs/Demand.pdf.

offices and homes. By one estimate, these developments will expand web traffic four-fold from 2008 to 2013, driven largely by video and "visual networking."[16]

Keeping pace with this fast-rising demand for bandwidth will require large additional investments to expand network infrastructure and capabilities. The precise dollar amounts required are difficult to calculate, in part because they will be affected by technological innovations. But the order of magnitude is likely to be substantially greater than current investment levels. In one, widely-cited report, EDUCAUSE, a higher-education technology group, estimated that providing "big-broadband" to every home and business with sufficient bandwidth to meet demand would cost an additional $100 billion over the next three to five years and larger investments in capacity going forward.[17] Another industry estimate projects that the long-term investments required to keep up with fast-rising bandwidth demand could cost an additional $300 billion over 20 years.[18]

While some of these additional investments could be funded by fees paid by new subscribers, demand for bandwidth is growing much faster than increases in uptake rates. Therefore, a significant portion of the additional costs will have to be passed on to current broadband subscribers. Policymakers must consider how the pricing framework used to fund these costs may affect access: should all users bear these costs equally, or is it socially preferable to let providers charge those who use the most bandwidth a higher proportion of those costs? The link between prices and broadband adoption suggests that higher costs for all consumers will slow the drive to universal broadband and expand the gaps that separate white from African-American and less affluent from wealthier citizens.

To explore these issues, we model the impact of the additional investments under different pricing strategies. First, we generate a baseline projection of broadband uptake by income under current conditions. We then estimate deviations from this baseline under different pricing approaches, in order to illustrate the impact of each approach on universal broadband access.

We begin by using the recent broadband uptake rates by income level collected by the Pew Internet and Life Project in 2009, assuming that future diffusion patterns for broadband access will be similar to those for dial-up Internet access and personal computer ownership. We use data on rates of dial-up Internet uptake by income from the Census Bureau Current Population Survey from 2000 to 2003 to predict increases in broadband through 2011 and then use overall PC adoption rates to simulate increases from 2012 through 2017. Furthermore, since studies show that rates of Internet uptake are income sensitive, we make additional adjustments to the baseline to incorporate expected income increases for each income group, based on the most recent projections of economic growth from the

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[16] Cisco Systems, "Hyperconnectivity and the Approaching Zettabyte Era." Cisco Systems White Paper, June 2009. http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/VNI_Hyperconnectivity_WP.pdf.

[17] John Windhausen Jr., "A Blueprint for Big Broadband." EDUCAUSE White Paper, January 2008. http://net.educause.edu/ir/library/pdf/EPO0801.pdf.

[18] David McClure, "The Exabyte Internet," U.S. Internet Industry Association, 1 May 2007. http://www.usiia.org/pubs/The%20Exabyte%20Internet.pdf.

Congressional Budget Office's (CBO) March 2009 report, "A Preliminary Analysis of the President's Budget and an Update of CBO's Budget and Economic Outlook."

Table 3 presents the baseline case of broadband adoption without future price increases. Without any additional charges to customers to finance the additional investment required to accommodate fast-rising bandwidth demand, we would expect to see universal broadband by 2016.

Table 3. Projected Shares of Households with Broadband Internet, By Income, 2009-2017, Baseline Case: No Price Increases

Household Income	2009 (Actual)	Projected Share of Households with Broadband Internet (%)							
		2010	2011	2012	2013	2014	2015	2016	2017
Under $30,000	44.1	51.5	60.8	69.1	78.4	87.6	93.2	99.0	99.0
$30,000 - $74,999	68.6	74.6	83.0	88.7	92.5	94.5	96.7	98.9	99.0
$75,000 and above	85.5	87.7	92.7	95.8	97.5	99.0	99.0	99.0	99.0

This simulation is a counter-factual scenario, because Internet providers would not be able to make the investments necessary to facilitate universal broadband without a source of additional revenues. In practice, the rapid increases in bandwidth demand associated with the fast-rising use of video and audio applications will compel Internet providers to undertake substantial investments to upgrade their existing infrastructure to maintain service reliability and satisfy customers.

Without another source of revenue such as fees on high-bandwidth content providers or high-bandwidth users, these additional investments will require broad price increases. Table 4, below, examines the rate of broadband adoption by income group, taking into account the price increases necessary to finance the additional investment and the sensitivity of each income group to these price increases, if the price increases are passed along to consumers in uniformly higher flat, monthly fees.

Table 4. Broadband Access with $300 Billion in Additional Investment and Flat Rate Pricing, By Income, 2009-2017

Household Income	2009 (Actual)	Projected Share of Households with Broadband Internet (%)							
		2010	2011	2012	2013	2014	2015	2016	2017
Under $30,000	44.1	51.5	58.1	63.5	69.6	75.3	78.0	80.9	79.4
$30,000 - $74,999	68.6	74.6	80.4	83.8	85.3	85.4	85.9	86.7	85.7
$75,000 and above	85.5	87.7	90.0	90.7	90.3	90.0	88.5	87.4	86.4

These results show a dramatic change in broadband uptake rates. While the price increases affect all income groups, the largest impact is seen in lower-income and middle-

income families. By 2017, almost 20 percent fewer lower-income households adopt broadband Internet compared to the baseline case (79.4 percent, compared to 99.0 percent), and over 13 percent fewer middle-income households purchase residential broadband (85.7 percent compared to 99.0 percent). Policies that have the effect of forcing providers to pass along their additional investment costs in higher, flat monthly fees may dramatically slow universal access.

The results are very different if we assume providers can use flexible pricing strategies that charge heavy bandwidth users for their additional consumption. We do not know precisely what form such new pricing models will take and, therefore, we cannot say precisely how costs would be allocated among different groups of consumers. For analytical purposes, and based on survey evidence, we assume that 20 percent of broadband users account for the large increases in bandwidth demand.[19] Table 5, below, illustrates the impact on broadband subscription rates if 80 percent of the costs of the additional investment are borne by that minority of heavy-bandwidth consumers. Heavy bandwidth users are assumed to be relatively price insensitive, so their broadband subscription rates remain unaffected. In this pricing scenario, with 80 percent of the additional cost allocated to the 20 percent of very high bandwidth users, future broadband adoption rates remain generally consistent with the baseline case. Lower-income households' access to broadband rises to 78.3 percent in 2013 and 98.5 percent in 2017 under this flexible pricing approach, compared to 69.6 percent and 79.4 percent under the flat-pricing approach.

Table 5. Broadband Access with $300 Billion in Additional Investment, Flexible Pricing, and 80 Percent of the Additional Costs Borne By Heavy, Price-Insensitive Users, By Income, 2009-2017

	2009 (Actual)	Projected Share of Households with Broadband Internet (%)							
Household Income		**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Under $30,000	44.1	51.5	60.8	69.0	78.3	87.3	92.8	98.6	98.5
$30,000 - $74,999	68.6	74.6	83.0	88.7	92.4	94.3	96.4	98.6	98.7
$75,000 and above	85.5	87.7	92.7	95.8	97.4	98.8	98.8	98.7	98.7

We also examined a pricing approach in which 50 percent of the costs of the additional investment are borne by inelastic, high-bandwidth consumers and 50 percent are passed along to all consumers in higher, flat subscription fees. In this scenario, Table 6, below, lower-income households adopt broadband at a noticeably slower pace than they do when the heavy-bandwidth users bear 80 percent of the cost. With all households absorbing half of the total costs of the additional investment, lower-income households increase their rates of

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[19] James J. Martin and James W. Westall, "Assessing the Impact of BitTorrent on DOCSIS Networks," *Proceedings of IEEE BROADNETS 2007, Fourth International Conference on Broadband Communications, Networks, and Systems*, September 2007. http://people.clemson.edu/%7Ejmarty/papers/bittorrentBroadnets.pdf.

broadband access to 75.0 percent in 2013 and 91.3 percent in 2017, compared with 78.3 and 98.5 percent when they bear 20 percent of the cost.

Table 6. Broadband Access Rates with $300 Billion in Additional Investment, Flexible Pricing, and the Additional Costs Divided 50-50 Between All Consumers and Heavy Users, By Income, 2009-2017

	2009 (Actual)	Projected Share of Households with Broadband Internet (%)							
Household Income		**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Under $30,000	44.1	51.5	59.7	66.9	75.0	82.8	87.2	91.9	91.3
$30,000 - $74,999	68.6	74.6	82.0	86.8	89.7	91.0	92.5	94.1	93.8
$75,000 and above	85.5	87.7	91.6	93.8	94.7	95.5	94.9	94.4	94.1

Again, we assumed that heavy bandwidth users are relatively insensitive to higher costs. However, if flexible pricing that applies half or more of the costs of the additional investment to them does induce these heavy users to cut back on their bandwidth demand, the additional investment costs also would be reduced, easing the additional pricing pressures on other broadband subscribers.

Policy Implications

Given the national commitment to achieving universal broadband and the growing appetite for online communication, it is likely that at some future date every American who wants broadband at home will have it. How soon that day arrives is less clear. Our analysis suggests that the pace at which Americans achieve universal broadband access could differ greatly depending on policy choices that affect how broadband providers defray the costs of the additional investment needed to expand broadband capacity.

How that investment is financed and the extent to which those costs fall on lower-income and middle-income consumers will have significant effects on how soon we can achieve universal access. To the extent that lower-income and middle-income consumers are required to pay a greater share of these network upgrade and expansion costs, we should expect a substantial delay in achieving universal broadband access. Our simulations suggest that spreading the costs equally among all consumers – the minority who use large amounts of bandwidth and the majority who use comparatively little – will significantly slow the rate of adoption at the lower end of the income scale and extend the life of the digital divide.

If costs are shifted more heavily to those who use the most bandwidth and, therefore, are most responsible for driving up the cost of expanding network capabilities, the digital divergence among the races and among income groups can be eliminated much sooner.

Net Neutrality versus Consumer Welfare

Jeffrey A. Eisenach

On October 22, 2009, the Federal Communications Commission issued a Notice of Proposed Rulemaking (NPRM) in the matter of "preserving the open Internet." The proposed rules, better known as "network neutrality" regulation, are styled as protections of consumer rights, and even grants of consumer "entitlements." Indeed, the NPRM goes to some lengths to explain how and why the rules would advance the Commission's general mandate, under the Communications Act of 1934, to regulate in the "public interest."

What the NPRM does not claim, however, is that the regulations will promote consumer welfare. The phrase appears only three times in the 107-page document, and not once in reference to the rules themselves. In this sense, the Commission is being honest: It does not claim its regulations will enhance consumer welfare, because they will not. To the contrary, the Commission's proposed net neutrality regulations are profoundly anti-consumer.

As proposed, the net neutrality rules would presumptively ban a wide range of business practices under which telecommunications carriers and other firms in the telecommunications value chain differentiate between various types of traffic and services. Such differentiation, as others in this volume explain, is not only generally pro-consumer, but – as Google chief economist Hal Varian has pointed out – virtually essential for competition to thrive in markets (like telecommunications) with high fixed costs and economies of scale.[20] In short, many of the practices the FCC proposes to ban are, as a general matter, pro-innovation, pro-competition, and pro-consumer.[21]

It is also true, of course, that discrimination can, in the presence of market power, constitute a form of exclusionary behavior. As the antitrust laws have long recognized, a monopolist may in some circumstances have both the ability and the incentive to use such practices to exclude competitors or "raise rivals' costs."

It is for precisely this reason – the fact that the same or similar types of conduct can be beneficial in some circumstances and harmful in others – that it is essential to analyze allegations of harmful discrimination on a case-by-case basis to determine, as the Federal Trade Commission explained in its 2007 report on net neutrality, the "net effect of such conduct on consumer welfare."[22] And yet, despite FCC Chairman Jules Genachowsky's emphasis on a "fact

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[20] Hal R. Varian, "Differential Pricing and Efficiency," *First Monday* 1;2, August 1996 at 2.

[21] For a more complete treatment of the benefits of product differentiation and "beneficial discrimination" in telecommunications markets, see Everett Ehrlich, Jeffrey Eisenach and Wayne Leighton, "The Impact of Regulation on Innovation and Choice in Wireless Communications," September 2009, available at SSRN 1478528; see also Federal Trade Commission, *Broadband Connectivity Competition Policy*, Staff Report, June 2007 at 8 ("All of these types of conduct can be anticompetitive and harmful to consumers under certain conditions. They also, however, can be procompetitive, capable of improving efficiency and consumer welfare, which involves, among other things, the prices that consumers pay, the quality of goods and services offered, and the choices that are available in the marketplace.")

[22] See FTC Report at 8.

based," "case-by-case" approach to enforcement,[23] the rules as proposed constitute a blanket ban on all forms of discrimination, subject to only one caveat: Network Management.[24]

To be sure, network management is an important qualifier – it means, in essence, that ISPs will not be prevented from conduct necessary to make sure that the Internet continues to function, that cell phone users will still be able to get a dial tone, and that remote healthcare procedures will not be interrupted by BitTorrent users downloading pornography or pirated music. We can and should be grateful the Commission recognizes the need for such practices.

But a network management qualifier is a long way from a general consumer welfare standard applied on a case-by-case basis. Indeed, the Commission's proposed regulations explicitly reject this approach.

Such a test would have two parts. First, the Commission would need to find evidence of market failure – that is (in this context) evidence that the firm engaging in the challenged conduct possesses market power. Second, the Commission would need to conclude that the challenged conduct itself is in fact exclusionary or otherwise harmful to consumers or competition.

Instead of such a case-by-case approach, the Commission proposes to find, first, that *as a general matter*, that *all* ISPs have market power, even in markets with multiple wireline and wireless providers. As others in this volume explain, such a finding is simply unsupportable under recognized principles of competition analysis, and even the question of whether *some* carriers may possess market power in *some* markets is highly debatable. Yet, the NPRM devotes only eight brief paragraphs to the analysis of competition in the broadband market.

Having disposed (or, at least, claimed to dispose) of the first part of a true case-by-case approach, the Commission next explicitly rejects any further effort to distinguish between beneficial and harmful discrimination. As the NPRM acknowledges, the Commission proposes to ban *all* discrimination: "Our proposed nondiscrimination and reasonable network management rule bears more resemblance to unqualified prohibitions on discrimination added to Title II in the 1996 Telecommunications Act than it does to the general prohibition on '*unjust or unreasonable* discrimination' by common carriers…."[25]

Thus, even reasonable and just discrimination – unless justified by "reasonable network management" – is to be banned.

Why, one wonders, has the Commission so blatantly and decisively rejected a consumer welfare approach to net neutrality regulation? A clue to the answer may be found in paragraph

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[23] See Julius Genachowsky, ""Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity," Speech before the Brookings Institution, September 21, 2009.

[24] NPRM at ¶11 ("The nondiscrimination principle would prohibit broadband Internet access service providers from favoring or disfavoring lawful content, applications, or services accessed by their subscribers, but would allow broadband providers to engage in reasonable network management."); see also NPRM at ¶92.

[25] NPRM at ¶109.

106 of the NPRM, where the Commission makes clear that the prime beneficiaries of its regulations are not consumers at all. "We understand the term 'nondiscriminatory' to mean that a broadband Internet access service provider *may not charge a content, application, or service provider* for enhanced or prioritized access to the subscribers of the broadband Internet access service provider, as illustrated in the diagram below. We propose that *this rule would not prevent a broadband Internet access service provider from charging subscribers* different prices for different services."[26]

And so the truth comes out: As proposed by the FCC, net neutrality means that discriminatory practices with respect to upstream firms like Google and eBay (Skype) are always prohibited; with respect to consumers, they are always allowed.

So much for consumer welfare.

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[26] NPRM at ¶106, emphasis added.

Banning Internet Access Price Discrimination Is Bad for Consumers

Larry F. Darby

Introduction

Advocates for regulating rates, services, and network management practices of broadband network access providers refer often to evocative terms and concepts – "openness," "neutrality," "equality," "rights," "freedoms," etc. – that, in the words of Lewis Carroll can "…mean so many different things." The meaning of words here is not a trivial matter, since evolution of the Internet and its contributions to economic growth and development will depend critically on which definitions "are to be masters."[27]

A recurring theme in the case for applying common carrier type rate and services regulation of Internet access providers is that "discrimination" is bad and markets cannot be trusted to prevent it. Columbia Law Professor Tim Wu, an articulate and frequently cited advocate for Net Neutrality measures, stated: "Network Neutrality is just another way of talking about discrimination." At a Senate Commerce Committee hearing last year on Internet regulation, Senator Dorgan stated and then asked: "I find it unbelievable that this [idea of nondiscrimination mandates] is controversial. Who on earth is standing up for discrimination?" Most economists and competition policy analysts have for nearly a century not only stood up for discrimination by sellers, but have advocated the same as an element of market conduct necessary to assure high levels of market performance.

The purpose of this chapter is to draw from a representative sample of the literature on the economic welfare impacts of "price discrimination." We extract from that literature a handful of propositions that taken together refute contentions about pricing network access and use by infrastructure providers – contentions that are put forth as the basis for recommendations that government impose some form of rate regulation to ensure that prices are "fair" and that users are protected.[28]

The literature to which we refer in the discussion makes clear, among other things, that service "versioning", market segmentation, price differentiation and other forms of discrimination among buyers and partners in the value chain a) are the norm in competitive industries, b) are necessary for economic efficiency under cost circumstances prevailing in telecommunications, c) are widely practiced by most firms in the information and communications technology (ICT) sector, d) are not related to market power and are impelled

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[27] When I use a word," Humpty Dumpty said, in rather a scornful tone "it means just what I choose it to mean -- neither more nor less." "The question is," said Alice, "whether you can make words mean so many different things." "The question is," said Humpty Dumpty, "which is to be master -- that's all." Lewis Carroll, Through the Looking Glass.

[28] This essay draws from an earlier piece: Larry F. Darby, *FAQs about Price Discrimination and Consumer Welfare*, ConsumerGram of The American Consumer Institute. Online at: http://www.theamericanconsumer.org/2000/08/18/faqs-about-price-discrimination-and-consumer-welfare.

by competitive market forces, e) increase consumer welfare (as measured by consumer surplus) and frequently the economic welfare of all participants, f) are consistent with the requirements for high rates of investment and innovation by facilities providers, and g) raise no issues that require imposition of rate structure regulation by the FCC. Market differentiated rates are superior in all essential respects to rates regulated by traditional means. They are by no means an indicator of market power or indications of consumer exploitation.

Distinguishing Economic from Sociopolitical Notions of Discrimination

We start with an uncontestable fact: the term "discrimination" has decidedly different meanings when considered in economic vs. sociopolitical contexts. Among non-economists the term generally carries with it a sense of disgrace, scorn, or contempt. Its definition is also quite loose and highly circumstantial.

> *In contemporary public discourse, the notion of discrimination is thoroughly muddled. The chaos stems not only from partisan manipulation but from ambiguities in the concept itself. The most common definitions of "discrimination" contradict each other, and individuals often switch from one definition to another.*[29]

This observation about discrimination is instructive inasmuch as the author could very well have been speaking about the structure of rates for Internet access, but was instead addressing discrimination in the socio-cultural context of race, religion, or sex.

The economic welfare view of discrimination is quite different. Over 80 years ago, Professor J.M. Clark expressed an economic welfare view, while perceptively anticipating the current debate when he wrote:

> *Discrimination is the secret of efficiency… [But], discrimination is not solely an economic fact. It raises moral and social issues: it is the tool of favoritism and greed and the vehicle of the highest social justice. It may rouse our righteous resentment or our admiring commendation.*[30]

Discrimination is another word for differentiation in the exercise of discretion, judgment, discernment, insight, acumen, perception, refinement, sophistication, percipience, or distinction. Discrimination allows us to divide good from bad. It reflects the exercise of choice or simple commonsense in personal or political affairs. It need not reflect bias, prejudice, unfairness, inequity, bigotry, malicious intent, intolerance, exploitation, predation, favoring the favored, fostering injustice, hurting innocent people, or contributing to any other opprobrious outcome.

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[29] Curtis Crawford, "Discrimination: A Clear and Consistent Definition" (April 2002). Online at: http://www.debatingracialpreference.org/DefiningDiscrimination.htm. An earlier version of this essay appeared in *Academic Questions* 14:3, Summer 2001 as "Rescuing the Concept of Discrimination."

[30] J.M. Clark, Economics of Overhead Cost, University of Chicago Press, Chicago and London, 1923. p. 416 (hereafter, J.M. Clark).

Net neutrality advocates have relied heavily on arguments that conflate the effects of economic price discrimination with those of sociopolitical and cultural discrimination. As a matter of economic policy, it is absolutely critical to separate the socio-political and moral and ethical baggage from the term discrimination and to focus on its economic elements and welfare implications.

Economic Welfare Impacts of Price Discrimination

It is fair to say that the economics literature on price discrimination offers very little support for the conclusion of net neutrality advocates that the threat of price discrimination warrants imposition of common carrier style rate and service regulation. The following reports a cross section of the economics literature, much of which dates back several decades.

Discrimination Is Required By Scale Economies And Common Costs. The efficiency, welfare maximizing character of prices reflecting marginal costs does not apply to firms with declining costs and a high ratio of fixed (common) to variable costs – characteristics that clearly apply to Internet access providers.[31] Economics 101 teaches that the firm cannot survive with prices set at marginal costs. The conclusion is not new. In the presence of overhead (fixed) costs as a large share of the total, "Discrimination is the secret of efficiency." The inability of such firms to survive with marginal cost pricing "leads to a system of making each separate section of the business pay the largest possible yield above differential cost.[32] And, finally, "…discrimination is not a symptom of monopoly, still less of extortionate prices." It is a natural result of overhead costs, and is found in practically every phase of business.

Price Discrimination Has Historically Been Required By National Telecommunications Policy. Discrimination in the sense of differentiation of products, services, prices or practices is permitted and has routinely been encouraged by the FCC under the Communications Act of 1934. "Carriers" have been required to differentiate rates by class of service, by type or class of user, by section of the country, by volume, and in numerous other, more specific, dimensions. Telecommunications policy has for several decades promoted price discrimination. Application of the law has given carriers wide latitude in varying rates to recover common costs and earn a fair return.[33]

It has been argued forcefully that "mandated service virtually requires differential pricing."[34] Thus, "Telecommunications services often involve large fixed costs, low marginal costs, and significant shared costs. If such services are required to be provided to a large

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[31] Fixed and/or common costs are not attributable on a cost causation basis to any particular user. They are shared costs; they must be fully recovered; but, they are not the responsibility of any one user. Thus, the means for their recovery varies widely from industry to industry and from firm to firm. Every method involves a form of "discrimination" in the sense that rates or contributions to overhead are different for different services or users. Any form of homogeneity or markup in pursuit of "neutrality" is nonsensical.

[32] J. M. Clark, p. 416.

[33] Section 202 (a) permits reasonable discrimination, reasonable prejudice, reasonable preference and imposing reasonable disadvantage among different users. FCC policy has been to encourage and in many cases require "just, reasonable and not undue" discrimination.

[34] Hal Varian, "Differential Pricing and Efficiency," *First Monday—Peer Reviewed Online Journal*, 1996. http://outreach.lib.uic.edu/www/issues/issue2/different/#SECTION00012.

number of diverse users, and costs are to be covered without the use of externally provided subsidies, it is very likely that differential pricing will be necessary."[35] Low prices sufficient to attract large numbers of subscribers will not cover costs, according to Varian. And, "The only way out of this dilemma is to either provide subsidies for customers with low ability to pay, or for the firm to engage in differential pricing." Put differently, given the cost structure of broadband networks, the goal of "universal broadband access" virtually requires rate discrimination.

Price Discrimination Is Not A Sign Of Market Power. The ability and incentive to discriminate with respect to price and terms of service do not establish the existence of market power. Thus, "Price discrimination among buyers…is …routine even in highly competitive markets, including hotels, computers, automobiles, books, clothing, groceries, restaurants, telecommunications, and the vast range of other products that offer coupons, rebates, student or senior discounts, quantity discounts, or different prices at different times or places. Indeed, it is hard to think of industries without price discrimination.[36] Furthermore, price discrimination generally leads to greater output (than for single, uniform prices for uses and users) and contrasts sharply with the well known monopoly practice of restricting output in order to increase profits.

Market segmentation and differential pricing are not counter to market competition, but rather an integral part of the operation of market forces. In a wide variety of circumstances "…it is the very presence of effective competition that forces discriminatory prices on the firm."[37] Uniform prices (that is prices that are not differentiated with respect to idiosyncratic demand characteristics associated with different uses and users) are NOT sustainable in most industry contexts. Put differently, competition may sometimes ineluctably lead to price discrimination. Thus, "…in a broad range of market types and conditions, where consumers can be separated into distinct groups with different demand elasticities and in which the market's commodity cannot easily be resold by one group to another, market pressures will prevent any equilibrium at which the price is uniform. Not only will each firm adopt discriminatory prices, but each firm is likely to be forced to adopt a unique vector of prices, each of which is dictated by the market."[38] And, "…in highly competitive markets, firms may have no choice [but to practice price discrimination] …"[39] The economics literature is clear. Price discrimination is not only compatible with effective competition and economic welfare maximization, but it may be necessary to forming a sustainable structure of prices.

Price Discrimination Is The Rule Rather Than The Exception In US Product And Service Markets. Price discrimination may be regarded as a two step process involving separation of the market into clusters of users and subsequent price differentiation among different clusters. Prices may be further differentiated among users within a cluster or for the same user at

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[35] Ibid.
[36] Einer Elhauge, "Why Above-Cost Price Cuts To Drive Out Entrants Are Not Predatory—and the Implications for Defining Costs and Market Power", *Yale Law Journal*, v. 12, 2003, p. 733.
[37] William Baumol, *Regulation Misled by Misread Theory*, AEI-Brookings Joint Center, 2006, p. 2.
[37] Ibid.
[38] Ibid., pp. 2-3.
[39] Ibid, p. 3.

different time periods or for different volumes. Thus, "Price discrimination among buyers…is…routine.[40] It is "…one of the most prevalent forms of marketing practice."[41] It is everywhere, since, "Casual observation suggests that price discrimination is common in many industries…"[42] Finally, "…pricing structures designed to accomplish segmentation [among users and uses] are widely used…in the economy."[43]

Market segmentation and price discrimination are widespread within the ICT sector. They are practiced by virtually all of the major suppliers: Intel, Microsoft, Dell, eBay, Amazon, Google, Yahoo, and others.[44] Practices equivalent to so-called "access-tiering" are common in the ICT sector and in (most) other sectors of the economy.[45]

In explaining and defending price discrimination, Professor Hal Varian, now the Chief Economist for Google, has expressed a view shared by most economists as follows:

> *The classic prescription for economically efficient pricing---set price at marginal cost---is not relevant for technologies that exhibit the kinds of increasing returns to scale, large fixed costs, or economies of scope found in the telecommunications and information industries. The appropriate guiding principle in these contexts should be that the marginal willingness to pay should be equal to marginal cost. This condition for efficiency can be approximated using differential pricing, and will in fact, be a natural outcome of profit-seeking behavior.*[46]

Market performance in other "regulated" industries – surface transport, air transport, electric and gas utilities, pipelines, and circuit switched telecommunications – has shown the

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[40] Einer Elhauge, "Why Above-Cost Price Cuts To Drive Out Entrants Are Not Predatory—and the Implications for Defining Costs and Market Power," *Yale Law Journal*, v. 12, 2003, p. 733.

[41] Hal Varian, "Price Discrimination," *Handbook of Industrial Organization*, vol. 1, (Schmalansee and Willig eds.), North Holland, 1989 at p. 598.

[42] William Baumol, Regulation Misled by Misread Theory, AEI-Brookings Joint Center, 2006, p.1

[43] Michael Levine, "Price Discrimination without Market Power", *Yale Journal on Regulation*, 2001, p. 2.

[44] "Versioning" is the term of art used to describe quality variation among users in the IT sector. It was coined by Professor Hal Varian. Versioning refers to a form of *quality discrimination* in which sellers purposely structure output and market offers so as to provide different qualities/versions of a good which they then sell at different prices. The whole purpose of versioning is to encourage consumers to cluster themselves in different groups according to their respective willingness to pay and thereby enable sellers to tailor prices according to consumer demand differences. While the term is relatively new, the practice is not. Hal Varian, "Versioning Information Goods", March 13, 1997 at p. 1. Online at: http://people.ischool.berkeley.edu/~hal/Papers/version.pdf.

[45] I use the term "access-tiering" in the same sense as suggested by Professor Lessig in testimony before the Senate Commerce Committee, namely: "By 'access-tiering,' I mean any policy by network owners to condition content or service providers' right to provide content or service to the network upon the payment of some fee." (Lessig testimony to Senate Commerce Committee, February 7, 2006 at p. 2.)

[46] Hal Varian, "Differential Pricing and Efficiency," First Monday—Peer Reviewed Online Journal, 1996 http://www.sims.berkeley.edu/~hal/people/hal/papers.html.

welfare enhancing properties of price discrimination of this kind is likely to evolve in markets for Internet access and use.[47]

Price Discrimination Is Not Grounds For Rate And Service Regulation. The presence of the ability, incentive and practice of rate and service discrimination by a network service provider is not sufficient grounds to warrant regulatory intervention in the price setting process.[48] Market segmentation and price differentiation among different clusters of use or user is a common means of competing throughout the economy. Price discrimination is not a "sign" of monopoly power and does not provide a principled consumer welfare basis for rate regulation. One expert concluded: "Indeed, it is hard to think of industries without price discrimination…, even though most of these industries are highly competitive or contestable, and the firms in them earn zero economic profit (i.e., a normal rate of return)."[49] Pricing to reflect demand characteristics is commonly done and contributes to economic efficiency. The characteristics of consumer demand are an integral part of efficiency judgments.[50] Whether or not a particular policy is efficient cannot be based on cost considerations alone.

Price Discrimination is Consistent with Investment Incentives Needed to Achieve Universal Broadband Goal. Price discrimination has salutary financial effects inasmuch as it permits cost recovery, reduces risk, allows for the widest diffusion and use of services and thereby encourages investment and innovation. A uniform pricing standard would increase risk, would limit the reach and scope of diffusion of services and would likely not cover costs – all of which are serious deterrents to investment.[51]

Investment analysts are concerned about the impact of net neutrality regulations on investment returns. Investors are somewhat skeptical about prospects that "…the substantial investment underway at the [phone companies] to deliver broadband networks to the home will deliver a satisfactory return on the incremental investment," according to testimony of Luke Szymczak, vice president of JPMorgan Asset Management. Craig Moffett, VP and senior analyst of U.S. cable and satellite broadcasting at Sanford C. Bernstein & Co. in recent testimony opposed network-neutrality mandates by government and warned that:

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[47] Andrew Odlyzko, "Pricing and Architecture of the Internet: Historical Perspectives from Telecommunications and Transportation," available at http://www.dtc.umn.edu/~odlyzko/doc/pricing.architecture.pdf. See also, Andrew Odlyzko, "The Evolution of Price Discrimination in Transportation and its Implications for the Internet" *Review of Network Economics,* Vol.3, Issue 3, September 2004. Online at: http://www.rnejournal.com/artman2/publish/vol3_3/The_Evolution_of_Price_Discrimination_printer.shtml.

[48] Ibid.

[49] Einer Elhauge, "Why Above-Cost Price Cuts To Drive Out Entrants Are Not Predatory—and the Implications for Defining Costs and Market Power", *Yale Law Journal,* v. 12, 2003, p. 733.

[50] Baumol, William J., and David F. Bradford (1970): "Optimal Departures from Marginal Cost Pricing," *American Economic Review*, 60(3), June 1970, pp. 265-83.

[51] "The practical effect of "net neutrality" obligations would be to require a telecommunications carrier to recover the full cost of its broadband network connection through a uniform flat-rate charge imposed on all end users." (Testimony of J. Gregory Sidak, 2-7-06 before Committee on Commerce, Science and Transportation, US Senate at p. 1.)

> *…if network owners were barred from creating a "fast lane" on the Internet to generate more revenue to cover capital expenditures, they would have to recover much, if not all, of their cost from subscribers, whose monthly bills would likely rise substantially…Mandated net neutrality would further sour Wall Street's taste for broadband-infrastructure investments, making it increasingly difficult to sustain necessary capital returns, and it would likely mean that consumers alone would be required to foot the entire bill for whatever network investments do get made.*[52]

Price Discrimination Adds to Consumer Welfare. Current and future (expected) levels of consumer welfare are assured to be greater with demand differentiated (discriminatory) price structures than with uniform prices. Using the present value of consumer surplus is the appropriate consumer welfare metric, economic welfare analysis establishes that demand differentiated prices increase total economic welfare and, more importantly, economic welfare of each class of use or users will under a wide variety of circumstances also be higher.[53] This is true for three reasons related to a) demand effects, b) supply effects and c) non-price effects.

Thus, in lieu of price differentiation, carriers will have to charge a higher average price to cover the full cost of the network. Some consumers (those with a relatively more elastic demand) will not be willing to pay a higher average price, which will repress demand, increase the burden of common costs on other users, and decrease consumer welfare (demand effect). Secondly, because broadband is price elastic, an increase in price will lead to a decrease in revenues. With falling revenue and repressed demand, investors will shun investments in some markets, which will impede broadband build outs, withhold state-of-the-art services from all consumers in some markets and thereby further reduce consumer welfare (supply effect), Finally, without investment supported by differential pricing, consumers will forego not have the option of higher quality services; they will be stripped of savings from joint consumption, and be denied benefits from technical change (non-price effects).

There Is No Evidence that Rate Regulation By Government Will Enhance Consumer Welfare. Technological and economic dynamism of the sector undercuts the ability to forecast future market conditions and, per force, the impact of regulation on market outcomes. Rate regulation is associated with unforeseen and unintended outcomes which invariably are costly. Given the ambiguities and complexity of measuring cost in a dynamic Internet services environment, cost based regulation is assured to be arbitrary, capricious and the source for substantial dynamic inefficiency and waste. Rate regulation is sure to introduce delay, increase

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[52] Testimony of Craig Moffet before the Senate Committee Hearing on Net Neutrality, "Wall Street's Perspective on Telecommunications", March 14, 2006. Online at: http://commerce.senate.gov/hearings/witnesslist.cfm?id=1 705. A hearings summary and commentary is available at: Ted Hearn, "Analysts Question Bell Investments", *Multichannel News,* March 14, 2006. Online at: http://www.multichannel.com/article/CA6316081 .html?display=Breaking+News.

[53] The economics literature generally supports the conclusion cited by Varian: "The general impression that follows from this discussion is if price differentiation allows more consumers to be served it will generally increase welfare…Market segmentation that allows markets to be served that would otherwise be neglected is also a case where overall welfare can be expected to be enhanced. Hal Varian, "Differential Pricing and Efficiency" (see footnote 46).

uncertainty, add to investment risk and thereby reduce both the rate and likely amount of capital formation on which new services and consumer welfare depend. As one authority put it:

> *…political pressure generated by resentment of price discrimination is usually expressed as calls for measures that eliminate the market power assumed to underlie it. And given that perfect regulation is as rare as perfect markets, those measures can easily produce results inferior to those they were intended to remedy.*[54]

Concluding Thoughts and Observations

Price discrimination is practiced throughout the US economy and is generally regarded as a source of economic efficiency that in general creates consumer welfare, when compared to pricing regimes that reflect more homogeneity and uniformity. The practice goes by a variety of names other than price discrimination – demand based pricing, charging what the traffic will bear, willingness to pay, Ramsey pricing, value of service pricing, and others, most of which attract less criticism than those referring in any way to "discrimination." Discriminatory pricing is taught in business schools in courses on general management, marketing, managerial economics, strategy, or the like. It is ironic that one of the greatest sources of discrimination derives from requirements to treat different entities the same, particularly in the context of the fact that usage by so-called "bandwidth hogs" often amounts to manifold times that of ordinary users. Under net neutrality, nondiscrimination proposals, all subscribers would pay the same rate, without regard to usage or congestion costs imposed on the network. Over 80 years ago an authority on recovering overhead costs of networks put it differently:

> *One of the simplest and most common kinds of discrimination occurs through failure to discriminate: that is, charging flat rate amounts where cost and service rendered both vary.*[55]

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[54] Levine at p. 4.
[55] Clark at p. 428.

The Packets Must Get Through

Steven Titch

To the ears of the American consumer, a rule that would require phone, cable and wireless companies to treat all Internet and Web applications the same way—with no favoritism shown—might sound like a fair deal.

From its start, open access is what the Internet has been all about. Indeed, consumers should be able to access the Internet and Web applications they wish. Any individual, business or organization who wants to set up a web presence, from a personal blog to a major e-commerce site, should face no barrier to reaching users.

No one wants to take the Internet's resources or utility away. Yet the proposal by the Federal Communications Commission (FCC) to create a "non-discrimination" rule, which would come under the general heading of network neutrality, although intended to preserve robust, open and quality access to all Internet applications, stands to have the opposite effect.

The non-discrimination rule, if enacted, would prohibit telephone companies, cable companies, wireless companies and other Internet service providers (ISPs)—the companies that built and own the local and long distance networks that carry Internet traffic—from applying any technology, technique or software that would prioritize, organize or otherwise structure Internet traffic so that it is delivered faster, has a guaranteed level of quality, or is partitioned in such a way that it does not slow or impede other traffic. While the FCC's Notice of Proposed Rulemaking on network neutrality, released October 22, 2009, would allow vaguely defined "reasonable" network management, the NPRM also stated "that a bright-line rule against discrimination… may better fit the unique characteristics of the Internet."[56]

To support his point, FCC Chairman Julius Genachowski says the non-discrimination rule was a founding principle of the Internet.[57] To call it a "principle" is somewhat misleading. It is true that when network engineers developed the Internet Protocol (IP), it was designed to use the intelligence in the computers and routers at each end of the connection. That was because at the time, the late 1960s and 1970s, there was no intelligence in the telephone network to perform even the most basic of quality and prioritization functions. Non-discrimination was a necessary condition of the early Internet, not a prescribed rule as to how Internet transmission would always work.

The Internet: Then and Now

Today, 40 years since the first Internet connection was set up, network transmission technology is far different. The public communications network does hold the intelligence to improve, enhance and prioritize Internet traffic. In private networks, it already does. In wireless,

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[56] Federal Communications Commission, "Notice of Proposed Rulemaking: In the Matter of Preserving the Open Internet Broadband Industry Practices," GN Docket No. 09-191, WC Docket No. 07-52, Oct. 22, 2009.

[57] Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity," speech to Brookings Institution, Sept. 21, 2009.

the entire history of technology evolution is about finding ways to fit more data into a radio channel of fixed space. Some of these techniques, because they grant transmission priority to certain applications over others, allowing data applications on devices like iPhones and BlackBerrys to work, would likely be considered discrimination under the FCC's new rule.

Second, and perhaps more important, today's Internet applications are a far cry from the simple text characters transmitted at 300 bits-per-second (b/s) over those first connections.

Think of the ways you've used the Internet today. You've probably sent email, maybe with photos or lengthy documents attached. Perhaps you've made a clothing purchase, or paid your credit card bill. Maybe you've downloaded some music, or watched a video from YouTube, Netflix or Hulu.

Did you use your wireless phone to send a text message on your way to work? To update your picture on Facebook? To check up your fantasy football team? Your cell phone uses the Internet, too.

When you badged into your office, your building's security system likely used the Internet to verify your employment status and let you in. In fact, your company's entire security network, from video surveillance to fire alarms, probably uses the Internet, especially if it is spread over several buildings and locations.

Then there are all the unseen transactions that occur within the network itself. Search engines constantly crawl the Web collecting keyword data from Websites worldwide. When you perform a Web search, data from thousand of servers are instantly correlated, packaged and delivered to your desktop, with ad links that correspond to your search parameters. The Web-based financial transaction that occurs in seconds involve multiple links and data exchange between you, the retailer, your bank, the retailer's bank, a credit verification database and any other party with a stake in the transaction.

As you might imagine, all this adds up to an enormous amount of data moving across the network. Indeed, Bart Swanson and George Gilder have been tracking the growth of Internet traffic since early this decade. In January 2008, using data from Cisco Systems, the world's leading supplier of Internet switches and routers, Swenson and Gilder reported that monthly Internet traffic in 2007 had reached 2.5 exabytes, or 2.5 quintillion bytes (2.5×10^{19}), up from approximately 1 exabyte in 2005. Cisco projected monthly Internet traffic would reach 5.5 exabytes by 2009 and 9 exabytes by 2011.[58]

While there is vast amount of bandwidth capacity in the public network, vast does not mean unlimited. And while investment in infrastructure continues, the costly deployment of more physical facilities—fiber optics and cell antennas—should not be legally locked in as the only solution growing bandwidth consumption.

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[58] George Gilder and Bret Swanson, Estimating the Exaflood, Discovery Institute, January 2008. Available at http://www.discovery.org/scripts/viewDB/filesDB-download.php?command=download&id=1475.

Besides, construction of more physical facilities only addresses the congestion problem. You may indeed speed traffic by building more lanes, but the expanding diversity of Internet and Web applications creates quality requirements that can't be solved by the addition physical facilities alone.

This is where the non-discrimination principle of network neutrality would create massive problems for users and applications providers. In order for some applications to function correctly, their data may require special treatment as it crosses the network. This is especially true with video, which is both data-intensive (a 10-minute, low-resolution YouTube video can be 100 megabytes) and error-sensitive. In fact, enterprises which put a lot of video on their networks, such as in the building security example above, use techniques such as bandwidth management, partitioning and packet prioritization to make sure video is transmitted effectively yet does not interfere with the flow of mission-critical enterprise data. It's troublesome that the FCC would prohibit in the public sphere techniques that are indispensible to smooth operation of business networks.

Packets and Prioritization

Since it is key to understanding the unintended consequences network neutrality presents, let's examine what we mean by data packets and packet prioritization.

The way the Internet Protocol is engineered, data—all those ones and zeros—travels the network in packets. The term is apropos. Think about the way you send a letter. You write your message on a piece of stationary and place it in an envelope, which you then address and mail. The post office uses the information on the envelope to route your letter to the intended recipient. If there is a problem, the letter is returned to sender, using the return address, also written on the envelope.

Data packets work the same way. A string of data is bundled into an electronic packet. The packet's envelope, or header, contains the destination information, in the form of an IP address. The network routers read this information and send the packet to its destination. If something goes wrong and the packet can't be delivered, the network signals the transmitting end, akin to a "return to sender." The transmitting computer or router sends the packet again and continues to do so until the machine at the other end acknowledges receipt.

The only difference is that on the Internet, an application, be it an email, image or video, contains thousands, if not millions, of packets. When we mail a letter, we can send the whole message in one envelope. On the Internet, it is more akin to sending your letter one word at a time, leaving it up to your recipient to wait for all the envelopes to arrive, then to assemble the message. And, as with the post office, on the Internet packets may not arrive in the order they were sent. As a sender, you will have to rely on the intelligence of your recipient to reorder the packets and reconstruct your message. If one packet is lost or damaged on the way, your recipient may have to deduce the missing information. This, of course, adds time to the ultimately delivery and communication of your message. In Internet lingo, this delay is called latency.

This is why the Internet transmission is often referred to as "best effort." It is practically the same principle as first-class mail. Computers send out data packets, they are transmitted across the network and arrive at their destination essentially when they get there.

Best effort is not as big a problem for email, documents and small files which can be assembled quickly. These applications can better tolerate latency and errors.

Other applications are far more sensitive to errors and latency. Take video streaming, for example. Video not only consists of much more data than most files, it also has to be delivered in the right order and needs to be assembled quickly.

Almost everyone has experienced freeze-ups while watching Internet video. These can be annoying with free services such as YouTube and Hulu. Imaging paying $10 to $20 for a streaming video only to have it fail partway through.

Latency is a major issue in gaming. If you've played *Resident Evil* online you know how frustrating it is to be killed by an oncoming zombie while you're firing away with your mouse yet seeing no result on screen.

Fortunately, the post office does not employ the non-discrimination principle. In mail or shipping, senders can pay more for one- or two-day delivery. They can request a return receipt. They can insure valuable items against loss. All of these come at an extra cost, but they are not seen as unfair to individuals who use regular mail, nor do "fast lane" services interfere with standard delivery.

Under the FCC's non-discriminatory rule, there would be no ability for providers of sophisticated applications to pay a premium to guarantee a higher level of performance. Nor could service providers charge the companies that use immense amounts of bandwidth—search engines, studios, media companies, peer-to-peer services—fees that would reflect the cost of the added management strain they place on the network. While the motivation is preservation of an open Internet, the outcome would be the opposite. The rules would demand ISPs follow 40-year-old data communications architectures that have already been surpassed. The result would be an expensive, slow, poorly performing Internet that would be unable to support bandwidth-rich applications.

On the other hand, there is every sign that foregoing Internet regulation would lead to the development of business models and market-based solutions that would create an environment where all types of applications could be supported and delivered; getting the network management support they need while avoiding interference with applications that work just fine with best effort.

The FCC argues that the market alone cannot manage competing interests when it comes to applications management on the Internet. Yet there has been no pattern of abuse. The non-discrimination rule comes in response to a single incident where a service provider used network technology to manage the way a third-party application worked. In October 2008, Comcast, the nation's largest cable company, confirmed reports that it was intentionally slowing down the rate of voluminous video files that were being transferred via BitTorrent.com, one of many so-called peer-to-peer (P2P) sites that allow users to search for and exchange movies and TV shows between and among their own PCs. BitTorrent software is designed to set up as many simultaneous connections as possible between the user's PC and BitTorrent's file sharing site (the more connections, the faster the transmission). To keep BitTorrent users from flooding the

network, especially at peak times, Comcast introduced software that limited the number of simultaneous connections the BitTorrent software could set up. BitTorrent users could still reach the site, but the rate of transfer was slowed. Comcast argued this network management decision was made to ensure service quality for the vast majority of Comcast Internet customers whose high-speed connections would be slowed by the amount of bandwidth P2P applications were gobbling up. Even cable industry critics such as George Ou, writing on ZDNet, conceded Comcast was within its rights to do so:

> *We can think of it as a freeway onramp that has lights on it to rate limit the number of cars that may enter a freeway… If you didn't have the lights and everyone tries to pile on to the freeway at the same time, everyone ends up with worse traffic.*[59]

What's more, Comcast and BitTorrent negotiated an amicable solution that respected each other's interest. Government handwringing over network neutrality has gone on for at least four years, yet the one instance of a dispute between a service provider and an applications provider over applications prioritization was resolved by market forces within weeks.[60]

The necessity of the FCC's network neutrality rules is questionable in general, but its non-discrimination mandate is downright counterproductive. Consumers will be better off without it. In summary, here are some reasons why:

Regulation will increase consumer costs

The cost of the management required to support sophisticated applications should be borne by the companies that produce, market and profit from these applications. Network neutrality, especially the non-discrimination principle, will force service providers to shift those costs onto the public in the form of higher broadband fees. Even network neutrality proponents, such as Computerworld's Mark Gibbs, admit this. "Now the downside: We're going to have to pay more. There's little doubt that regulated Internet service will probably be more expensive but that's the consequence of doing what's right for our society."[61]

Gibbs worries that if phone and cable companies can charge applications providers for prioritization and management, it will stifle innovation. That is not true. Fee-based network management services would, however, force entrepreneurs to develop business plans that account for the full cost of delivering service, a disciplined approach that is much more likely to yield long-run success all around. The network neutrality alternative sets up a dubious scheme that permits a business to privatize its gains from Internet commerce, while socializing its costs. It's hard to see what's "right for our society" about this.

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[59] George Ou, "A Rational Debate on Comcast Network Management," ZDNet, Nov. 6, 2007, available at http://blogs.zdnet.com/Ou/?p=852.

[60] The Comcast-BitTorrent example, along with the two other cases on which the FCC is building its case for Internet regulation, as discussed in depth in my policy study "The Internet is Not Neutral (and No Law Can Make It So)," Reason Foundation, May 2009.

[61] Mark Gibbs, "Network Neutrality: Doing the Right Things" Computerworld, Oct. 1, 2009. Available at http://www.computerworld.com/s/article/9138792/Network_neutrality_Doing_the_right_things?taxonomyId=16&pageNumber=2.

There will be no cost check on commercial bandwidth consumption

When commercial bandwidth costs are socialized—that is transferred to consumers—businesses have no incentive to limit their exploitation of Internet capacity. The exaflood will only get worse as the largest users, immune from paying the cost of their consumption, grab as much bandwidth as they can. So in addition to paying more, as net neutrality enthusiast Gibbs states, consumers will find the Internet a slow, frustrating experience. Wealthier consumers may have the option of purchasing higher bandwidth options, such as fiber to the home, but with no check on the supply side, even that capacity stands to be consumed.

Smaller players will be hurt, not helped

The final irony is that non-discrimination is supposed to protect the proverbial "little guy." Yet, with no partitioning or prioritization available for deep-pocketed companies, the smaller operations will be run off the road first. It would make sense for Fox or Universal to purchase a "fast lane" for its video feeds that are routinely downloaded by millions of users. The quality of this video might be better than what a local blogger can afford, but then again Fox and Universal can afford many things the lone blogger can't. The point of the open Internet isn't what the small Web site can afford; it's whether the small Web site can be heard. When heavy traffic can be prioritized and partitioned, the small site gets through.

Many innovative applications will never be developed

Policymakers argue that non-discrimination on network management is needed to ensure the Internet remains an incubator for innovation. To counter this, let's return to the post office analogy. Those who have visited Seattle may have come across the Pikes Place Fish Market, where each morning you can buy Alaskan king salmon that had been swimming the icy Pacific waters just hours before. At one time, if you wanted the best fish in the Northwest, you had to live in the Emerald City. Today, because of overnight shipping, Pikes Place Fish Market can deliver anywhere in the U.S.

For Pikes Place Fish Market, normal shipping (i.e., "best effort"), which can take three to seven days, was never an option, for obvious reasons. Its access to the national market, and the chance for consumers in Texas to buy superior seafood fresh from the catch would not have been possible without a premium choice for delivery.

The Internet works the same way. We already can name many existing services, like video and gaming, which would benefit from a fast lane. What we don't yet know are the applications and services that will be created *because* there is a fast lane. Regulation closes these opportunities off.

For all the talk about preserving a free and open Internet, network neutrality's non-discrimination rule would do neither. As bandwidth consumption increases almost geometrically, today's Internet needs commercial options that include prioritization, bandwidth optimization, applications partitioning and packet prioritization. If the Internet's going to work, the packets must get through.

Competition, Innovation and "Neutrality:" What Lies Behind the Rhetoric?

Everett Ehrlich

> *The rise of serious challenges to the free and open Internet puts us at a crossroads. We could see the Internet's doors shut to entrepreneurs, the spirit of innovation stifled, a full and free flow of information compromised...Saying nothing -- and doing nothing (about the principles that create "net neutrality") -- ... would be a dangerous retreat from the core principle of openness -- the freedom to innovate without permission -- that has been a hallmark of the Internet since its inception, and has made it so stunningly successful as a platform for innovation, opportunity, and prosperity.*
>
> FCC Chair Julius Genachowski
> September 21, 2009

This remarkable remark, made in the speech given by Chair Genachowski in which he outlined the two added principles that would create a "free and open" Internet, raises two important classes of questions. The first, of course, is specifying the "serious challenges to the free and open Internet." The second, and equally important yet more tacit, is how the absence of "net neutrality" would lead to an abridgement of "the freedom to innovate without permission."

The rhetoric of neutrality has, at various times, spoken of a compromise of the "end to end" principle, or about "permitted innovation," or about other problems associated with the view that broadband Internet service providers are a choke point that would throttle innovation. In his speech, Chair Genachowski appeared to embrace this view. But like much of the neutrality campaign, the arguments made in its favor amount to a series of assertions about the nature of competition, innovation, and the Internet itself. The underlying fact pattern is rarely evoked, nor is the way in which innovation happens critically examined.

This essay is an effort to address those gaps. It first discusses the "challenges" that, in the Chair's view, threaten the "free and open Internet." It then discusses what's really at stake in the neutrality debate, and examines what the possible innovative gains and losses might be under neutrality rules.

What Are "The Challenges?"

In his September 21 remarks, Chair Genachowski referred to the "challenges" facing the Internet as threefold. The first was "limited competition among service providers." This view holds that the cable- and telco-based providers of broadband Internet are a duopoly that presumably restrains the flow of benefits created by competition – falling prices, rising output, and innovation.

I have argued elsewhere that this view is flawed.[62] For example, in making the case that there is inadequate competition in the provision of broadband, some neutrality proponents argue that the number of broadband providers has gone from numbering in the hundreds to only a handful. What this argument refers to is the presence of myriad DSL providers in the late 1990s and early 2000s, all of whom were able to sell their service over phone company lines because of the regulatory requirement that they be allowed access to those systems. They built no new infrastructure, they did not innovate, and their services were wholly duplicative.

In contrast, there are only a few broadband competitors today, but they are actual *competitors* -- rivals who invest and innovate at each other's expense. Rather than firms that compete on a single platform, the U.S. broadband market now enjoys competition among entire *platforms* – consumers can access broadband via telco infrastructure (now including fiber), via cable, and, increasingly, via wireless. If the DSL providers of a decade ago were the sucker fish who lived off the bodies of whales, we now have an actual competition among whales. And that competition is only going to become more robust as wireless Internet grows in capability (WiMax). Thus, regardless of what you believe now, the future of broadband is one of *more* competition, not less.

Do these competing platforms constitute a duopoly? In the classic duopoly theory of Cournot, now 170 years old, two producers learn – like prisoners taken into separate rooms – that they are better off colluding than competing, and hence restrain the growth of output and raise prices. But Cournot's duopolists collude on price because that is the only area in which they can compete. That is, they produce a static, homogenous good and do not differentiate their product through innovation or customer service, as do broadband ISPs.

Imagine a world in which cable- and telco- "duopolists" agreed to restrain output and avoid price competition. They would then go out and compete *regardless* by providing faster and more reliable Internet service, making the entire point of collusion moot. That is, in brief, the Internet's history. In short, the duopoly model doesn't hold when a good is constantly changing through innovation.[63]

Let me make this point by quoting myself on the matter, fifteen years ago:

> *One day, capital intensive, fixed-cost systems will compete in a business defined by market penetration… (These) technologies are going to compete. Households will have the ultimate A/B switch.*[64]

This self-indulgence aside, the very competitiveness of these platforms is an important driver of innovation. Connection speeds continue to explode, as does the penetration of high-

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[62] See "The Reality of Competition in the Broadband Market," http://www.evehrlich.net/wp-content/uploads/2009/08/The-Reality-of-Competition-in-the-Broadband-Market.pdf.

[63] Nor does it when until costs decline, as they do in the high fixed cost world of broadband provision, and profitability is achieved by amortizing those costs over a larger number of subscribers.

[64] See http://www.evehrlich.net/1994/09/the-economics-of-signal-whats-ahead-for-the-information-superhighway/.

speed Internet. (See Shapiro and Hassett on page 5 of this volume.) And when considered in light of these connection speeds, the effective price of broadband is plummeting.[65]

The broadband Internet is, in short, a competitive environment and, as WiMax grows in availability and speed, will be more so in the future, not less. As opposed to sucker fish that compete to feed off the bodies of whales, we have a competition among the whales. Far from a challenge to the open Internet, this is what will preserve it.

A second "challenge" the Chair refers to is multi-market competition, or as he puts it:

> *The great majority of companies that operate our nation's broadband pipes rely upon revenue from selling phone service, cable TV subscriptions, or both. These services increasingly compete with voice and video products provided over the Internet. The net result is that broadband providers' rational bottom-line interests may diverge from the broad interests of consumers in competition and choice.*

Several points ought to be made regarding this assertion. He first is that current law already prohibits many of the violations this proposition imagines. For example, in the Madison River case, a rural telephone company was stopped by the FCC from blocking voice-over-Internet applications. In that regard, anti-trust law already provides significant protection.

But it should also be borne in mind that being in multiple markets – video, Internet, wireless and wireline telephony, and the like – exposes a company to *more* competition, not *less*.

The contrary view holds that a Verizon, AT&T, or Comcast, for example, will use the profits from one segment of their business to subsidize the others. But this isn't what happens. Instead, the more markets in which a firm participates, the more competition to which it is exposed. That's because the multi-market firm faces competition in every market.

Imagine, for example, that a firm experiences competitive losses in the wireline market and decides to divert to that product segment investments and resources from its wireless group. By doing so, it is conceding market to its wireless rivals. And while firms like Verizon, Comcast, Cox, ATT, or others often face many of the same competitors in many of their markets, the list of competitors is always expanding, whether it is in television, wireless, wireline, or mobile broadband carriers. In fact, it is increasingly possible to "synthetically" bundle video, telephony, and broadband without ever dealing with the integrated telco or cable companies.

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[65] Critics have argued that the prices of broadband have not changed much, but by making this argument, they ignore what the consumer is buying. According to the industry group US TELECOM, the same $40-$50 monthly price range of broadband bought a connection of about 1 Mbps (megabits per second) in 2001, 3 Mbps in 2004 and 15 Mbps in 2007. Providers have obviously identified a price point most households will support and then compete to see who can provide the highest quality service at that price point. This is, therefore, evidence of robust competition and innovation. In fact, this is precisely the type of behavior described as competitive in William Baumol's theory of competitive markets (W J Baumol, J C Panzar and R D Willig, *Contestable Markets and the Theory of Industry Structure*, New York, 1982).

Finally, the third of the Chair's "challenges" "involves the explosion of traffic on the Internet. With the growing popularity of high-bandwidth applications, Internet traffic is roughly doubling every two years." Yes – YouTube is now using more bandwidth than that of the entire Internet at the beginning of the decade – Steven Titch, in another essay in this volume, notes that Internet traffic rose by 250 percent from 2005 to 2007 and is projected by Cisco to double from 2007 to 2009. But with bandwidth continually dropping in price (thanks in part to competitive providers), it's not surprising that the demand for it has burgeoned.

What ought to surprise us is that capacity has kept pace! Economy-wide investment in telecommunications capital goods now runs at about $10 billion a month, perhaps the ultimate sign of competitive vibrancy. And this investment was only forthcoming once the FCC had loosened providers from the demand for common carriage in first cable, and then telephony (fiber).

Neutrality and Innovation

The Chair's "challenges" to an open Internet, therefore, do not seem to be grounds for active intervention, certainly not for as sweeping a policy reform as embodied in the principles he advocates. But beyond this connection lies the problem on which Chair focuses – that innovators will need "permission" to innovate if nothing is done to protect them.

The idea of innovators needing "permission" seems Orwellian – what "permission" is the Chair talking about?

We can begin to answer this (hypothetical) question by asking what neutrality would accomplish. In its shortest form, a "neutral" Internet is one in which all packets travel under the same conditions – or, to be more straightforward, some packets can't buy the right to move together *en* bloc or receive priority over others if there is congestion. This is what constitutes an "open end-to-end" Internet.

It should be noted that most of the economy operates in a "non-neutral" way. The air traffic system, electric utilities, wireless telephones – all use some variation of peak-load pricing to manage their capacity, which is why running your dryer during the weekdays is more expensive while using a mobile phone on a night or weekend is cheaper. Consumers are allowed to match price and product quality every day – they can buy "snail mail" or send mail by FedEx, or buy Sears' "Good," "Better," and "Best." So unless the argument is that the Internet is so unique – so *sui generis* – that allowing such conventional arrangements is intolerable, there must be some other explanation for the exception to which the Internet is entitled.

The objections raised by neutrality proponents are twofold, if I may categorize them on their behalf. The first is that the broadband ISPs – Verizon, AT&T, Comcast, and so on – are predisposed to abusive behavior. Mark Cooper of the Consumer Federation of America, in a debate with me in September, 2009, sponsored by the New America Foundation, said that responding to their abuses was like playing "whack a mole."

As anyone involved in this area will attest, this argument is pretty thin gruel. Madison River, a rural phone exchange, tried to limit Voice over Internet Protocol (VOIP) access on its Internet, and the FCC told them to grow up. AT&T once censored the live transmission of a Pearl Jam concert. A contract lawyer for Verizon Wireless once wouldn't let an abortion rights

group send out a mass text message, and was overruled by the company the next day. That's the list of "whack-a-mole" abuses. When the Pearl Jam incident occurred, neutrality advocate Larry Lessig remarked on his blog that he'd been warning about this potential abuse for "a decade" – did he wait a decade for validation of his position to find it in pulling the seven-second switch on Eddie Vedder? The argument for massive intervention in an important and well-behaving market needs to rest on something more profound.

There's then a more comprehensive argument – that allowing some websites to buy an "express lane" through the clutter will retard innovation by allowing price discrimination of making scale a more important barrier to entry; this is surely what the Chair means when he talks about "permission to innovate." If you believe that the high-speed ISPs are not sufficiently competitive, then this must be a concern. For example, what if Verizon were to decide that it was going to sell "express lanes" only to iTunes, and let other music providers sit in traffic? Or, going further, what if they signed some type of exclusive arrangement with iTunes and, as the New York Times editorialized in an embarrassing moment, "slow down or block their competitors' Web content." Dismayingly, *The Daily Show's* Jon Stewart suggested that Comcast might buy NBC and harass the content of other networks.[66]

As I've argued, that's not a neutrality issue – that's a predicate for a RICO case, a matter of open racketeering. If nothing else, it's subject to anti-trust laws. But more importantly, why don't we see it *right now*? If the providers have this potential for abuse, what restrains them today?

The answer is obviously *competition*. Users would flee any provider that provided exclusive deals that did not deliver consumer value (as did, for example, AT&T's deal with the iPhone, which obviously benefitted both parties as well as triggering a new cycle of innovation in handsets, but that neutrality would forbid). Why would providers allow their users to have access to MSNBC but not Fox, or vice-versa? Why would they consciously alienate users in a business that relied on higher yields to amortize high fixed costs? The answer you might get is "because they don't compete," but 1) they obviously *do* compete, as we can see by rising penetration, innovation, and investment, and 2) even if they *didn't*, why cannibalize their business by alienating users and rendering the "exclusivity" they might offer less valuable -- or the pleasure of forcing users to watch only either O'Reilly or Olbermann?

There's a different version of this argument, and a more sophisticated one. It's this – if you let some websites buy their way to the "front of the line," then they will preclude others from competing with them. In the eyes of thee proponents, the "open end-to-end principle" means that if the Internet gets slow, everyone will sit in traffic together. To do otherwise, as Susan Crawford has said, is to stop someone in a garage or a dorm room from being the "next Google."

There are several difficulties with this argument, not the least of which is that most of the funding and organization in support of neutrality has come from Google itself, meaning that

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[66] http://www.thedailyshow.com/watch/mon-october-26-2009/from-here-to-neutrality.

it is actively working to create an environment that penalizes it and helps its competitors. That, in its own right, should be, a troubling quandary.

But there are other, more economic, arguments against this view. The first is this – that there are *already* advantages built into the Internet and that allowing "express lanes" doesn't create advantages, but *balances* them. That is, scale is *already* a vital determinant of entry and abandoning neutrality would *lessen* its importance by making scale cheaper to achieve.

The most important example of existing scale is caching, placing remote servers around the Internet so that users are always near one when they try to reach Google or eBay or YouTube. By disallowing some websites from buying their way to a faster (or more reliable) connection to users, rather than a policy that prohibits economies of scale from being a determinant of success, neutrality all but *assures* scale's importance.

The idea that the "next Google" is to be found in a dorm room or garage is also potentially misleading. Sites such as Google, eBay, Yahoo, Match.com, Amazon, or whatever else (sometimes) arose from those humble beginnings because the Internet was in a formative period in which first-mover advantages were important. YouTube was a clever innovation; it was subsequently purchased by Google, the 13th largest company in America (by capitalization). Competing against a firm of this size will require scale no matter how you look at it; the best way to facilitate such competition is to make scale easier to achieve. But neutrality does quite the opposite – it preserves *existing* scale advantages.

So neutrality is unlikely to prohibit innovation by making scale important – scale is already important and neutrality would preserve it, freezing it in amber through caching and other capital-intensive techniques. Good ideas continue to percolate through the Internet and allowing price to ration congestion is unlikely to stop them.

There are then the set of innovations that neutrality would *preclude*, and these are important. Under the doctrine of "neutrality," the output from a remote medical device or the results of a securities transaction is given the same priority on the Internet as a video of a cat playing the xylophone. The best way to sort out these priorities is through markets, as we allow in every other circumstance.

Part of the problem with this arrangement is that it prohibits – if you like, *denies permission* to – innovations for which reliability is an important attribute. Consider the example of a remote medical device – perhaps a pacemaker or insulin pump – that sends a wireless signal to a transmitter that connects to a hospital. Buffering time would be an issue here – remove it, and the innovation is possible.

There are then possible new goods that would rely on different levels of reliability to allow consumers to match quality and price. High-definition broadcasts of live entertainment – sports events, concerts, and the like –would need reliability that could not be purchased under a "neutral" regime. (As the above-cited Titch article notes, a low-resolution, 10-minute YouTube video can be as large as 100 megabytes.) Or imagine different levels of quality associated with a service such as Skype; for one price, consumers can have a high-end equivalent in which interruptions for packet assembly and assembly are not needed because these packets have priority – either they move faster if there is congestion or they have purchased the right never

to be disassembled when they are transmitted across the Internet. For another price – zero – consumers can live with interruptions or turn off video when needed. Again, neutrality does not "permit" these kinds of innovations.

The idea that broadband providers will block innovations draws on a variety of faulty assumptions: that they are not competitive or otherwise do not respond to the will of consumers; that it is in their business interest to limit the content to which users can be exposed; that anti-trust and racketeering statutes do not provide protection against abuses; that neutrality would reduce economies of scale as a competitive advantage (instead of exacerbating them); and that there are no innovations that would be accelerated by a "competitive," as opposed to a "neutral" regime. None of the assumptions can bear the weight of scrutiny.

The debate will move forward when we drop the use of such Orwellian terms as "permitted innovation" or compromising "the full and free flow of information," or the "shutting of doors" to innovators and entrepreneurs. No such prospects are in the cards. Policy-makers discredit themselves when they insinuate that they are.

Does Net Neutrality Help or Hurt Consumers?

Stephen B. Pociask

Purpose

An FCC Notice of Proposed Rulemaking (NPRM) seeks to add and codify principles preserving an "open Internet," innocuously called *net neutrality*.[67] The FCC effort, as well as the introduction of legislation in the United States House of Representatives,[68] comes at a time when Congress has asked the FCC to develop a nationwide broadband plan, one that would spur consumer welfare and more ubiquitous infrastructure investment. As the FCC considers public comments, the wide variance in opinions about what exactly constitutes *net neutrality*, what the principles would encompass and how they should be enforced, create great uncertainly as these principles become regulations. While the FCC appears amenable to allowing Internet Service Providers (ISPs) to engage in reasonable network management, depending on exactly what regulations are eventually enforced could affect ISP pricing, quality and service differentiation, making the Internet look like what some have called a "one-size-fits-all" dumb pipe.[69]

While the industry can be characterized as having high fixed costs and economies of scale, the market performance of the industry points to extraordinary growth, high investment, increased competition, faster speeds and lower prices. According to the FCC's latest data (June 2008), broadband services reached over 132 million subscribers in the U.S., delivered by 863 asymmetrical digital subscriber line providers, 238 symmetrical digital subscriber line providers, 259 traditional wireline providers, 296 cable modem providers, 308 fiber providers, 4 satellite providers, 6 power line providers, 505 fixed wireless providers and 24 mobile wireless providers.[70] In total, these providers have at least some coverage in every zip code in the U.S. and there are indications that competition continues to increase. For instance, the FCC's previous broadband report estimated that 77.6% of zip codes had 5 or more providers, while its latest report estimated that 87.4% of zip codes had 5 or more providers – a 10% increase in overall U.S. penetration in just six months. By the middle of last year, there were 130 million more broadband subscribers today than there were just 10 years before. Along with increased speeds and extraordinary increases in growth, prices have significantly declined.[71] Based on market performance, there is no economic justification for a regulatory remedy.

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[67] "In the Matter of Preserving the Open Internet Broadband Industry Practices," Notice of Proposed Rulemaking, GN Docket No. 09-191 and WC Docket No. 07-52, Released October 22, 2009.

[68] In July 2009, Representatives Markey and Eshoo introduced the Internet Freedom Preservation Act (H.R. 3458), see http://markey.house.gov/images/PDFs/netneutralitybill.pdf.

[69] Scott M. Fulton, III, "House Republicans in Uncharacteristic Unison over 'One-Size-Fits-All' Net Neutrality," Betanews.com at http://www.betanews.com.

[70] These figures come from the FCC's broadband report "High-Speed Services for Internet Access" Status as of June 30, 2008, FCC, July 2009.

[71] Evidence of falling prices is documented by the United States Telecom Association, available online at http://www.ustelecom.org/uploadedFiles/Learn/Broadband.Pricing.Document.pdf. Also see, J. Gregory Sidak, "A Consumer Welfare Approach to Network Neutrality Regulations of the Internet," forthcoming in the *Journal of Competition Law & Economics*, Oxford Press, Vol. 2:3, 2006, p. 400. Sidak provides an example where the price of a 1.5 mbps DSL service declined by 81% during the last five years.

In fact, the FCC has cited the absence of Internet regulation as aiding the successful promotion of network investment, innovation and growth:

> *The Internet has evolved at an unprecedented pace, in large part due to the absence of government regulation. Consistent with the tradition of promoting innovation in new communications services, regulatory agencies should refrain from taking actions that could stifle the growth of the Internet. During this time of rapid telecommunications liberalization and technology innovation, unnecessary regulation can inhibit the global development and expansion of Internet infrastructure and services. To ensure that the Internet is available to as many persons as possible, the FCC has adopted a "hands-off" Internet policy. We are in the early stages of global Internet development, and policymakers should avoid actions that may limit the tremendous potential of Internet delivery.*[72]

While the FCC is now intent on writing net neutrality regulations, there has yet to be any identification of exactly what market failures exist that these regulations would fix, nor has there been any quantitative cost/benefit analysis to demonstrate how consumers would benefit. However, there have been numerous studies demonstrating that net neutrality regulation would, in fact, harm consumers. This, in fact, was the conclusion of the United States Department of Justice in their September 2007 filing to the FCC:

> *The FCC should be highly skeptical of calls to substitute special economic regulation of the Internet for free and open competition enforced by the antitrust laws. Marketplace restrictions proposed by some proponents of "net neutrality" could in fact prevent, rather than promote, optimal investment and innovation in the Internet, with significant negative effects for the economy and consumers.*[73]

The remaining portion of this essay provides evidence on the consequences of net neutrality regulation on consumers.

Net Neutrality means that Consumers Pay More for Investment Upgrades

While the FCC NPRM appears to permit consumers to pay different prices for different services, it clearly prohibits ISPs from offering differentiated prices to applications and content providers, effectively banning multi-sided pricing. Multi-sided pricing exists when a platform brings together independent groups that value each other's participation in the market. For instance, a newspaper (as the platform) brings together readers and advertisers -- collecting subscription fees from readers and selling ad space to businesses. Hahn and Wallsten observed that banning multi-sided pricing (effectively setting the ISP price for content providers at zero) would lead to consumer welfare losses.[74] In a comprehensive study on this issue, Darby and

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[72] "Connecting the Globe: A Regulator's Guide to Building a Global Information Community, Federal Communications Commission, available at http://www.fcc.gov/connectglobe/.

[73] "In the Matter of Broadband Industry Practices," WC Docket No. 07-52, *Ex parte* Filing from the United States Department of Justice to the Federal Communications Commission, September 6, 2007, p. 1, available at http://www.usdoj.gov/atr/public/comments/225767.htm.

[74] Robert Hahn and Scott Wallsten, "The Economics of Net Neutrality," AEI-Brookings Joint Center for Regulatory Studies, 2006.

Fuhr found that a ban on multi-sided pricing would require consumers to pay for all of the upgrades to the Internet, thereby increasing consumer prices and decreasing broadband demand – both of which would reduce network investment.[75] The study estimated the present value of lost consumer welfare to be as much as $32 billion over 10 years, or about $285 per broadband household. Sidak evaluated and modified Darby's figures and re-estimated the welfare losses to be in the range of $3.44 to $7.74 billion per year.[76] Pociask found that restrictions on multi-sided market pricing would mean that consumers lose $69 billion in potential benefits over the next 10 years.[77]

Net neutrality, as currently proposed by the FCC in its NPRM, would also prevent ISPs from providing enhanced quality of service to unaffiliated content providers. Litan and Singer estimated that this would lead to billions of dollars of consumer welfare losses – including a $1.5 billion decrease in consumer welfare just for foreclosing enhanced quality of service offerings to online multi-player video game providers.[78] In other words, net neutrality, as currently proposed, would prohibit voluntary commercial agreements with unaffiliated content providers – a practice that would keep consumers from getting lower broadband prices and make consumers pay for all of the investment and upgrade costs for the next generation network.

Net Neutrality Would Make the Network "Dumb" and Costly

The FCC's NPRM suggests that ISPs can retain reasonable network management, but how that is defined could make all of difference of whether consumers are adversely impacted by increased congestion, unwanted span and malicious online attacks. Even requiring ISPs to provide public details on their network management techniques could provide hackers and others the information they need to circumvent network management techniques and protect online consumers.

Studies evaluating the effects of making the Internet a dumb pipe point to adverse consequences for consumers. Litan and Singer cite one study's estimates that an unmanaged network would cost as much as $466 per month.[79] In another study, Ford, Koutsky and Spiwak found that a neutral network could cost consumers $300-$400 more per month than an "intelligent" network.[80] Yukel, Ramankrishnam, Kalyanaraman, Houle and Sadhvani showed that an undiffentiated service network could require nearly twice the provisioning (and therefore twice the network costs) as a managed network.[81]

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[75] Larry F. Darby and Joseph P. Fuhr, Jr., "Consumer Welfare, Capital Formation and Net Neutrality: Paying for Next Generation Broadband and Networks," *Media Law and Policy*, Summer 2007, pp. 122-64.

[76] J. Gregory Sidak, "A Consumer Welfare Approach to Network Neutrality Regulation of the Internet," *Journal of Competition Law and Economics*, 2:3, pp. 349-474, 2006.

[77] Stephen Pociask, "Net Neutrality and the Effects on Consumers," The American Consumer Institute, May 9, 2007.

[78] Robert E. Litan and Hal J. Singer, "Unintended Consequences of Net Neutrality Regulation," *Journal on Telecommunications and High Technology Law*, 2007.

[79] *Ibid*, on p. 15.

[80] George S. Ford, Thomas Koutsky and Lawrence J. Spiwak, "The Efficiency Risk of Network Neutrality Rules," Phoenix Center, Policy Bulletin No. 16, May 2006.

[81] Murat Yuksel, K. K. Ramakrishnan, Shiv Kalyanaraman, Joseph D. Houle and Rita Sadhvani, "Class-of-Service in IP Backbones: Informing the Network Neutrality Debate," Proceedings of ACM International

Net Neutrality Would Raise Prices for Low-Income Consumers

While the FCC's NPRM does not appear to take issue with ISPs charging different prices for different end-user services, some advocates for net neutrality have. Restrictions on price discrimination would limit the ability of Internet Service Providers to offer significantly lower priced broadband services at slower speeds and service quality. The effect of this prohibition would be to average service speeds and quality across all consumers, and, accordingly, price. That averaging would benefit high-end consumers by potentially lowering their price, but it would raise prices for lower-end consumers. This point is echoed by Greg Moore, executive director of the National NAACP Voter Fund:

> *The effects could be disastrous for low-income and minority communities, pricing them out of the broadband market by guaranteeing a free ride to companies such as Google and eBay while shifting costs for broadband expansion back to consumers. Although net neutrality activists claim to be protecting free speech, net neutrality regulations would effectively silence many minority voices, as low-income communities drop off the online landscape because they can't afford the price of admission.*[82]

Since broadband services are price elastic and since consumers with lower incomes are apt to be more price sensitive than other online users, any restriction on price discrimination would lead some lower income consumers to drop their online service. Even though high-end consumers are less price sensitive, there would still be some demand stimulation from lower prices, but (because of differences in price elasticity) the demand stimulation affecting high-end users would not offset the demand repression affecting low-end users. One study documents that increased network costs would disproportionately harm lower income consumers:

> *Net Neutrality regulations would also increase the price of broadband services, because it increases the cost of the network that provides those services. Because broadband services are very price sensitive, just a $5 increase in price could lead to a 15% drop in total broadband subscribership and a 60% decline in demand for lower-income, price sensitive consumers.*[83]

Service Innovation Threatened by Internet Regulations

Before the Internet became a mass market service, the idea of prioritizing traffic was considered a natural evolution from a best-effort Internet to an Internet that could meet quality of service standards.[84] Net neutrality regulations would deny ISPs the ability to differentiate services and prices, which may stymie Internet service innovation with the tragic result that

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Conference on Measurement and Modeling of Computer Systems (SIGMETRICS), Annapolis, MD, June 2008, pp. 465-466.

[82] Greg Moore, *Asbury Park Press*, May 11, 2007.

[83] Pociask (2007).

[84] Robert Bonometti, Stephen Pociask, Patrick White, Eric Firdman and Stathis Mavrotheris, "The Economics of Multimedia Data Networking," Harvard University Network Infrastructure Symposium, Dec. 1997, published by MIT Press.

some services and applications will never reach the consumer market. Net neutrality advocates support regulations that would prohibit an ISP from giving service guarantees to telemedicine applications between patients and hospitals. They also support provisions that would prevent network operators from giving priority to the delivery of emergency information over downloading music, and prohibiting Internet sponsors from paying for access to super fast Internet customers.

The late Dr. Frank Bowe, longtime distinguished professor for the Study of Disabilities at Hofstra University, wrote that net neutrality regulations would inhibit supportive technologies that can help millions of Americans with special needs.[85] Net neutrality would prohibit service level guarantees, which would hamper video relay and peer-to-peer video services. For Americans with hearing loss, these services are "functionally equivalent to a voice phone," according to Professor Bowe. Regulations may also inhibit development of innovative Internet services, such as text-to-speech applications that help the blind.

Because Internet regulations would prohibit ISPs from offering tailored services to customers, some unique network-based applications would never be developed to help the elderly and infirm. For example, under net neutrality, ISPs could be prohibited from adding extra network security for online access to hospital medical data banks. Dedicating bandwidth to integrated monitoring and interventions systems for chronically ill patients would be illegal, since it would require prioritizing medical needs over less critical information – like music downloads and other entertainment content. Unique video-based applications for telemedicine would be prohibited, including, for example, applications that allow doctors and hospitals to share and send video telecommunications, X-rays, and digital images to doctors and hospitals located in other parts of the country. At risk would be telemedicine applications now used to diagnose diseases such as osteoporosis, arthritis and cancer, as well as services used to monitor homebound patients with diabetes, congestive heart failure and other serious illnesses.

According to Litan, accelerating broadband use – just for senior citizens and those with disabilities alone – will add $620 billion in economic benefits in the next 25 years.[86] However, Litan sees the imposition of Internet regulations as a real threat to these benefits. One endocrinologist, Max E. Stachura, M.D., correctly summarized the problem with way:

> *A telehealth provider could conceive a new application for monitoring or remote management and therapy, but a network neutrality framework could preclude the broadband provider from offering the necessary bandwidth configuration. The point is that it is impossible to know today the network requirements of tomorrow's telemedicine. Policymakers would be unwise to lock in regulations that can only limit the flexibility of the broadband Internet.*[87]

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[85] Frank G. Bowe, "Net Neutrality and People with Disabilities," Hofstra University, May 2006.
[86] Robert Litan, "Great Expectation: Potential Economic Benefits to the Nation from Accelerated Broadband Deployment to Older Americans and Americans with Disabilities," NMRC, Dec. 2005.
[87] Max E. Strachura, M.D., "Promoting Telehealth in a Broadband World," APT, June 2006.

Conclusion

This essay has provided examples of how net neutrality rules would impede investment and innovation, and would push costs to consumers – particularly, lower-income, those with special needs, low-end online users and others. In the absence of any clear market failure, policymakers need to be cautious about promulgating rules that create more costs than benefits.

Environmental Considerations in Proposed Net Neutrality Regulations of Broadband Networks

Joseph P. Fuhr, Jr.

Introduction

The benefits of telecommunications networks and new information technologies are realized in all sectors of the economy and in a variety of different value-creating ways. Current public policy deliberations respecting "Net Neutrality" in the Congress and at the FCC will have significant impacts on the magnitude, type and distribution of these benefits. At stake are jobs, investment, innovation, increases in productivity, economic growth and the general availability of the bounty of the Internet to all citizens, as envisioned in the emerging national broadband policy. These issues and consequences are all a part of the general "Net Neutrality" debate.

However, broadband networks are very helpful in achieving other worthy public objectives such as environmental preservation, quality education, public security, health care, senior welfare, and rural development. In the context of this special ability of broadband networks to create extraordinary distant and collateral benefits, development of broadband should be encouraged. Regulation and taxation of broadband can reduce supply and demand for broadband networks by reducing funds available for investment and by raising prices for broadband services. The result will ripple and reverberate economy-wide and be felt by citizens who are denied the benefits, recognized and pursued by governments at all levels and in most countries, sure to be generated by the Broadband Economy.

This essay examines the positive effect that broadband can have on the environment and, by extension, some potential (unintended) environmental consequences of well meaning government market place interventions that have the effect of reducing investment and innovation in broadband networks.

The wide adoption and use of broadband applications can achieve a net reduction of 1 billion tons of greenhouse gas over 10 years, which, if converted into energy saved, would constitute 11% of annual U.S. oil imports.[88]

Broadband's Benefit to the Environment

The opportunity for broadband and information technology to reduce or avoid energy use, and thus help the environment, is evident in where we work, how we shop and what we consume. For instance, electronic communications are reducing the demand for first-class letters and newspaper subscriptions, which, in turn, reduces the need for paper, saves trees, conserves energy, pollutes less water and emits less greenhouse gases into the atmosphere. As workers telecommute, billions of gallons of gasoline are saved. E-commerce means that less square footage of commercial, retail and wholesale facilities are needed, which saves the energy required to build and operate these facilities. As workers teleconference, business travel is reduced, sparing carbon and other emissions as well. In short, high-speed Internet services and

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[88] Figures cited in this essay come from Joseph P. Fuhr and Stephen B. Pociask, "Broadband Services: Economic and Environmental Benefits," The American Consumer Institute, October 31, 2007.

other technologies are affecting how people shop, travel, work and use products, and the benefits to the environment can be significant.

The following are our specific estimates of the emission savings that are likely to result from the cumulative "network" effects of wide adoption and use of broadband-based applications and forecast the additional environmental benefits if trends continue over the next ten years. In terms of greenhouse gas emissions, these activities are likely to produce the following cumulative incremental benefits:

- Business-to-Business and Business-to-Consumer e-commerce is predicted to reduce greenhouse gases by 206.3 million (U.S.) tons.
- Telecommuting will reduce greenhouse gas emissions by 247.7 million tons due to less driving, 28.1 million tons due to reduced office construction, and 312.4 million tons because of energy saved by businesses.
- Teleconferencing could reduce greenhouse emissions by 199.8 million tons, if 10% of airline travel could be replaced by teleconferencing over the next 10 years.
- Reduction in first-class mail, plastics saved from downloading music/video and office paper from emails and electronic documents could reduce emissions by 67.2 million tons. For example, over the next 10 years, shifting newspaper subscriptions from physical to online media alone will save 57.4 million tons of carbon dioxide and other greenhouse gas emissions.

In summary, a review of existing literature shows that the potential impact of changes stemming from the delivery of broadband is estimated to be an incremental reduction of more than 1 billion tons of greenhouse gas emissions over 10 years.

Public Policies and Direction

It is important to note that the promise of these advancements and their contribution to improving the environment can only be fully realized with the widespread use of broadband services. In fact, it is likely that more widespread use of broadband services will lead to further innovation of services and applications that will produce even greater benefits for the environment. These innovations may include even faster Internet speeds, advances in wireless broadband networks, increased reliability and features that make online activities and transactions safer and more secure. To the extent this is true; the figures above underestimate the potential for greenhouse gas reductions and other environmental benefits that can result from the transformation of U.S.'s communications infrastructure from narrowband to broadband.

Expanding the availability of broadband can reduce energy use and lower greenhouse gas emissions and deserves to be an important consideration in developing a comprehensive energy policy. Focusing on ways to use these technologies as a tool to change behavior and energy use may achieve even greater savings. More research and ideas are needed to incorporate information technology solutions into the nation's energy policies. And even on a personal level, as people and businesses consider their own carbon footprints, they should be aware of the solutions that broadband and information technology can bring.

1. Energy Policy

U.S. legislators are trying to balance tough economic and environmental issues. On the one hand, energy is necessary for a vigorous and growing economy, but it has significant

environmental effects including carbon and other emissions that have been linked to global warming. In addition, the U.S. economy is heavily dependent on foreign oil that has been subject to volatile prices. That leaves the U.S. with three challenges, which are high energy prices, high energy use and high environmental impacts, not to mention national security issues.

Carbon dioxide from combustible fossil fuels represents 82% of greenhouse gas emissions,[89] and from 1990 to 2000 greenhouse gas emissions have increased 16%.[90] Actions to stem this threat have to date been modest at best and some proposed actions will most certainly affect economic growth and the basic standard of living of American consumers.[91] However, to do nothing simply would contribute to another set of problems – namely, pollution and global warming, which will affect our health and welfare.

As the adage goes -- *there is no silver bullet*. Most energy specialists concede that fixing the energy problem will be very difficult and that any success will require actions on a number of fronts – creating many alternative energy sources, imposing taxes to curb consumption,[92] encouraging energy efficiency, expanding recycling and encouraging domestic production. Public policies need to adopt standards that reduce pollutants, protect green areas and invest in clean energy research. These commonsense measures may not by themselves be enough. Some hard choices need to be made that address a comprehensive energy policy that deals with our consumption and production of energy on many fronts. Unfortunately, these choices will likely come at a cost to consumers.

2. Broadband Policy

Advanced technologies, including broadband services and telecommunications technologies, can have significant effects on energy use and the environment. Telecommunications services are changing our lives for the better. Broadband services and applications provide new ways to communicate and transfer information, including voice, data and video services. These services can facilitate telecommuting, teleconferencing, e-commerce, telemedicine and other applications that will save consumers and businesses travel expense, traffic congestion and time, as well as reducing greenhouse gas emissions. These technology solutions can increase business and personal productivity, while discouraging some of the migration to offshore jobs and encouraging what is called *homeshoring*, at little or no additional costs to consumers or economic welfare.

The transmission of bits of information, for example, means that consumers can download the content of books, CDs and videos, sparing the transport costs between manufacturer, warehouse and retail store, as well as reducing the production of paper and

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[89] According to the Department of Energy's National Information Administration, available online at http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html.

[90] This is a 2001 estimate from the Department of Energy. For more information, visit the Energy Information Administration's environmental website at www.eia.doe.gov/environment.html.

[91] "A Bargain," *The Economist*, May 4, 2007. A 0.1% reduction in worldwide GDP in each of the next 43 years is estimated to be the cost to "stabilise greenhouse-gas concentrations at 550 parts per million," according to www.economist.com/world/international/PrinterFriendly.cfm?story_id=9135283.

[92] Robert J. Shapiro, "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes," The American Consumer Institute, Feb. 2007, downloadable at www.aci-citizenresearch.org.

plastics. Broadband services in homes reduce the need for workers to commute to the office. Nurses can use remote health monitoring equipment to check the vital signs of some homebound patients. Students can attend class without ever leaving home.

The general benefits of these technologies and their effects on workers and consumers can be substantial. The *environmental benefits* of these technologies in addressing the nation's energy problem and reducing greenhouse gas emissions can be far reaching. Broadband services can achieve better and cleaner energy use, without stifling economic output, worker productivity and the standard of living of American consumers. The benefits are likely to be widespread, accruing to broad groups such as consumers, employees and employers, as well as specific niche groups, such as the special needs and the elderly.

A number of activities that advanced telecommunications and other technology-based services support can help the environment without sacrificing economic output, including e-commerce, telecommuting, e-materialization, telemedicine, teleconferencing and distance learning.

Workers and consumers routinely send and receive electronic documents that were once printed on paper, thereby saving trees, reducing air and water pollution and saving the energy needed for manufacturing, distribution and sales. Newspaper circulation is declining, in large part because of increased electronic forms of news. Home-monitoring of patients is leading to fewer emergency room visits and readmissions, while reducing the air pollution associated with some home visits by nurses. This is particularly beneficial to those with special needs and the elderly for whom travel is difficult, costly and potentially dangerous. These trends are likely to continue.

Having reviewed the literature and estimated the current level of the environmental effects, the forecasted 10-year cumulative incremental environmental benefits are immense – exceeding one billion tons of greenhouse gas emission reductions over the next ten years. The greatest potential for greenhouse reductions appears to be in e-commerce (206 million tons), telecommuting (over a half a billion tons), teleconferencing (200 million tons) and paper reduction (57 million by reductions in newspaper circulation alone). If all of the greenhouse reductions noted were converted into energy saved, that could save 555 million barrels of oil by year 10, or roughly 11% of the oil imported into the U.S. today.[93] Also, there are countless other potential benefits that were not measured which suggest that the potential environmental benefits of these technologies could be even greater. More research is needed to analyze and quantify these other benefits.

In general, the evidence shows that broadband-driven technologies can make a sizable contribution to reducing carbon emissions, as well as many other environmental benefits. This suggests that technological innovations such as these should be part of any comprehensive energy policy.

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[93] This assumes that a gallon of oil is equivalent to 40.5 kWh, 42 gallons per barrel and similar standard measures and calculated the annual savings in year 10. For comparison, there were is approximately 5 billion barrels of oil imported into the U.S. in 2006. These assumptions and U.S. crude oil and petroleum products imports come from www.eia.doe.gov and our estimates are only approximate.

On the other hand, since public policy for energy and environmental quality is shaped by a different set of regulators than those who govern information technology and specifically broadband, it is in the public interest that they collaborate in preserving the promise of information technology in curtailing greenhouse gas emissions at the same time as they foster economic growth. In a sense, the need for a "best of both worlds balance" is the main policy lesson learned from the information technology's and broadband's contribution to environmental preservation.

3. Regulations that may Impede Investment will Harm the Environment

In terms of policy development, the promise of these advancements and their contribution to the environment cannot be fully realized without the encouragement of ubiquitous advanced technologies and widespread use of broadband services by consumers and businesses. The extent, to which these environmental benefits can be fully realized, depends in large part on the ubiquitous deployment and widespread use of broadband services. That requires policies that encourage investment on the supply side and greater subscribership on the demand side.

On the other hand, public policies that impede the deployment of these technologies, such as net neutrality regulations and taxes, would slow broadband investment, reduce consumption and deployment of broadband services, and threaten the potential environmental benefits – most notably the reduction in greenhouse gases. However, while acknowledging the link between broadband development and environmental benefits, further policy discussions of how to best encourage adoption of broadband is beyond the scope of this study.

Conclusion

In summary, telecommunications and information technologies can play an important role in improving the environment and reducing greenhouse gas emissions. Further work is needed to explore policies that would encourage advances in telecommunications technologies, along with a sound and comprehensive energy policy that encourages energy efficiency, clean energy sources, independence, and conservation. Such policies can make a meaningful and sizable improvement in our environment by slowing energy use, conserving our water and natural resources and reducing greenhouse gas emissions. However, policymakers need to take steps to encourage investment that would benefit consumers and lead to large scale adoption of these important environmental applications.

Network Neutrality Regulation Would Impose Consumer Welfare Losses

By Hance Haney

The construction of the Internet is still not – and may never be – complete, and experts foresee the need for continuing massive investment by network operators. It could cost more than $350 billion to achieve universal access to the fastest broadband speeds, according to the staff of the Federal Communications Commission.[94] Another analysis, by Bret Swanson and George Gilder, concludes that the U.S. Internet of 2015 will be at least 50 times larger than it was in 2006 in order to accommodate the transition from text and low-resolution graphics to visually rich, interactive, high-resolution images.[95] They estimate that total new network investments – to expand bandwidth, storage, and traffic management capabilities in core, edge, metro, and access networks – will exceed $100 billion by 2012.

Aside from the many other benefits of broadband, $5 billion invested in broadband infrastructure would directly create 100,000 new jobs in the telecommunications and information technology industries in the year in which the spending occurs, according to President Larry Cohen of the Communications Workers of America.[96] A study by the Brookings Institution found that 300,000 private non-farm jobs are created throughout the entire economy for every one percentage point increase in broadband penetration.[97]

Unfortunately, some analysts view the massive investment required to expand the Internet's capacity – not counting the even more massive investment that would be necessary to deploy fast broadband access universally – skeptically. Others are more optimistic. However, the mixed views from analysts have created uncertainty for investors.[98] The investments necessary to build broadband infrastructure are inherently risky by their very nature, according to Debra J. Aron and Robert W. Crandall, who caution that "[p]rojects with inherently significant risk, as these are, would be especially sensitive to regulatory risk."[99]

This paper briefly highlights one significant opportunity to maintain high levels of investment in broadband networks at a lower relative cost to consumers, which current proposals for network neutrality regulation would prohibit. It also summarizes some of the

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[94] Fawn Johnson, "FCC Says Universal High-Speed Web Access Could Cost $350B," *Wall Street Journal* September 29, 2009, available at http://online.wsj.com/article/BT-CO-20090929-715810.html?mg=com-wsj.

[95] Bret Swanson George Gilder, "Estimating the Exaflood: The Impact of Video and Rich Media on the Internet – A Zettabyte By 2015?" Discovery Institute, January 29, 2008, available at http://www.discovery.org/a/4428.

[96] National Broadband Strategy Call to Action, *Communications Workers of America,* December 2, 2008, available at http://www.cwa-union.org/news/national-broadband-strategy-call-to-action.html.

[97] Robert Crandall, Robert E, Litan and William Lehr, "The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis of U.S. Data," Brookings Institution. (Jun. 2007, available at http://www.brookings.edu/papers/2007/06labor_crandall.aspx.

[98] Robert W. Crandall and Debra J. Aron, "Investment in Next Generation Networks and Wholesale Telecommunications Regulation," November, 03 2008, available at SSRN: http://ssrn.com/abstract=1294910 at 25-27.

[99] Id.

arguments on both sides of the more general question, "What impact does regulation have on investment?"

Purpose of Net Neutrality Regulation

Net neutrality regulation would limit the ability of broadband service providers to experiment with innovative pricing or bundling models to increase the appeal of broadband services. Robert Hahn and Scott Wallsten note that net neutrality is really another name for price regulation, which would require broadband providers to effectively charge content providers a price of zero.[100]

Net neutrality regulation would mandate that broadband providers must treat lawful content, applications, and services in a nondiscriminatory manner, subject to certain exceptions.[101]

Absent net neutrality regulation, nothing prevents broadband providers from raising the prices that providers of applications and services pay and lowering prices for consumers. For example, instead of charging consumers for access to advertising, broadband providers could charge advertisers for access to consumers. Lowering consumer prices for broadband access would benefit access, application and service providers in addition to consumers.

Should the government ensure that online advertising revenues flow only into the pockets of content providers, or should it allow the market to determine the most efficient way to allocate this resource? Advertising revenues support both content and delivery in other media, enabling providers to charge consumers little or nothing. The CEO of Google believes that mobile phone service could be free, subsidized by targeted ads.[102] The company was also prepared to establish a free, ad-supported Wi-Fi service throughout San Francisco with Earthlink, although negotiations with the city were unsuccessful.[103]

Prohibiting Content from Supporting Access

One simple way some of the cost of expanding the Internet and providing universal access could be shifted from consumers to content providers would be for broadband providers to offer content providers the option of paying for different levels of service. Consumers could see differences in the speed or reliability of Internet services depending on whether broadband providers choose to offer and content provider choose to pay, for premium service. Net

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[100] Robert Hahn and Scott Wallsten, "The Economics of Net Neutrality," *AEI-Brookings Joint Center for Regulatory Studies,* June 2006, available at http://aei-brookings.org/admin/authorpdfs/redirect-safely.php?fname=../pdffiles/ForReposting_6-19-06.pdf.

[101] In the Matter of Preserving the Open Internet, *Notice of Proposed Rulemaking*, GN Docket No. 09-191, October 22, 2009, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-09-93A1.pdf at paragraph 106.

[102] "Google CEO sees free cell phone service," *Reuters*, November 13, 2006, available at http://www.msnbc.msn.com/id/15700344/.

[103] John Markoff, "Google Says It Has No Plans for National Wi-Fi Service," *New York Times*, August 16, 2006) available at http://www.nytimes.com/2006/08/16/technology/16google.html; and Chris Nuttall, "Blow as two 'Muni WiFi' schemes fail," *Financial Times*, August 31, 2007, available at http://www.ft.com/cms/s/0/83dc6c26-5750-11dc-9a3a-0000779fd2ac.html?nclick_check=1.

neutrality regulation would only allow broadband service providers to charge subscribers different prices for different services, but not a content, application, or service provider.

Broadband access is provided in a multi-sided market, in which distinct groups share a common platform and benefit from each other's participation.[104] According to Larry Darby,

> *Because of the externalities among different sides, platform providers cultivate all sides. Thus, newspapers need readers and advertisers; broadcast networks need station affiliates, program producers, viewers, and advertisers; credit card companies need cardholders and participating merchants; Internet search engines providers need searchers, content, and advertisers; and so on…the Internet is comprised of agents that both receive value from and confer value upon other agents.*

New broadband subscribers create value for existing and future subscribers by lowering the average network cost per connected customer: "Twice as many customers connected allows costs to be spread in a way that reduces by half the cost borne by each customer," according to Darby.[105] Value is also created for service and application providers whose business models are related to the number of subscribers, "eyeballs," hits or other audience-related metrics.[106] Google CEO Eric Schmidt seemed to endorse this point during an interview with *Wired* magazine.

> *Remember, one of the critical things in our model is that having inexpensive or, ideally, free access to broadband is a good thing. Especially if it's somebody else who's going to subsidize that using their economics, we think it's great. And the more broadband we can get globally, the better. It's better for the world; it's better for our advertisers; it's better for Google.*[107]

Darby estimates the consumer welfare gain would be $8 billion over 10 years if content providers shared 10 percent of the common costs of constructing fiber-to-the-home (FTTH) to under one million households in the first year and up to 28.3 million homes in the tenth year.[108]

J. Gregory Sidak calculates savings of $3 billion to $6 billion per year if new sources of revenue allowed broadband providers to reduce access prices to the then-existing base of broadband subscribers (50.2 million households) by $5 to $10 per month.[109] Sidak also concluded that an additional 14.3 million homes would subscribe to broadband access in response to a $5 per month subsidy, and an additional 28.6 million homes would subscribe to

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[104] Larry F. Darby, "Consumer Welfare, Capital Formation and Net Neutrality: Paying for Next Generation Broadband Networks, The American Consumer Institute," June 6, 2006, available at http://www.handsoff.org/hoti_docs/studies/ACI060606.pdf at 38.

[105] Id., at 28.

[106] Id.

[107] Text of Wired's Interview with Google CEO Eric Schmidt, *Wired*, April 9, 2007, available at http://www.wired.com/techbiz/people/news/2007/04/mag_schmidt_trans?currentPage=all.

[108] Id., at 9 (citing Andre Hagui).

[109] Gregory Sidak, "A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet," *Journal of Competition Law and Economics,* Vol. 2, No. 3. September 2006, available at http://jcle.oxfordjournals.org/cgi/content/abstract/2/3/349 at 464-66.

broadband access in response to a $10 per month subsidy.[110]

Although the net neutrality debate has so far mostly focused on which policies will best maintain and promote innovation in Internet applications and services, an equally important issue is whether these policies will create a loss in consumer welfare by forcing end users to bear the entire cost of maintaining and upgrading a rapidly growing Internet. Network neutrality proponents, according to Alfred Kahn,

> *[F]ail to comprehend—or choose to ignore—that the market here is "two-sided"—providing Internet content and services to consumers and the attention of consumers to advertisers. It makes no more sense, therefore—and is clearly misguided for consumer advocates—to want to forbid the broadband access suppliers that carry those advertising messages charging the advertisers for access to the public than to require newspapers, television broadcasters or cable companies to obtain their revenues exclusively from readers, viewers or subscribers.*[111]

Impact of Regulation on Investment

Of all the industries under the FCC's jurisdiction, the two most successful also happen to be the least regulated – the wireless and cable industries, both of which were largely deregulated during the Clinton administration.

In a recent speech discussing net neutrality regulation, FCC Chairman Julius Genachowski suggested that regulation actually has a positive effect on investment.

> *Some will seek to invoke innovation and investment as reasons not to adopt open Internet rules. But history's lesson is clear: Ensuring a robust and open Internet is the best thing we can do to promote investment and innovation.*[112]

There were proposals during the Clinton administration to impose "open access" on cable modem services. Then-FCC Chairman William E. Kennard, an opponent, stated,

> *[T]the best decision government ever made with respect to the Internet was the decision that the FCC made 15 years ago NOT to impose regulation on it. This was not a dodge; it was a decision NOT to act. It was intentional restraint born of humility. Humility that we can't predict where this market is going.*[113]

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[110] Id.

[111] Alfred E. Kahn, Federal Trade Commission, February 13, 2007, available at http://www.ftc.gov/opp/workshops/broadband/presentations/kahn.pdf at 6. Kahn is the Robert Julius Thorne Professor of Political Economy (Emeritus) at Cornell University who has also served as chairman of the New York Public Service Commission, chairman of the Civil Aeronautics Board, Advisor to the President (Carter) on Inflation, and chairman of the Council on Wage and Price Stability.

[112] Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity and Prosperity," Federal Communications Commission, September 21, 2009, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293568A1.pdf.

[113] William E. Kennard, "The Road Not Taken: Building a Broadband Future for America," Federal Communications Commission, June 15, 1999, available at http://www.fcc.gov/Speeches/Kennard/spwek921.html.

Net neutrality and "open access" are close policy substitutes, note Thomas W. Hazlett and Anil Caliskan, who point out that cable modem services held nearly a two-to-one market share advantage when DSL carriers (but not cable modem services) were most heavily obligated to provide "open access" to competing ISPs. [114] Once the FCC eliminated a key provision of that access regime in February 2003 (further deregulation occurred in August 2005), DSL subscribership increased dramatically. By year-end 2006, DSL subscribership was 65% higher than it would have been under the linear trend established under open access regulation.[115]

Jeffrey A. Eisenach observes that U.S. cable operators invested more than $115 billion to upgrade their networks between 1996 and 2006. Investment accelerated significantly in 2000, immediately after Chairman Kennard made clear unbundling would not apply.[116] He adds that the bulk of cable's investment has gone into network upgrades that have yielded a faster, more robust broadband infrastructure.

Eisenach says that all of the evidence suggests cable companies in the U.S. would not have deployed advanced broadband infrastructures, or deployed them as rapidly and wisely as they did, if the FCC had yielded to pressure to impose "open access" requirements in 1999, nor would the telephone companies today be rapidly and widely deploying advanced FTTH and fiber-to-the-neighborhood (FTTN) infrastructures if the FCC had imposed unbundling requirements on those investments. [117]

Nevertheless, S. Derek Turner believes regulation has "only a minor influence over investment decisions" in network industries. He believes that considerations about future growth potential and fear of competition eroding profits are bigger factors.[118]
The only proof Turner cites in his paper is the testimony of former FCC chief of staff Blair Levin before a congressional committee. According to Levin,

> *[W]hile it is true that regulation, looked at in isolation, has a negative impact on investment in the enterprise being regulated, it may not be true when one looks at the whole picture.*[119]

Levin claims that Regional Bell Operating Company capital expenditures as a percentage of revenues rose after the 1996 Telecom Act and fell after the won certain regulatory relief. He also claims that program access regulation stimulated the rise of the Direct Broadcast Service

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[114] Thomas W. Hazlett and Anil Caliskan, "Natural Experiments in U.S. Broadband Regulation" February 1, 2008, George Mason Law & Economics Research Paper, No. 08-04 available at http://ssrn.com/abstract=1093393 at 5.
[115] Id. at 10.
[116] Jeffrey A. Eisenach, "Broadband Policy: Does the U.S. Have It Right After All?" Progress & Freedom Foundation, September 2008, available at http://www.pff.org/issues-pubs/pops/2008/pop15.14USbroadbandpolicy.pdf at 8-9.
[117] Id., at 16.
[118] Turner, S. Derek, Dismantling Digital Deregulation: Toward a National Broadband Strategy, Free Press, May 11, 2009, available at http://live.freepress.net/files/Dismantling_Digital_Deregulation.pdf at 69-70.
[119] Blair Levin, Prepared Remarks, Committee on the Judiciary, United States Senate, June 14, 2006, available at http://judiciary.senate.gov/hearings/testimony.cfm?id=1937&wit_id=5421.

industry, which in turn stimulated cable to invest in network upgrades to offer improved video service and an offering DBS could not offer: broadband.[120]

The 1996 law and the implementing regulations issued by the FCC did trigger massive investment by the Bell Operating Companies in regulatory compliance. It also prompted hundreds of billions of investment by now bankrupt competitive local exchange carriers in advertising and overhead.[121] The facilities investment that did occur overall was skewed towards transport and away from last mile access. Regulation contributed to a speculative bubble in telecom investment.[122] When almost $2 trillion in private equity and half a million jobs disappeared as a result of the telecom crash in 2000-2002,[123] everyone had to scale back their investment. The FCC's pro-competition policy – however brilliant it appeared in theory – was a failure.

It is true cable companies had ownership interests in certain content, and the program access rules ensured that this content could be available to their satellite competitors. But the program access rules were merely an antidote for the harmful effects of previous regulation, which protected cable operators from competition – thus making it both easier and necessary for them to expand vertically. Examples of this regulation include exclusive franchises, the cable-telco crossownership prohibition and artificial spectrum scarcity. The program access rules prove only that regulation begets more regulation.
Kahn advises against regulation in part due to the fact it usually tends to discourage investment.

> *The industry is obviously no longer a natural monopoly, and wherever there is effective competition—typically and most powerfully, between competing platforms—land-line telephony, cable and wireless—regulation of the historical variety is both unnecessary and likely to be anticompetitive—in particular, to discourage the heavy investment in both the development and competitive offerings of new platforms, and to increase the capacity of the Internet to handle the likely astronomical increase in demands on it for such uses as on-line medical diagnoses and gaming.*[124]

Notwithstanding the benefits Internet applications and service providers see for themselves, Kahn adds that so far as he can see, enactment of a net neutrality requirement will be beneficial only to professional litigators.[125]

Conclusion

Despite the fact that massive investment will be required in all segments of the Internet, and the Internet is a multi-sided market where all groups derive value from each other's participation, net neutrality regulation would prohibit innovative pricing or bundling models to increase the appeal of broadband services by only allowing broadband service providers to

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[120] Id.
[121] Id., at 9 (citing Darby, Larry).
[122] Robert W. Crandall, "Competition and Chaos: U.S. Telecommunications Since the 1996 Telecom Act", Brookings Institute, 2005, p. 156.
[123] Paul Starr, "The Great Telecom Implosion," *American Prospect*, September 9, 2002, available at http://www.princeton.edu/~starr/articles/articles02/Starr-TelecomImplosion-9-02.htm.
[124] Kahn, supra xviii, at 1.
[125] Id., at 7.

charge subscribers different prices for different services, but not a content, application, or service provider.

If net neutrality regulation preserves current revenue streams of revenue – such as ensuring that online advertising revenues flow only into the pockets of content providers – it will force broadband service providers to recover the entire cost of upgrading and maintaining the Internet from consumers. Policymakers should be mindful of consumer welfare losses as they consider whether net neutrality regulation is in the "public interest" or merely in the self interest of some but not all groups in a multi-sided market.

Contentions by some net neutrality advocates that regulation promotes investment are not supported by the evidence.

Innovation, Regulation and the Future of Wireless Communications

Wayne A. Leighton

Innovation in wireless communications has a long history. Misguided regulation in wireless markets has a history almost as long. As the Federal Communications Commission (FCC) considers applying net neutrality rules to the wireless industry, it should carefully consider the potential negative consequences on innovation and consumer choice in this market.

Today, a number of advocates and policymakers want increased regulation in the wireless industry, including formal adoption of the net neutrality principles from the FCC's 2005 policy statement, along with additional principles.[126] They argue that today's network providers engage in anticompetitive behavior to the detriment of consumers, as Hush-a-Phone, an equipment vendor, was limited by AT&T, a wireline network provider, half a century ago. Proponents of increased regulation maintain that their policies will promote competition and innovation at all levels of the wireless ecosystem.

That argument, however, inappropriately compares the monopoly provision of wireline communications in the 1950s with the competitive provision of wireless communications today. Further, it neglects the significant innovation that has taken place at all levels of the market. More worryingly, net neutrality regulation poses a risk to future innovation by threatening business practices that make this innovation possible.

The significant innovation at all levels of the wireless market is a result of competition at all levels of the market, from applications, services and devices at the "edge" of the network to the "core" elements of the network itself. Consider applications, services and devices. In a 2007 petition before the FCC, Skype Communications argued that consumers were restricted in their ability to access applications and services of their choosing, on devices of their choosing.[127] But a little over one year later, Apple launched its apps store for the iPhone. Today there are tens of thousands of new applications that were not even heard of when Skype filed its petition. Apple has an inventory of 85,000 applications, which have been downloaded by AT&T's customers over 2 billion times. While Apple's website currently leads in available applications, there are tens of thousands more from other sources.

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[126] The 2005 principles state that users are entitled to access the content of their choice, use applications and services of their choice, attach any device that does not harm the network, and have competition among content, applications and services, and network providers. Recently, FCC Chairman Julius Genachowski has suggested the addition of two more principles: non-discrimination and transparency by broadband service providers. *See* Federal Communications Commission, *In the Matter of Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, *Policy Statement*, CC Docket No. 02-33 (2005) (*Internet Policy Statement*); Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity" (Remarks Before the Brookings Institution, Washington, DC, September 21, 2009) available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293568A1.pdf.

[127] Skype Communications S.A.R.L., Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, RM-11361, February 20, 2007. This petition was subsequently incorporated in *Broadband Industry Practices: Notice of Inquiry*, WC Docket No. 07-52, 2007.

With regard to devices, CTIA reports that there are 33 wireless device manufacturers competing in the U.S. market, offering consumers over 630 models. While in 2007 Skype was concerned that WiFi service was unavailable or disabled, in the first half of 2009 there were at least 29 devices with WiFi capability, and more are coming.[128] The competition for applications, services and devices is robust. Indeed, it would appear that the challenge for service providers—and all those who interface with customers—may be to find the optimal way to inform customers of the dizzying array of choices without overwhelming them.

Advocates of increased wireless regulation, however, often focus more on competition at the network level. To some extent, this is understandable. While over 90 percent of Americans have access to four or more wireless network providers, this is fewer than the dozens of device manufacturers and many hundreds of application and service developers. But to view wireless networks in this light is to ignore the fact that they operate in a capital-intensive industry with large sunk costs. This is a reality wherever wireless networks exist.

In fact, the U.S. market for wireless services is one of the most competitive in the world, and on key measures, *the* most competitive. The level of concentration among network providers is remarkably low, with the lowest market share for the top two providers, and the lowest market share for the top four providers, among all OECD countries. Even more important is the behavior by the firms in the market, as firms with market power restrict output and raise price. But in this industry, prices have fallen from 44 cents per minute in 1993 to 6 cents per minute in 2007, as the quantity consumed, in terms of minutes of use (MOU) for voice service, has gone through the roof. Total MOU is over 2.2 trillion annually, and the average subscriber has over 800 MOU per month, more than subscribers in any other OECD nation.[129]

It is clear that wireless network operators are competing. They also are innovating. In fact, many of the innovations in the applications, services and devices that consumers enjoy today would not be possible were it not for this corresponding innovation at the core. Wireless ecosystems, like other ecosystems, are highly synergistic.

To see evidence of innovation at the network level, one must understand its relevance to all other levels in the supply chain for wireless services. Ten years ago a mobile device provided voice calls, and that was about all. What do consumers demand today? They want a conversation with the spouse, an email from a coworker, directions to an unfamiliar address, the latest song by their favorite artist, and a clip from their favorite TV show or perhaps their nephew's latest video creation. Consumers get all this from services and applications such as Google, Hulu, YouTube and hundreds more; from devices such as the Apple iPhone, the Blackberry Curve and the Palm Pre; and from wireless networks that have the capacity to carry these services.

Innovation That's Seen and Innovation That's Unseen

It is this last element—the wireless network—that is most overlooked when the average consumer thinks about innovation in the wireless ecosystem. A consumer can easily appreciate

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[128] CTIA, Written Ex Parte Communication, RM-11361; GN Docket No. 09-51; WC Docket No. 07-52, May 12, 2009.
[129] *Id.*

the difference between a service that sends only short text messages and one that sends almost anything, including high-quality video. Similarly, a cellphone from a decade ago compares to today's iPhone the way Orville and Wilbur's Wright Flyer might compare to a modern Airbus. But a network provider? One would be forgiven for thinking it simply sends bits of information over the airwaves, same as a decade earlier.

What is not seen by the average consumer—and not appreciated by many policymakers and other observers—is the innovation by network providers in carrying this information over the airwaves. Voice communications uses relatively little bandwidth. In contrast, new services and applications, run on the latest smart phones, use considerably more bandwidth. For example, a 15-minute video download to an iPhone or Blackberry consumes the same bandwidth as 1,000 minutes of voice conversation. Similarly, a user with a smart phone that runs apps at 1 Mbps will consume 100 times more bandwidth than a user making a voice call on a basic mobile phone.[130]

To handle this increasing traffic, wireless operators must manage their networks in increasingly efficient—yes, innovative—ways. In the U.S., they have been doing so for some time. The U.S. market has more subscribers served per MHz of spectrum than any other country in the OECD.[131] Furthermore, these are not low-use customers who can be easily crammed into a few MHz of spectrum. On the contrary, as noted above, the average U.S. subscriber enjoys more usage than those in any other OECD nation.

The Unseen Threat to Innovation

Wireless network operators do not simply manage their networks to handle more traffic. They also engage in a number of practices that contribute to innovation and consumer choice, and that ultimately benefit consumers. However, advocates of net neutrality oppose some of these practices, such as establishing network management rules that limit the bandwidth a subscriber may use under certain circumstances, and distributing handsets under exclusive agreements.

Of course, firms may engage in such practices to promote anti-competitive ends, to the detriment of consumers. But a necessary condition for this strategy to succeed is the presence of market power. As demonstrated above, the U.S. is one of the most competitive wireless markets in the world, providing a strict check on the market power of any one provider.

While network management, exclusivity arrangements and other practices are not likely to harm consumers in a competitive market, one might reasonably ask if they benefit consumers. The answer is yes. In a competitive market, firms may engage in these and other practices for one of three rationales, each of which is associated with efficient behavior and which may help increase competition and innovation in this industry. In contrast, prohibiting such activities may do the opposite, limiting competition and innovation.

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[130] Rysavy Research, "Wireless E-Mail Efficiency Assessment: RIM BlackBerry and Microsoft Direct Push (Including iPhone)," January 27, 2009.
[131] CTIA Ex Parte, May 12, 2009.

1. Minimizing Transaction Costs

Wireless network operators and device manufacturers are among a large group of firms that use exclusive distribution agreements to lower the transaction costs and risks associated with introducing new products. Apple's agreement with AT&T concerning the iPhone is a prominent example. However, in a variety of industries, such arrangements are common when firms at different levels of a supply chain need to work together to sell an innovative product or service.

Specifically, firms at different points on a supply chain, such as a device manufacturer and a network provider, may use exclusive arrangements as an efficient means to deal with a common problem when multiple dealers distribute the same product. Economists call this the free-riding problem, and it exists when efforts by all dealers to promote the product and provide excellent customer service increase overall demand. The incentive for any one dealer is to let the other dealers do the heavy lifting and thus free-ride on their efforts. If all dealers act this way, too little promotion occurs, too little is spent on providing excellent service, and sales of the product fall below an economically efficient level. Exclusivity minimizes this problem, with all parties having an incentive to provide an optimal level of consumer education and service.

2. Improving Product Quality

The wireless ecosystem of today is enormously complex; much more than it was only a decade ago. Network providers, device manufacturers and others in this ecosystem may engage in any number of activities that seem questionable to net neutrality proponents, but are in fact efficient mechanisms to provide a reliable, high-quality user experience with a complex product or service. A common example is network management.

Even in the context of wireline networks, a market with fewer facilities-based providers than wireless, network management offers significant potential consumer benefits, as Chris Yoo has explained elsewhere.[132] Demand for network usage is heterogeneous and highly variable—or "lumpy"—while fixed costs by definition are invariable in the short run. Providers therefore face multiple challenges in attempting to meet the demands of consumers. Will consumers want faster speeds, and if so, how much faster? How much are they willing to pay for these speeds? How many MB or GB will consumers want to consume in a given month, or even at a given time of day, and how much more are they willing to pay for greater use of the network? Will they be willing to trade latency in some services for higher speeds in others, or for a lower price? In a market where quality may be defined in many ways, carriers should be encouraged to experiment with different models for meeting consumers' needs, not restricted to a narrow set of allowable "network management" practices that are limited by the needs of technical feasibility.

3. Meeting Diverse Needs Through Product Differentiation

Wireless network providers do not, of course, simply manage quality. They consider the entire value proposition for the consumer—price, speed, latency, reliability, coverage, and more. In a market with heterogeneous demand—for which wireless services could be the poster child—a common strategy for a provider is differentiation. In a market with heterogeneous

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[132] *See* Christopher S. Yoo, "Beyond Network Neutrality," 19 *Harvard Journal of Law and Technology* 19:1, Fall 2005, pp. 1-77.

demand as well as high sunk costs, such a strategy is a necessity. Specifically, in telecommunications and other industries with large sunk capital investments, firms must set price above marginal cost in order to operate efficiently, and in order to price this way they must differentiate their products and services.

Nonetheless, many proponents of increased regulation on wireless and wireline networks overlook the value of differentiation because they view the services provided by these networks as a commodity. In short, the network is seen as a collection of dumb pipes. If regulations are established to enforce this view, product differentiation is limited, if not entirely prohibited. A new entrant offering a service that is a commodity has no way to stand out by offering, for example, a network that is more favorable to bandwidth-intensive gaming applications, or a network that significantly limits bandwidth-intensive apps but charges very low prices for basic service, or any of a number of other combinations of price, speed, reliability, and the other qualities consumers demand. But if new entrants cannot differentiate themselves, consumers will rationally stay with the big, established operator.

In contrast, a differentiated provider may be able to meet its high upfront costs and higher per-unit costs even with lower sales volume, thus contributing to competition in the market. In other words, differentiation is not a problem to be solved; it is exactly what policymakers should want. Economists have long understood that product differentiation in declining cost industries makes competition possible and is generally beneficial to consumer welfare. Among the many respected economists who have made this point is Hal Varian, now chief economist at Google.[133]

Promoting Innovation and Consumer Choice

While public policy plays a critical role in promoting innovation and consumer choice, it does not call for an expansive set of net neutrality regulations. Rather, policymakers should focus on making available more spectrum, the essential element of the wireless ecosystem, upon which applications, services, devices and networks depend. As the International Telecommunication Union has observed, by 2010, between 760 MHz and 840 MHz will be needed.[134] Given that the U.S. has about 600 MHz currently available for wireless services,[135] this implies an immediate shortfall of roughly 200 MHz. Further, the ITU estimates that by 2020 the industry will need between 1280 MHz and 1720 MHz, requiring at a minimum a doubling of current spectrum availability.[136] Providing additional spectrum—which may require the efforts of both the FCC and Congress—may do more to promote innovation in wireless than any other single policy.

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[133] Hal R. Varian, "Differential Pricing and Efficiency," *First Monday* 1:2, August 1996, at 2.

[134] International Telecommunication Union, "Estimated Spectrum Bandwidth Requirements for the Future Development of IMT-2000 and IMT-Advanced," Rep. ITU-R M.2078, 2006.

[135] While the FCC has described 643 MHz of spectrum as "potentially available for terrestrial CMRS," this measure includes 40 MHz of AWS-II and AWS-III spectrum that has yet to be auctioned. Accordingly, the estimate used here refers to approximately 600 MHz. *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, *Thirteenth Report*, WT docket No. 08-257, January 16, 2009, available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-54A1.pdf.

[136] ITU, "Estimated Spectrum Bandwidth Requirements for the Future Development of IMT-2000 and IMT-Advanced," *supra note* 9.

In contrast, the strict application of net neutrality rules may restrict legitimate business practices that ultimately promote innovation and consumer choice. Whether these practices help lower transaction costs, ensure quality improvements, or allow for differentiation in markets with high sunk costs, policies that limit such activities in a competitive market are most likely to harm consumers, not help them.

Suggested Reading:

Ev Ehrlich, Jeffrey A. Eisenach and Wayne A. Leighton, "The Impact of Regulation on Innovation and Choice in Wireless Communications," *Fostering Innovation and Investment in the Wireless Communications Market*, GN 09-157 (September 30, 2009), available at http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=7020039915.

David J. Farber and Gerald R. Faulhaber, "Innovation in the Wireless Ecosystem: A Customer-Centric Framework," *Fostering Innovation and Investment in the Wireless Communications Market*, GN 09-157 (September 30, 2009), available at http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=7020039960.

Michael L. Katz, "Public Policy Principles for Promoting Efficient Wireless Innovation and Investment," *Fostering Innovation and Investment in the Wireless Communications Market*, GN 09-157 (September 30, 2009), available at http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=7020039961.

Robert Hahn and Hal Singer, "Why the iPhone Won't Last Forever and What the Government Should Do to Promote Its Successor," prepared for Mobile Future (Sept. 21, 2009).

Robert W. Hahn, Robert E Litan and Hal Singer, "The Economics of Wireless Net Neutrality," 3 *Journal of Competition Law and Economics* 399 (2007).

Thomas W. Hazlett, "Declaration of Thomas W. Hazlett," *Fostering Innovation and Investment in the Wireless Communications Market*, GN 09-157 (September 30, 2009), available at http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=7020039962.

Christopher Yoo, "Beyond Network Neutrality," *Harvard Journal of Law & Technology*,19:1 (Fall 2005).

Building the Internet of the Future

Richard Bennett

Overview

The current Internet is the culmination of a 50-year experiment with packet switching that began independently in the minds of young American engineer Paul Baran and Professor Donald Davies in the UK. Their work inspired the designers of the ARPANET, which fostered the education of the engineers who designed the CYCLADES network in France, who in turn provided the conceptual framework for the modern Internet. The Internet now serves 1.6 billion people connected to 30,000 autonomous networks, which meet in 300 Internet Exchange Points around the world where they exchange Internet Protocol (IP) packets.

We got where we are by global cooperation in research, independent investment, technical advances, and ongoing global collaboration in research, engineering, and operations. The Internet is a global system that cannot, in principle, be controlled by any one national regulator, although several nations have succeeded in limiting the ways that their citizens can use it.

We use this system today for e-mail, social networking, telephony, video-conferencing, and publishing prepared content in many forms, and will continue to use these traditional applications for some time. In the not-too-distant future, we're going to make greater use of rich audio-visual media for a variety of applications such as home monitoring and control, the maintenance of the smart grid, interpersonal communication in rich forms all the way up to holograms, and encompassing wider circles of participation. Distance learning, distance conferencing, and entertainment experiences from near and far will be routine. Libraries, encompassing written as well as audio-visual content, will of course be easily searchable, and if we're too tired or restless to read a book, we'll have it read to us or performed on a nearby screen by real or virtual characters, and we'll chat with friends (or strangers if we prefer) while we watch or simply immerse in a 3D sound field.

More than eight billion new CPUs will be sold this year, but only a small minority will be networked. As this number grows, CPUs will be embedded in our cars, homes, workstations, glasses, and clothing; we won't have to login or out as we move around because they'll know who we are, where we are, where we're going and what we intend to do when we get there. They'll know how to share this information with each other while keeping it from prying eyes. We'll interact with our machines more by gesture and speech than by keyboards and mice, but they'll anticipate a lot our wants, wishes, and whims.

We'll need a network with several orders of magnitude more power, reach, and scale than the ones we have today to make this future come to pass, of course. The Internet of the Present will not become the Internet of Future: there is no migration path. Rather, it will be one of the networks that will form parts of this new Mega-Internet; probably an appendage that we utilize for passing stored content. It will be like the AlohaNet in Hawaii was when it was attached to the ARPANET through a gateway: a limited, but still vital, system.

Internet Architecture

It's been known for some time that the Internet architecture is challenged. The system has grown far beyond the scope of its original design, and currently suffers from a number of ailments related to its addressing and routing scheme, the structure of its protocols, and the method of its financing and operation. The Internet Architecture Board's (IAB) Workshop on Routing and Addressing declared as much in 2006:

> *The clear, highest-priority takeaway from the workshop is the need to devise a scalable routing and addressing system, one that is scalable in the face of multihoming[137], and that facilitates a wide spectrum of traffic engineering (TE) requirements.[138]*

The Internet's addressing problem began when TCP and IP were separated. There was only one address, and IP got it. IP turned what had been a computer address into the address of a wire, which would have been fine if the computer had then got an address of its own. This didn't happen, hence issues with mobility, scalability, and routing redundancy arose because routes and wires had addresses but end systems didn't. The Internet is thus an end-to-end system in which "ends" aren't directly addressable. The Internet engineering community has tried to work around this fundamental design flaw with systems such as Classless Inter-Domain Routing (CIDR – pronounced "cider") and Locator/ID Separation (LISP)[139], but these modifications simply delay the problem.

It's clear that a new architecture is needed, and some of the best minds in the research community have been trying to devise one for some time now, using a variety of test beds funded in by the National Science Foundation such as GENI and Stanford's Clean Slate. The Internet of the Future will provide a richer set of transport services than the current system does: The one-size-fits-all model of transport and billing inhibits growth. There is a very important reason to emphasize this requirement.

We have seen that most of the innovation the Internet has fostered takes place at the edge of the network. This is by design. But we have also seen an interaction between the capabilities of the network and the range of applications that it can support. When TCP/IP was originally deployed on the ARPANET infrastructure, the fastest link between any two routers was 56 kilobits per second. At that speed, video streaming was not a practical application. Most uses emphasized stored content and limited interactivity, such as the remote logins that were the major use of the ARPANET before TCP/IP.

As the link speeds have improved (all the way up to 100 gigabits per second in some cases,) the range of practical applications has broadened and now we take it for granted that we can do one-on-one video conferencing in standard definition and transfer entire DVDs worth of files, but not always at the same time and not always as often as we might like. We can now access the Internet from mobile devices, despite the evident shortcomings of a system of

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[137] Multi-homing provides multiple network paths to a system or service.

[138] David Meyer, Lixia Zhang, and Kevin Fall, eds., "Report from the IAB Workshop on Routing and Addressing," RFC 4984 <http://www.ietf.org/rfc/rfc4984.txt>.

[139] David Meyer and Darrel Lewis, "Architectural Implications of Locator/ID Separation," Internet Draft <http://tools.ietf.org/pdf/draft-meyer-loc-id-implications-01.pdf> (accessed September 27, 2009).

addressing that's distinctly hostile to mobility, thanks to a number of clever tricks inside the mobile networks, but the handoffs from sub-network to sub-network aren't always as fast as they should be. Capability has improved, but we're not yet in a position to utilize a fully pervasive system of universal connectivity, nor will we ever be in such a position given the constraints of the current architecture.

The Internet of the future has to support multi-homing, multi-tasking and rapid mobility. The economics of this system need to be rational, with a proportionate ratio of cost and price for various uses and a high capital efficiency ratio. Currently, we have to increase the speed of a core link by 5 megabits per second to realize a 1 megabit per second apparent increase in throughput, and the ratio should be closer to 1:1.[140] And it has to be secure and resilient to failures, although most of the security will continue to be provided in end-systems rather than in the transport system.

Internet R & D

There's no guarantee that the Internet of the future will be designed in the United States. The world of the Internet is flat, and many of the brightest engineering minds live and work outside our borders. Internet users outside the US often chafe at the privileged position we occupy, with ownership of half of all IPv4 addresses and control of ICANN. In fact, we can be absolutely confident that a great many of the innovations we will come to accept on the Internet of the Future will be created outside our borders, as that the fundamental architecture may be as well. We're constrained by establishment thinking here, and often fail to appreciate how thoroughly wedded we are to conventional wisdom and sacred cows.

Take a step back from the net neutrality debate and note the rhetoric: how much of it relates to "the preservation of the Internet as we know it" or the preservation of existing business models? If you subtract those two elements from the debate, there is very little left but empirical questions. But this has been the centerpiece of Internet policy discourse in the US since 2005.

The nice thing about network architecture research is that it doesn't take large teams with enormous budgets to make fundamental advances. Paul Baran worked with a very small team, as did Louis Pouzin, the inventor of the framework for end-to-end networks that informs the Internet of today (as well as the four other major packet networks created during the same period as the Internet). These gentlemen and their teams had a willingness to construct the problem differently than their predecessors had; no commitment to the preservation of a status quo, and the ability to produce spare, elegant designs that could scale into extremely large systems with no loss of capability of runaway increase in overhead.

The Internet of the Future will start with a very simple architecture which combines the functions we now know such a network needs to have in a different conceptual model. The model will probably be "recursive," one in which large pieces are built out of small pieces whose structure resembles that of the larger ones, and so on. It performs all the functions the Internet

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[140] The inability of the Internet core to saturate links is a consequence of the congestion control algorithm employed by TCP.

of Today does, and many more, but it will not look the same from a technical or regulatory perspective.

Transitions

We're in a period of transition between the Internet of the Past and the Internet of the Future, and consequently are caught in the middle of several tugs-of-war and innovation tensions, many of them not visible to the public except in their side effects. Changes in the networking technical and financial models have unavoidable implications for investment efficiency and regulation. We don't know which elements of the Internet of Today will survive the transition and which ones will be upgraded, but we can be certain the networks we use in ten years time will support the applications we already use.

The range of innovation we see in network applications is always limited by the range of capabilities the network enables. Lettuce farmers in the Central Valley of California couldn't sell their produce in Eastern markets at all until they had a system of transportation that could deliver fresh goods. Freshness is a quality differentiator in many cases, so high transport costs can equate to high profits for producers and better goods for consumers. And similarly, media mail was once vital to the publishing market, despite its considerable delay, because books have such a long lifetime. These are familiar dynamics in network economies, digital and otherwise: time and economy are fundamental parameters in both the cost and the value of any transport system, and pricing does well to reflect this fact. Both now and in the future, network policy should permit (and even encourage) service pricing to reflect service cost. Delivery services that are responsive to application needs are an enabler of converged services.

Contention and Congestion

The management of congestion by allocating communications resources in real time is one of the central technical issues in packet switching, as well as a major challenge to policy makers. Many regulatory models aimed at Internet access and inter-domain routing fail to appreciate the sensitivity that this problem has for network utility, as it manifests on Internet access networks in a very different way than it did on the Public Switched Telephone Network (PSTN). On the PSTN, a single decision to allocate resources is sufficient to protect the QoS of an entire conversation, and all conversations have the same bandwidth, latency, and cost requirements.

The Internet has to solve the resource allocation problem packet-by-packet, and for variations in these three new dimensions. Unless carefully considered with respect to the requirements of new applications, PSTN-style regulations proposed under the guise of "anti-discrimination" rules will severely affect the utility of Internet access networks in the countries where they're imposed.

There is a natural tendency in regulatory policy, as in law generally, to defer to precedent in drafting rules, but technology exists to invalidate precedent; it replaces inferior historical systems with newer, better ones. Current work in the Internet engineering community is on a collision course with Internet service frameworks proposed by some national regulators, potentially including the American FCC. The Internet is changing to support new applications, and will do so regardless of the stance of any particular national regulator; those regulators who are too quick to preserve the Internet of the Present by banning key characteristics of the Internet of the Future will find their economies left behind.

Conclusion

The Internet of the Future will come about with or without action by the United States; networking is now a global concern and much of the work that will build this network is already underway around the world. If the United States wishes to provide leadership in this effort, let alone participate in it, we'll need to abandon the idea that there's a seamless path from the networks of the past to those of the future.

Our network regulations must permit experimentation with technology and business models, and must be free of vague, service-stifling generalities as well as overly prescriptive minutiae. We'll need to develop rules for unlicensed and secondary use of spectrum that recognize the nature of digital packet networks and build on our experience with such systems in the past five years; we'll need to provide expedited means of resolving disputes over spectrum use that don't require lengthy court battles.

The Internet that we use today was designed for research purposes and pressed into service to meet user needs for a global system before it was sufficiently developed for the purpose. Moore's Law, massive investment, and the heroic efforts of a global team of professional administrators working around the clock have enabled it to come this far, but we can't count on it to grow much larger without major changes.

Fortunately, we've learned enough along the way to be able to devise a system that will serve us for the next 35 years. The trick is to tap into the intelligence of the network engineering community around the world, extract the best ideas, test them in parallel, and synthesize. Government can play a supportive role in this process by permitting and monitoring experiments in technology, financing, and end-user education. Protecting consumers from deceptive practices and collusion is an important government function; contributing to unhealthy atmospheres that can be created by mis-educating consumers about legitimate networking practices is not.

Should Wireless Carriers Have a Duty to Support Google Voice or Skype?

Hal J. Singer

With the regulator's gun at its head, on October 7, 2009, AT&T agreed to support voice applications over its wireless data network, joining Verizon who made a similar announcement last year. The policy debate about whether a wireless carrier should be required to support online voice applications, like Skype or Google Voice, now appears to be over. According to investors, the not-so-voluntary decision by AT&T had a small yet negative effect on the firm's profits. Whether the decision by AT&T and other wireless carriers is actually good for consumers is another matter.

In a recent speech at Brookings, Federal Communications Commission (FCC) Chairman Julius Genachowski argued that wireless firms should open up their systems to potential competitors in the wireless space—notably Skype and Google. This sounds good, but imposing such a "duty to deal" here can harm some consumers by raising prices for wireless plans, reducing choice in the near term, and reducing innovation in the long term.

In this case, there was no good economic reason for requiring such a duty. Economics suggests that a duty to deal can be good for consumers only under certain conditions, including when a firm has significant market power, and when a failure to deal will impair a rival's ability to impose meaningful price discipline. But these necessary conditions are not met here.

As of March 2009, AT&T supplied 30 percent of the wireless market, hardly close to a dominant position. This means that the carrier could not prevent an Internet rival like Google or Skype from serving a significant slice of the wireless market.

Furthermore, there is little evidence that giving Google or Skype free access to AT&T's customers would lower wireless prices. In contrast to cable prices, which have moved upwards in recent years, wireless prices have plummeted. The Cellular Consumer Price Index (CPI), which is produced by the Bureau of Labor Statistics, decreased by 0.3 percent in 2007 while the overall CPI increased by 2.8 percent; that same cellular price index has declined by a stunning 36 percent since 1997. And average revenue per minute, a measure of the price of a mobile phone call, has decreased from $0.47 in 1994 to $0.06 in 2007, a decline of 87 percent. Given this climate, it is doubtful that Google Voice or Skype, when used in conjunction with a carrier's data plan, could materially reduce prices for mobile voice service. Because neither of the two necessary conditions appears to be satisfied, there should be no duty to deal.

Those following the legal treatment of duties to deal will recognize that the Supreme Court followed this economic reasoning in its 2008 decision in *linkLine*. A reseller (linkLine) was seeking access to a telephone company's network so that it could resell the company's broadband service. The relevant economic issue for the Court in deciding whether to impose a duty to deal was not whether linkLine would be better off with access to the telephone company's pipes (it would), but whether broadband prices would be materially lower than the prices resulting from the already intense competition between cable modem and digital subscriber line providers. Because the goal of the antitrust laws is to enhance consumer welfare

(as opposed to protecting competitors), the Court correctly chose not to impose a duty to deal on the telephone company.

It would have been nice if the FCC Chairman had grounded his recent policy principle to bar Internet discrimination in terms of enhancing consumer welfare, but he did not. Price discrimination that is presumptively competitive—such as charging an application provider more for greater speeds or a guaranteed quality of service—is considered taboo under the new regime. The Chairman also suggested that broadband providers cannot "disfavor an Internet service just because it competes with a similar service offered by that broadband provider." This principle has no limits; a carrier with a one percent market share that was charging competitive prices for its service could be compelled to open its platform to rivals.

To see exactly how such a rule can hurt consumers, I offer a simple example based on the carriers' current prices and policies. Assume customers must buy both a data plan and a voice plan to activate a smartphone—that is, they cannot buy a data plan for a smartphone on a standalone basis. The price for an unlimited data plan is $30 per month. The lowest priced voice plan (450 minutes) is $40 per month. The price of a more typical voice plan (900 minutes) is $60 per month. Accordingly, the average customer pays $90 per month for a combined data-voice plan that includes 900 minutes.

Table 1 summarizes these plans alongside what I call "revenue-equivalent" plans, which would preserve the carrier's revenues in the event that a subscriber shifts his voice minutes to Skype or Google Voice.

Table 1: Current Wireless Plans and Revenue-Equivalent Plans

Plan	Current Monthly Price	Revenue-Equivalent Plan A	Revenue-Equivalent Plan B
Unlimited Data	$30	$50	$30
Voice (450 minutes)	$40	$40	$60
Voice (900 minutes)	$60	$60	$60
Bundle (data + 450)	$70	**$90**	**$90**
Bundle (data + 900)	**$90**	$110	$90

To trace through the impact of imposing a duty to deal with Google Voice or Skype (or a carrier's begrudgingly accepting such a duty), one needs to make a simplifying assumption. Suppose there are two types of wireless customers: 1) those (like myself) who would never install Google Voice due to a strong preference for high-quality mobile calls; and 2) those perhaps more price-conscious or tech-savvy customers who would install Google Voice and reduce their voice plan from 900 minutes to 450 minutes to save $20 per month. Because the carrier can't tell which type of customer it is getting, and because the second type causes the carrier to lose voice revenues relative to the status quo, the carrier would likely try to make that money back. For example, it could raise the price of its unlimited data plan from $30 to $50 per month. This option is depicted as "Revenue-Equivalent Plan A" in Table 1. From a revenue perspective, the carrier is kept whole, as total revenue is maintained at $90 per month. No harm, right?

Not quite. Consider a customer like myself, who now faces a higher price if I stick with the bundle that includes the 900 minute plan (priced at $110 under the new regime versus $90 under the old regime when the carrier wasn't supporting Google Voice). I could dodge the $20 increase on the data plan by installing Google Voice and taking the cheaper 450 minute plan like my tech-savvy peers, but given my preferences for the carrier's voice service, I would be worse off.

And the tech-savvy or price-conscious customer who was willing to make the switch and download Google Voice is not necessarily better off. Although his total expenditure stays flat at $90, the quality of his voice calls is degraded, which reduces his welfare (albeit to a lesser degree). If customers like me are unequivocally harmed, and if the others are not clearly improved, then consumer welfare in the aggregate has declined.

Alternatively, the carrier could maintain its revenues on its tech-savvy customers by raising the price of its lowest-price voice plan from $40 to $60 per month (revenue-equivalent plan B in Table 1). Once again, the tech-savvy customer who installs Google Voice saves nothing by going to the minimum voice plan; his total expenditure stays at $90 per month. While customers like me are spared any ill-effects under this scenario, the folks who now get clobbered are those customers who primarily use the smartphone for data needs. Now their voice plan, which is hardly used, is more expensive.

The purpose of tracing through these scenarios is to demonstrate the interaction between a duty to deal and the pricing of different wireless plans. The fact that AT&T's stock price did not fall more than a few percentage points after its announcement to support Internet voice applications suggests that investors are expecting the firm to re-jigger its prices. Proponents of a duty to support Internet voice services clearly have not considered these ramifications. The pricing flexibility that was permitted when the wireless industry was lightly regulated ensured that voice-only customers could get low-priced voice plans, and that customers seeking the standard voice-data bundle (like myself) found low-priced data plans. But when one lever (a duty to deal) of this complex system is pulled, the whole system starts to gyrate and no one can be sure where consumers will end up.

When faced with the prospect of higher wireless data prices resulting from the duty to deal, I suspect the net neutrality crowd will argue that the FCC can maintain consumer welfare by imposing price regulation *on top of the duty to deal*. With price controls, wireless carriers would be prevented from protecting voice revenues by keeping a lifeline voice plan on the market for $40 per month or a low-priced data plan at $30 per month or both. At long last, the tech-savvy customer who installs Google Voice on his iPhone will be better off, as the carrier would be foreclosed from recapturing its $20 per month in lost revenues under either option presented here. Indeed, the FCC could go one step further by requiring that the carriers sell a standalone data plan for $40. Now the tech-savvy customer can shed his entire voice commitment to the carrier of $60 per month.

The lesson is that one bad regulation (a duty to deal) spawns another (price controls). One can't help thinking that the original bargain struck between the regulator and the carriers has been violated. After all, unlike Google and Skype, the carriers invested *billions* of dollars in infrastructure and spectrum licenses to get these wireless networks up and running. And then

they recently tossed in a few more billion to upgrade those networks to 3G. Price controls and innovation do not mix well; it is doubtful that the carriers would be willing to extend themselves once again—4G networks were on the horizon—only to have their assets taken from them.

Imagine that back in 1994, when the FCC first auctioned these licenses, Chairman Genachowski came back from the future to announce that, when he was in charge, wireless carriers would be subjected to an onerous duty to support a rival voice provider named Google who would make no investments in the network but could effectively resell the carrier's voice service for free. When the duty to deal was discovered not to achieve its intended goal—to breathe life into Internet voice applications—the carriers subsequently would be required to offer a standalone data plan at a government regulated price. How much do you think the licenses would have fetched under that set of rules? If the answer is anywhere south of what the government reaped in those initial spectrum auctions, then the mid-course correction in the rules amount to a taking of property.

Suggested Reading

Why the iPhone Won't Last Forever and What the Government Should Do to Promote Its Successor (prepared for Mobile Future), co-authored with Robert Hahn (Sept. 21, 2009).

The Economics of Wireless Net Neutrality, 3 JOURNAL OF COMPETITION LAW AND ECONOMICS 399 (2007), co-authored with Robert W. Hahn and Robert E Litan.

The Unintended Consequences of Net Neutrality, 5 JOURNAL ON TELECOMMUNICATIONS AND HIGH TECH LAW 533 (2007), co-authored with Robert E. Litan.

Net Neutrality: A Radical Form of Non-Discrimination, REGULATION, Summer 2007.

Telecom Time Warp, WALL STREET JOURNAL, July 11, 2007, at A15, co-authored with Robert W. Crandall.

Net Neutrality Mandates Likely Violate the First Amendment

Randolph J. May[141]

There are many reasons why the Federal Communications Commission should not adopt new laws mandating "net neutrality" for broadband Internet service providers (ISPs). But an often overlooked and underappreciated one is that net neutrality mandates likely would violate the First Amendment free speech rights of the ISPs, such as Verizon Communications Inc. or Time Warner Cable, to which they would apply. So the controversy over net neutrality is a case where greater sensitivity paid to constitutional values will lead to sound policy. Conversely, the adoption of unsound policy in the form of net neutrality mandates likely will lead to denigration of First Amendment rights.

While net neutrality proposals may have some variation in form and substance, all have this in common, including proposals for FCC or congressional action: one way or another, they propose to restrict ISPs from taking any action to "block, impair or degrade" consumers from reaching any Web site or from "discriminating" against any unaffiliated entity's content. For example, under the FCC's proposed new neutrality rules announced in October 2009, a broadband provider "would not be able to prevent any of its users from sending or receiving the lawful content of the user's choice over the Internet" and "would be required to treat lawful content, applications, and services, in a nondiscriminatory manner." A bill (HR 3458) introduced in July 2009 by Democrat Representatives Edward Markey and Anna Eshoo, felicitously called the "Internet Freedom Preservation Act," states that ISPs shall "not block, interfere with, discriminate against, impair, or degrade the ability of any person to use an Internet access service to access, use, send, post, receive, or offer any lawful content, application, or service through the Internet."

It is generally agreed that except for a few isolated incidents which were remedied fairly quickly, neither the cable operators nor the telephone companies providing broadband Internet services have blocked, impaired or otherwise restricted subscriber access to the content of unaffiliated entities. As a matter of sound policymaking, both the FCC and Congress should be very hesitant to adopt a regulation or pass a law in anticipation of conjectured harms that may never materialize. As the Internet continues to evolve, such a regulation or law passed in anticipation of conjectured harms almost certainly would turn out to be overly broad in application, restricting efficient business arrangements that otherwise would allow ISPs to make available services demanded by consumers at lower costs. Moreover, the necessarily vague terms of the mandates – what constitutes "discrimination" -- would be grist for the litigation mills for years to come.

But put aside the policy arguments for now. Even if neutrality mandates made good sense, they should not be imposed if they impinge on constitutional rights. The First Amendment's language is plain: "Congress shall make no law . . . abridging the freedom of speech." ISPs like Comcast and AT&T possess free speech rights just like newspapers, magazines, movie and CD producers -- or the man preaching on a soapbox. They are all speakers for First

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[141] An earlier version of this article was published in the National Law Journal in August 2006.

Amendment purposes, regardless of the medium used. And under traditional First Amendment jurisprudence, it is just as much a free speech infringement to compel a speaker to convey or post messages that the speaker does not wish to convey or post as it is to prevent a speaker from conveying or posting messages it wishes to convey or post. Thus, neutrality laws mandating, for example, that an ISP not block access to any lawful Web site would mean that it could not choose to restrict access to material that in its view, say, is "indecent" or "homophobic" or "racist." (I am not suggesting that an ISP *should* adopt practices restricting access to any content, or that if it did, such a business model *would* succeed in the marketplace. The examples simply illustrate the free speech interests at stake.)

To be sure, freedom of speech under the First Amendment is not absolute. For example, in 1994 in *Turner Broadcasting System v. FCC*, the U.S. Supreme Court, in a 5-4 decision, rejected the argument that, at least on its face, a law requiring cable operators to carry the signals of local broadcast stations violated the cable operators' First Amendment rights. But the court relied very heavily on Congress' judgment that local stations providing free television deserved special protection. It also assumed that cable operators possessed a bottleneck that allowed them to play a "gatekeeper" role controlling programming that entered subscribers' homes. Net neutrality mandates have nothing to do with the protection of local stations. Moreover, in today's competitive environment, it cannot be seriously contended that cable operators any longer have bottleneck control of the video content that enters consumers' homes.

The proposed neutrality nondiscrimination mandates are eerily reminiscent of the Federal Communications Commission's fairness doctrine, which it jettisoned in the mid-1980s in light of the new media proliferating even then. The fairness doctrine required that broadcasters present a balanced view of controversial issues. When the Supreme Court upheld the regulation against First Amendment challenge in 1964 in *Red Lion Broadcasting Co. v. FCC*, it did so on the basis that it considered broadcasters different from other speakers because they use the radio spectrum. The court characterized the spectrum as a scarce public resource. Apart from whether the Court today would reach the same result regarding broadcasters' free speech rights, it has refused to extend such scarcity-based reasoning to other media. We certainly don't want to import fairness doctrine-type speech restrictions into the world of subscription-based broadband ISPs.

In effect, what the net neutrality proposals really seek to do, without saying so directly, is to reverse the Supreme Court's 2005 decision in *National Cable & Telecommunications Assoc. v. Brand X Internet Services* by turning ISPs into common carriers required to carry all messages indifferently. In addition to the problematical First Amendment implications, to do so would implicate the Fifth Amendment takings clause, because it is questionable whether, in the increasingly competitive broadband environment, compelled access to the ISPs' private property would be found to be a proper public use.

Important constitutional interests are at stake in the net neutrality debate. Greater appreciation for these constitutional interests, especially freedom of speech, is likely to lead to sounder communications policy.

To Regulate; or Not to Regulate: Where is the Broadband Market Failure?

Larry F. Darby

Economic regulations have historically been rationalized as efforts to facilitate the operation of markets (laws of contract, property rights, torts, etc.) or to address market "failures" (antitrust laws, utility regulation, consumer protections, etc.). In addition to protecting the broad "public interest" economic regulations in practice are often imposed on suppliers as means to redistribute real income (a form of taxation via regulation) or to (re)distribute business growth opportunities among different private interests. The case put forth for regulating broadband network access appears to be in the latter category. Net neutrality advocates cite market failure as the basis for government intervention, but a fair assessment of historical conduct and performance of the broadband network access sector compels analysts to look elsewhere for the impetus to regulate.

The basic arguments for regulating market conduct of broadband network access providers – "network neutrality," "openness," "fairness," "level playing fields" and the like – are largely rhetorical and essentially non refutable. Nothing about markets or government action is "neutral." All private or public actions create benefits for some and impose costs for others. Rules being proposed in the name of "net neutrality" or related notions will create winners and losers on both the demand and supply sides of the market, and among different classes of consumers and suppliers. One's sense of the broad public interest depends on what criteria are judged most important (jobs, net neutrality, investment, economic growth, universal access at low cost, etc.) and how they are weighted. Policy making is ultimately about balancing among competing goals and distributing costs or value among contending private stakeholders.

Sources of Market Failure

Welfare economists have identified several sources of potential failure of markets – failure in the sense of the inability of markets to achieve so-called optimality or maximum efficiency. Externalities, market power, imperfect information, and public goods aspects are the main culprits identified by welfare economists as sources underlying failure of markets in the abstract to achieve maximum efficiency.[142] While there are numerous, clear instances in which these "classical welfare economics" bases for regulation obtain, most government interventions have different explanations. So it is in the case of the proposed regulations to preserve "net neutrality."

While net neutrality advocates address, more or less, two of these sources of failure – market power and imperfect information – the core of their argument does not have historical, empirical or theoretical referents. Maintenance of neutrality, preservation of openness, consistency with founding network principles and related goals of the net neutrality brief are uniquely applicable to current controversies over market conduct of owners of broadband networks and their behavior toward applications and content providers or others in the Internet

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[142] Richard O. Zerbe, Economic Efficiency in Law and Economics, especially chapter 7, "The Failure of Market Failure", Edgar Elgar (pub) Northampton, MA, 2001.

supply chain. As the main indicator of market failure, net neutrality advocates have referred to elements of the structure of network owner/operator markets, their conduct and their performance.

Concentrated Market Structure. Net neutrality advocates cite high concentration of sales revenue shared by two providers – cable and telephone networks – in most local markets in which consumers make choices. Use of the term "cozy duopoly" is a frequent and popular substitute for analyzing what really matters to consumers – rates and service quality currently and over time. One advocate went so far as to declare: "…when a market has fewer than the equivalent of six equal-sized competitors, the market just doesn't function properly."[143] This economic nonsense has been cited repeatedly. By this standard, there is market failure and the basis for economic regulation nearly everywhere.

Google advised the FCC that the broadband problem "…is the market itself, rather than in a roster of actual and potential 'bad acts.' In other words, the flaw is structural, not behavioral."[144] Variations on this structural theme of market failure have been repeated numerous times, generally without much in the way of supporting analysis, by Free Press, Public Knowledge, Consumer Federation of America, bloggers and other advocates of regulation.

The absence of analysis regarding the sufficiency of market concentration as a rationale for public intervention is understandable. There is not much there. My review of six different analytical perspectives on duopoly turned up negligible support for the *market structure/market failure/need for regulation* train of logic. The literature review and search for evidence that duopoly is per se an indicator of market failure and sufficient to warrant utility type regulation focused on six different perspectives.[145] These included: 1) the neoclassical industrial organization view of the relations between structure, conduct and performance; 2) duopoly models of game theorists; 3) outcomes from experimental economics focused on duopoly; 4) evidence from other sectors served by two dominant firms;[146] 5) conclusions from competition policymakers and analysts in general; and 6) facts about the historical and current price, service and investment performance broadband providers. While each perspective recognized that competition was imperfect, none found the basis for concluding that duopoly markets are not

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[143] Testimony of Mark Cooper, Director of Research, Consumer Federation of America before the United States Senate Committee on Commerce, Science and Transportation Regarding Competition and Convergence March 30, 2006, p. 4.

[144] Comments of Google Inc., In the Matter of Broadband Industry Practices, FCC WC Docket No. 07-52, June 15, 2007, 10.

[145] See, Remarks of Dr. Larry F. Darby, "How 'Cozy' is the BB Duopoly?" delivered at the Progress and Freedom Congressional Seminar: "Broadband Competition: Is the Glass Half Empty or Half Full? June 12, 2009. Available online at: http://www.theamericanconsumer.org/2009/10/22/remarks-of-dr-larry-f-darby-how-cozy-is-the-broadband-duopoly/.

[146] These included: Moodys and S&P; Fed Ex and UPS; Pepsi and Coke; Home Depot and Lowes; Kodak and Fuji Film; MCI and AT&T in the early days of interexchange telephone competition; Lexis/Nexis and WestLaw; Dish Network and Direct TV; Air Canada and Westjet in the Canadian air transport market; Gillette and Wilkinson Sword; and, AirBus and Boeing. Competition is imperfect in these cases, but vigorous and arguably effective in the sense that extensive economic regulation has not been warranted or imposed.

workably or effectively competitive or that duopoly, not otherwise analyzed, warrants imposition of economic regulation.

Existing concentration in broadband markets is not the product of monopoly conduct. It stems from the fundamental technological and economic character of broadband networks and markets. Fixed costs are high relative to variable costs; there are substantial economies of scale relative to the size of the market; costs are in substantial part sunk; and marginal costs are well below average costs. Each of these plays a role in constraining the feasible, efficient number of sellers. Each of the two main current broadband network platforms (cable and wireline telco) was once regarded as natural monopolies. They now compete because of digitization of their networks which allows each to provide voice, video and data services while serving more generally as Internet access platforms.

Net neutrality advocates' fascination with the epithet "cozy duopoly" masks the fact that an appreciable number of Internet subscribers have three, four or more alternative providers.[147] The negative characterization ignores as well growing consumer use of wireless networks and devices for "broadband" communications. Indeed, the anticipated growth of wireless, unless hampered by government action or inaction, promises a third path into most households in the foreseeable future.[148]

Competition among broadband networks is far from the textbook model. But, merely citing sound bites and talking point characterizations about market structure says absolutely nothing germane about the efficacy of current market operations, consumer welfare, the need for economic regulation, nor the type of regulation needed. Advocates must look elsewhere. The Scotch Verdict applies: "Case not proven!"

Broadband Market Conduct. If the structural case for regulation not compelling, indications of the need for regulation based on the market conduct of broadband network providers is even less so. Advocates almost invariably cite two episodes – one by a wireline telephone carrier (Madison River) and the other by a cable network operator. Both involved blocking network use to selected subscribers. However, in both instances, the offensive conduct was discontinued in the context of existing regulations.[149]

The claimed anticompetitive conduct basis for broadband regulation is almost exclusively prospective and conjectural. Put differently, little of great consequence has happened yet, but in the view of advocates: "It might!" And, in their view, ex ante regulation is needed to make certain that it does not occur. Distinguishing between actual market failure

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[147] Jeffrey A. Eisenach, "Broadband Policy: Does the U.S. Have It Right After All?". Progress and Freedom Foundation, Progress on Point Release 15.14 September 2008.

[148] Sources and extent of future wireless growth, and the need for adequate spectrum to accommodate it, are detailed in Rysavy Research, *Mobile Broadband Spectrum Demand*, December 2008 esp. sections 2 and 3, online at: www.rysavy.com/Articles/2008_12_Rysavy_Spectrum_Demand.pdf. For an excellent accounting of handset and network innovation and its impact on wireless services growth see Gerald R. Faulhaber and David J. Farber, Innovation *In The Wireless Ecosystem: A Customer-Centric Framework,* at: http://www.att.com/Common/about_us/public_policy/fcc_wireless_noi/Paper-Faulhaber_Farber.pdf.

[149] The applicability of existing regulation and the ability of the FCC to estop the practice is undergoing Court review. Details of the legal status of the FCC Internet Principles are outside my purpose here.

and conjectural or prospective market failure is not merely a debating point. The briefs for imposing regulation are notable for their conditional, rather than factual, orientation. Most of the discussion about the need for regulation includes conjectures about what might happen in absence of regulation rather than facts about anticompetitive conduct or poor performance. Coherent economic analysis is missing.

New Pricing Conduct. One aspect of potential network operator market conduct is seldom mentioned by regulatory advocates, but as a practical matter clearly underlies most of the concern about what broadband network providers might do in the future.

The source of concern, by applications providers – Google and others – is that network providers might in the future be inclined to adopt so-called "two-sided" pricing models, the essence of which would relieve the demand side, subscribers to Internet access, of part of the cost burden and shift it to advertisers or applications or content providers or some other service that harvests value from use of broadband networks. Two-sided markets have two discrete groups of customers.[150] Thus, credit card companies charge both users and merchants; information suppliers – newspapers, magazines, cable television, and others – charge both subscribers and advertisers; software companies serve both developers and end users, and so on. Firms that derive value from broadband networks may well be seeking protection from regulators to make certain that all network costs are recovered by broadband suppliers from their Internet subscribers and none are assigned for recovery from applications or content providers.

Market Performance. Advocates of regulation tend to discount or ignore the facts of what is happening in terms of broadband prices (they are falling); average bandwidth or rate of throughput (they are increasing); the rate of capital expenditure (it is substantial and accounts for an extraordinary share of broadband network operators' cash flow from operations); jobs created (broadband operators create more than the average number of jobs per dollar of revenue derived from consumers compared to the S&P 500 or large Internet applications providers.)[151] These facts and trends are of fundamental analytical importance in discussions of

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[150] Larry F. Darby, "Consumer Welfare, Capital Formation and Net Neutrality: Paying for the Next Generation Broadband Networks," Darby Associates, June 6, 2006. "Multisided markets wherein central economic platforms of various sorts create value for multiple stakeholders are increasingly the rule rather than the exception in the US economy. Similar characteristics can be found in Yellow Pages directories (businesses, readers), publication software like Adobe Acrobat (authors, readers), Internet backbones and search engines (sites, surfers), shopping malls (shops, consumers), credit card platforms (end users and cooperating merchants derive value therefrom); matching and employment agencies, auction houses, service vouchers networks, payment systems, all kinds of communication networks, videogame consoles, scientific journals, Internet search engines (which provide value for searchers, "searchees," and advertisers); broadcast platforms (which create value for end users, production assets, advertisers and content providers); to name a few." Available online at: http://www.theamericanconsumer.org/2006/06/06/consumer-welfare-capital-formation-and-net-neutrality-paying-for-next-generation-broadband-networks.

[151] See, Presentation of Dr. Larry F. Darby to PFF Hill Panel, "How Cozy is the Broadband Duopoly", especially Table 1. On line at: http://www.theamericanconsumer.org/2009/10/22/remarks-of-dr-larry-f-darby-how-cozy-is-the-broadband-duopoly.

broadband market failure, but they typically yield in the briefs of net neutrality advocates to catch-words and out of context anecdotes.

Pro-regulatory critics' of broadband suppliers favorite "indicator" of US market performance comes in large part from the results of reports from Europe showing the US behind other countries in broadband development – ranked variously around number 15 in the world. Pro-market critics of these critics correctly call attention to a) well known infirmities of any inter-country comparisons, b) biases stemming from selection of indicators of broadband performance, c) superior US rankings using alternative metrics and d) clear dominance of US sector in network investment. There is an inescapable impression that differences over the interpretation of various US rankings resemble somewhat a Rorschach Ink Blot Test. Their meaning is very much in the eye and mind of the beholder. What we see depends on us individually – our frames of references, our biases and our policy preferences.

Beyond their ambiguity, the major limitation of international comparisons of broadband performance is that they tell us nothing about the causes of the gap, nor more importantly what might or should be done to close it. Too little work has been done to identify successful strategies that might be imported from other countries. Notably in the present context of discussions of regulatory offsets to alleged market failures, there is nothing in the experience of other countries to suggest that government regulations imposed in the name of "net neutrality" will have a positive impact on closing the gap. Nor is their any suggestion that emulating other countries might be costly. Indeed, the whole debate about international rankings finesses the question of the costs or benefits of government efforts, economic regulation in particular, to improve economic performance – a topic to which I now turn.

Government Conduct: Imperfections in Regulation

Critics citing our international broadband rank do so for the most part as part of an argument favoring government intervention to impose "net neutrality" based regulations on broadband network operators. This despite the lack of evidence that the absence of regulation is the source of any gap, real or imaginary,[152] and without regard to a) the ability of government to elevate our ranking via economic regulation or b) the costs at the margin of imposing regulations to offset alleged costs in markets. Regulatory advocates refer mainly to imposing various constraints on broadband network suppliers, despite the fact that reputable, reliable consumer surveys indicate that while network access prices and availability and services quality matter, more than half of respondents cite demand side factors – lack of computers, lack of computer savvy, lack of interest, etc. – as the reason for not subscribing to available broadband services.[153] Clearly, imposing economic regulation on grounds of imperfections in supply does nothing to address these major sources of lagging broadband subscription. But, the story does not end there. Critics also ignore the potential costs of substituting public for private decision makers in the supply of broadband networks and services.

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[152] For discussion of some possible reasons for reports of a US lag, see Robert D. Atkinson, Daniel K. Correa and Julie A. Hedland, Explaining Broadband Leadership, May 1, 2008. Available online at: http://www.itif.org/index.php?id=142.

[153] *See* John Horrigan, Pew Internet and American Life Project, *Home Broadband Adoption 2009*, June 2009, available online at http://www.pewinternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf.

Markets are imperfect, but so too are government regulatory processes. While the case for markets has been exhaustively researched and expressed in both empirical and theoretical terms, the infirmities of government regulation have gotten less analytical attention and are often merely implied or mentioned in passing in terms of unanticipated or unintended consequences. To be sure, economic analysts have cited regulatory lag, imperfect or asymmetric information, the absence of regulatory commitment, regulatory capture by vested interest groups, and, particularly relevant in the current context, the simple inability of well-meaning and well informed government officials reliably to forecast the impact of regulatory constraints in a dynamic market setting. Fixing markets is like shooting at a moving target. Markets solve imperfections through private contract, but also create new ones as technology evolves, consumers tastes change and market strategies mature. While many of the consequences of imposing one or another element net neutrality based regulation on network suppliers can be reasonably and reliably foretold, many cannot. The unintended, unanticipated consequences will not be trivial.

We must consider the possibility, some say likelihood, of the appearance of some forms of government failure in processes put in place to "fine tune" markets. In this context, no less an authority than Professor Joseph Stiglitz, Nobel prize-winner and formerly Chairman of the President's Council of Economic Advisors recently wrote:

> *Anyone who has watched the U.S. government in the last seven years is well aware not only of the possibility of government failure but also of its reality. In some cases it is a matter of incompetence, in others of corruption, in still others it is a result of ideological commitments that preclude taking appropriate actions…Government programs can be subverted.*[154]

We take recent remarks of FCC Chairman Genachowski as in substantial agreement with the need to take a realistic view of not only market imperfections, but of government imperfections as well. The Chairman recently emphasized the importance when considering new regulations of "getting it right," while also being candid about the Commission's mixed history of doing so: "The Commission's history in this area holds great examples of success…But there are also examples of failures…In short, at times the Commission has gotten it right, and at times it has gotten it wrong."[155]

Concluding Observations

Market structure in the current debate is a red herring. It provides no reasoned basis, and certainly none from consumer welfare analysis, for imposing conduct constraints on broadband network providers. Nor for that matter do factual assessments in the context of

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[154] Joseph E. Stiglitz, "Government and Markets: Toward a New Theory of Regulation", Government Failure vs. Market Failure: Principles of Regulation, Edward Balleisen and David Moss, Eds., The Tobin Project, (Forthcoming November, 2009), at page 17. Available online at: http://www.tobinproject.org/twobooks.

[155] Prepared Remarks of FCC Chairman Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity", September 21, 2009. Online at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293568A1.pdf.

traditional economic welfare analyses of conduct and performance reveal compelling signs of market failure. Misconduct appears limited to isolated events, while profits (the traditional sign of market power) of broadband network providers are modest by any standard. The telcos and cable companies providing broadband networks earned roughly half the return on capital over the past five years of that earned by the average of the S&P 500 companies (10.7%) and about a quarter of the return on capital earned by Google (19.7%) over the same period.[156] The impetus for regulation must lie elsewhere.

The recent FCC NPRM to extend the net neutrality principles is suggestive. Paragraph 106 of that NPRM will very likely attract a lot of attention as a potential alternative motivation of the new rules.

> *We understand the term 'nondiscriminatory' to mean that a broadband Internet access service provider may not charge a content, application, or service provider for enhanced or prioritized access to the subscribers of the broadband Internet access service provider…[t]his rule would not prevent a broadband Internet access service provider from charging subscribers different prices for different services.*[157]

No matter how you read this declaration, the language makes clear that the purpose of the new "nondiscrimination" rule is not to protect subscribers (consumers), but to prevent two-sided market pricing by broadband network operators. Specifically, the language would forbid broadband network operators from charging other Internet firms ("content, application, or service providers") and applying the proceeds to defray common costs that will otherwise necessarily be borne by consumers.

It is not clear how this proposed rule contributes to timely achievement of universal broadband availability.

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[156] Calculated from company 10 K SEC filings and from financial information available online at: http://moneycentral.msn.com/investor/invsub/results/compare.asp?Page=InvestmentReturns&Symbol=GOOG.

[157] Notice of Proposed Rulemaking, *In the Matter of Preserving the Open Internet: Broadband Industry Practices*, (GN Docket No. 09-191 and WC Docket No. 07-52NPRM) October 22, 2009 at paragraph 106.

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