

NET NEUTRALITY AND CONSUMER WELFARE

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ABSTRACT

The Federal Communications Commission's proposed net neutrality rules would, among other things, prohibit broadband access providers from prioritizing traffic, charging differential prices based on the priority status, imposing congestion-related charges, and adopting business models that offer exclusive content or that establish exclusive relationships with particular content providers. The proposed regulations are motivated in part by the concern that the broadband access providers will adopt economically inefficient business models and network management practices due to a lack of sufficient competition in the provision of broadband access services. This paper addresses the competitive concerns motivating net neutrality rules and addresses the potential impact of the proposed rules on consumer welfare. We show that there is significant and growing competition among broadband access providers and that few significant competitive problems have been observed to date. We also evaluate claims by net neutrality proponents that regulation is justified by the existence of externalities between the demand for Internet access and content services. We show that such interrelationships are more complex than claimed by net neutrality proponents and do not provide a compelling rationale for regulation. We conclude that antitrust enforcement and/or more limited regulatory mechanisms provide a better framework for addressing competitive concerns raised by proponents of net neutrality.

JEL: K20; K21; K23; L40; L50; L51; L52; L96; L98; O31; O38

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I. INTRODUCTION

In October 2009, the Federal Communications Commission (FCC) proposed draft rules for “preserving a free and open Internet.”¹ These rules included a “nondiscrimination” principle, stating that “[s]ubject to reasonable network management, a provider of broadband Internet access service must treat lawful content, applications, and services in a nondiscriminatory manner.”² This proposed rule is the core of what is popularly referred to as “net neutrality.”

In the FCC’s view, its proposed net neutrality rules would “prohibit a broadband Internet access provider from discriminating against, or in favor of, any content, application or service.”³ Broadband access providers would be prohibited from: (1) prioritizing traffic and charging differential prices based on the priority status; (2) imposing congestion-related charges; (3) adopting business models that offer exclusive content or that establish exclusive relationships with particular content providers; and (4) charging content providers to access the Internet based on factors other than the bandwidth supplied.

The net neutrality framework outlined by the FCC reflects the view that there is insufficient competition in the provision of broadband access services to ensure that broadband access providers will adopt business models and network management practices that are consistent with consumers’ interests. Net neutrality proponents argue that in the absence of regulation, broadband access providers will adopt “non-neutral” network management that disadvantages certain types of Internet content, harming competition for and investment in content. The FCC’s Notice of Proposed Rulemaking (NPRM), for example, states that “market forces alone are unlikely to ensure that broadband Internet access service providers will discriminate in socially efficient ways and that, absent regulation, such discrimination is likely to change fundamentally the nature of the Internet, reduce competition, and hinder innovation and growth.”⁴ The FCC further suggests that non-neutral network management practices also “could reduce innovation at the edge of the network.”⁵

This article addresses the economic rationale for net neutrality regulation and the potential impact of such rules on consumer welfare. We conclude that many of the concerns expressed by net neutrality advocates are misplaced and that the proposed regulations are likely to harm consumer welfare. We show that there is significant and growing competition among

¹ Preserving the Open Internet; Broadband Industry Practices, Notice of Proposed Rulemaking, 24 F.C.C. Rcd. 13064 (2009) [hereinafter NPRM].

² *Id.* ¶ 104.

³ *Id.*

⁴ *Id.* ¶ 67.

⁵ *Id.* ¶ 70.

broadband access providers and that few significant competitive problems have been observed to date, suggesting that there is no compelling competitive rationale for such regulation. We also evaluate claims by net neutrality proponents that regulation is justified by externalities between the demand for Internet access and content services and show that such interrelationships are more complex than claimed by proponents and do not provide a compelling rationale for regulation. Finally, we explain how net neutrality rules would interfere with the development of business models and network management practices that may be efficient responses to the large, ongoing, and unpredictable changes in Internet demand and technology.

The FCC noted, correctly in our view, that the Internet has “transformed our nation’s economy, culture, and democracy.”⁶ The Internet remains highly dynamic and continues to experience dramatic growth in demand. To date, and in the absence of regulatory requirements to do so, access providers have maintained business models and network management practices that, as a general rule, do not prioritize traffic or impose congestion-based charges. Net neutrality rules would freeze current business models and network management practices that currently characterize the provision of Internet services. However, the scope of services provided using the Internet is rapidly changing, and restricting the ability of Internet service providers to respond to changes in technology and demand limits the ability of firms to respond to changed circumstances, which is likely to harm investment, innovation, and consumer welfare.

The objective of net neutrality proponents is “preserving a free and open Internet.”⁷ By itself, this is not an economically appropriate goal of public policy, which instead should focus on maximizing consumer welfare. It is difficult if not impossible for regulators today to anticipate which business models and network practices will be efficient in the future. Instead, history shows that attempts by regulators to control the development of new technologies can result in delays that harm consumer welfare. Under these circumstances, imposition of potentially far-reaching restrictions on business practices is likely to harm consumer welfare. If and when competitive concerns arise, they can be better addressed through antitrust enforcement and/or more limited regulatory mechanisms.

The remainder of this article is organized as follows. Section II presents background on the Internet and evaluates the competitive assumptions that underlie net neutrality proponents’ competitive concerns. Section III discusses ongoing changes in Internet services and technologies and shows how net neutrality rules may interfere with the development of efficient business models and network management practices. Section IV concludes.

⁶ *Id.* ¶ 1.

⁷ *Id.* ¶ 16.

II. EVALUATION OF THE COMPETITIVE RATIONALE FOR NET NEUTRALITY REGULATION

A. Overview of Net Neutrality Proponents' Competitive Concerns

The provision of Internet services involves a wide variety of service providers.⁸ Broadband Internet access services are largely provided by cable companies and telephone companies, and, as discussed further below, new fourth-generation (4G) wireless broadband Internet access services are now being widely deployed. Internet backbone providers provide high-capacity long-haul transmission services typically with fiber optic transmission technologies. Backbone providers' networks interconnect at multiple hubs, and the resulting network of Internet backbones typically provides for multiple routes between points. Finally, content and application providers operate on the "edge" of the Internet and use a variety of business models to distribute content. Some content providers operate their own "server farms" with direct access to an Internet backbone. Others use distributed servers in multiple geographic areas to store or "cache" content closer to end-users to improve service quality. Smaller content providers often contract with third parties to host content and to provide connections to the Internet.

Today, the economic arrangements between Internet service providers are largely unregulated, and the evolution of Internet business models and network management practices has largely been driven by market forces. The Federal Trade Commission's (FTC) 2007 report notes that, "since about 2000, the FCC has undertaken a substantial and systematic deregulation of broadband services and facilities, concluding that cable, wireline, powerline, and wireless broadband Internet access services are 'information services' that are not subject to common carrier requirements."⁹ As a result, providers of Internet services are not required to provide physical connections to other carriers; nor are they subject to obligations to provide services at "just and reasonable" rates or to comply with nondiscrimination requirements.¹⁰ Similarly, the provisioning of backbone traffic and interconnection is unregulated. The FTC notes that "[t]o this day, there are no general, industry-specific regulations that govern backbone interconnection in the U.S."¹¹

It has long been technologically possible to prioritize Internet traffic, but it typically has not been delivered or priced on this basis. Despite the lack of any regulatory obligation, Internet traffic has generally been handled by

⁸ FED. TRADE COMM'N, STAFF REPORT, BROADBAND CONNECTIVITY COMPETITION POLICY, June 2007, at 23–28, available at <http://www.ftc.gov/reports/broadband/v070000report.pdf> [hereinafter FTC STAFF REPORT], provides a more detailed overview of these components of Internet services. There is significant overlap in the firms that operate in these categories.

⁹ *Id.* at 3.

¹⁰ *Id.* at 42.

¹¹ *Id.* at 25.

service providers on a “first-in-first-out” and “best efforts” basis.¹² Both net neutrality proponents and others claim that broadband access providers have a growing incentive to deviate from current practices by using alternative business models that may include charging content providers, payments for prioritized services, or charges based on network congestion created by content providers or users.

Many industry observers and service providers argue that changes in business practices may be an efficient response to changes in demand and technology that promote consumer welfare. Net neutrality proponents, however, claim that such changes would be the inefficient consequence of market power exercised by broadband access providers and would harm competition and consumer welfare. Net neutrality proponents claim that providers of Internet services have a growing incentive to discriminate against rival content providers by charging relatively high fees (or providing lower quality service) to those rival content providers or even by denying access to rival content providers altogether. Net neutrality proponents claim that such discrimination harms competition among content providers. The economic literature discusses the applicability as well as the limitations of such claims. In particular, discrimination by a firm with market power against firms in adjacent markets harms competition in adjacent markets only under limited circumstances.¹³

As a preliminary matter, it is important to recognize both that the mere existence of price differences does not necessarily imply price discrimination and that the existence of price discrimination does not necessarily imply harm to competition. For example, price differences attributable to differences in the quality of service are not “discriminatory” but instead can reflect the higher cost of providing higher quality services. Even then, the impact of discrimination on consumer welfare is ambiguous and can result in an increase in output (relative to the level that would exist without discrimination).¹⁴ Price discrimination can result in prices to certain consumers that are below those that would prevail in its absence and an increase in sales to these consumers.

Price discrimination that raises a firm’s profits may create incentives for broadband access providers to invest in expanding or upgrading their networks. Price discrimination is widespread and need not result in harm to

¹² *Id.* at 2.

¹³ See, e.g., RICHARD A. POSNER, *ANTITRUST LAW* 198–99 (2d ed. 2001); Dennis W. Carlton & Michael Waldman, *The Strategic Use of Tying to Preserve and Create Market Power in Evolving Industries*, 33 *RAND J. ECON.* 194 (2002); Jay P. Choi & Christodoulos Stefanadis, *Tying, Investment, and Dynamic Leverage Theory*, 32 *RAND J. ECON.* 52 (2001); Barry Nalebuff, *Bundling as an Entry Barrier*, 119 *Q.J. ECON.* 159 (2004); Michael D. Whinston, *Tying, Foreclosure, and Exclusion*, 80 *AM. ECON. REV.* 837 (1990).

¹⁴ The FCC itself recognizes that discrimination can advance consumer welfare. NPRM, *supra* note 1, ¶ 103.

competition—that is, harm to the competitive process that deprives or impedes consumers’ access to alternative suppliers, resulting in higher prices. For example, price discrimination by a monopolist who does not face entry cannot harm the competitive process because, by assumption, there are no rivals. Because price discrimination need not result in harm to consumers or competition and because it would be costly and difficult to try to identify only those instances in which consumers are harmed, the elimination of all forms of discrimination is not an economically appropriate policy goal.

Although net neutrality proponents focus on broadband access providers’ incentives to discriminate, access providers also face a variety of incentives not to engage in discrimination or other business practices that do not promote consumer welfare. Competition among broadband access providers, including cable, DSL, and, increasingly, wireless broadband, enables consumers to switch providers if they are not satisfied with the service from their current provider. As discussed further below, available data also indicate that subscribers frequently switch service providers and that broadband access providers face considerable customer “churn.”¹⁵ As a result of this competition, attempts by a broadband access provider to limit access to Internet content would likely result in the loss of subscribers that prefer unrestricted access, which, in turn, provides a competitive constraint that limits incentives for such actions. The FTC’s 2007 report shares this view, noting that “[a]bsent coordination or collusion among providers, as long as consumers have one or more alternatives to which they can turn, it is difficult to imagine them accepting the blockage or elimination of content that is important to them.”¹⁶ In addition, regardless of the competitive alternatives available, discrimination by broadband access providers that limits access to content usually reduces the amount that consumers are willing to pay for broadband access services. That is, consumers are willing to pay more for access to more content and, as a result, broadband access providers face disincentives for restricting access to Internet content.

B. Status of Broadband Access Competition

Net neutrality proponents claim that competition in the provision of broadband access competition may not be “effective” and thus may not constrain broadband access providers from engaging in anticompetitive discrimination. This section reviews this claim and summarizes the current status of competition in the provision of broadband access services.

¹⁵ “Churn” is an industry term that refers to the fraction of a service provider’s customers lost in a given time period.

¹⁶ FTC STAFF REPORT, *supra* note 8, at 157.

In evaluating claims that competition in the provision of broadband services is ineffective, it is important to recognize the rapid growth of broadband services and sharp declines in price in recent years. Between mid-2002 and mid-2008, the number of high-speed broadband access lines in the United States grew from 16 million to nearly 133 million, and the number of residential broadband lines grew from 14 million to nearly 80 million.¹⁷ Internet traffic roughly tripled between 2007 and 2009.¹⁸ At the same time, prices for broadband Internet access services have fallen sharply. For example, in 2002, Charter Communications was offering broadband service with 512 to 768 kbps speeds for \$40 per month.¹⁹ Today, Charter offers a bandwidth of 10 mbps, roughly 13 to 20 times faster service, for the same \$40 per month.²⁰ Similarly, the price of Verizon DSL service with 768 kbps download bandwidth fell from \$49.95 in 2001 to \$19.99 in 2007.²¹

Most geographic areas today are served by multiple providers of broadband Internet access services. FCC data indicate that in June 2008, 99.8 percent of zip codes in the United States had two or more providers of high-speed Internet lines available, and 94.6 percent of zip codes had four or more providers.²² Available data also indicate that switching or churn among broadband customers is substantial, and comparable in magnitude to those observed among consumers of other telecommunications services. For example, Cablevision's monthly churn rate in the fourth quarter of 2007 was 2.1 percent for its cable customers and 2.2 percent for its high-speed data customers.²³ Similarly, monthly churn in 2008 among Verizon's FiOS customers (who receive both video and Internet access services) was 2.0 percent,²⁴ whereas churn among Verizon's wireless telephone subscribers was 1.3 percent.²⁵

¹⁷ FCC, High Speed Services for Internet Access, <http://www.fcc.gov/wcb/iatd/comp.html> (last visited Aug. 6, 2010) (follow 2/10 Release Tables to view Tables 1 and 3) [hereinafter FCC High Speed Services Report].

¹⁸ Goldman Sachs, Broadband 100: Fears "Over the Top"? Early Stage Broadband Video Investing Across Tech, Media and Telecom, May 2009, at 7 [hereinafter Goldman Sachs]; Univ. of Minn., Minnesota Internet Traffic Studies, <http://www.dtc.umn.edu/mints/home.php> (last visited Aug. 6, 2010).

¹⁹ Jason Bazinet, Mark Crossman & Spencer Wang, *Broadband 2003: Deflation Looms and Market Shares Will Shift*, J.P. MORGAN INDUSTRY UPDATE, Dec. 2002, at 8.

²⁰ Charter Commc'ns, <http://www.charter.com/Visitors/Products.aspx?MenuItem=36> (last visited Aug. 6, 2010).

²¹ Robert E. Litan & Hal J. Singer, *Unintended Consequences of Net Neutrality Regulation*, 5 J. ON TELECOMM. & HIGH TECH. L. 533 (2007).

²² FCC High Speed Services Report, *supra* note 17, tbl.15. The FCC tracks high-speed lines available through ADSL, SDSL, cable modem, fiber, satellite, fixed wireless, mobile wireless, and powerline technologies.

²³ Buckingham Research, *The Last Mile—Monitoring Quarterly Trends in Telecommunications, Video, and Data*, at 91 (Aug. 27, 2008).

²⁴ Credit Suisse, *Verizon—Positioning for the Future*, at 17 (Oct. 22, 2009).

²⁵ RBC Capital Markets, *Wireless Retail Update—Telecommunications Services*, at 2 (Nov. 22, 2009).

Competitive concerns of the type cited by net neutrality proponents are further mitigated by the entry of new broadband service providers as well as by the expansion and upgrading undertaken by existing providers in response to, and in anticipation of, the large and ongoing increases in Internet demand, which are discussed in more detail below. The new technologies offered by both entrants and existing market participants—including 4G wireless services (using WiMax or LTE technologies), high-capacity fiber-based services, and upgraded cable-based services—offer significant increases in throughput to subscribers.

A wide variety of high-capacity broadband access services are now in the process of being deployed.²⁶ Among others, Clearwire lists 55 cities where it provides 4G service in the United States as of August 2010.²⁷ It typically offers wireless coverage throughout most of these metropolitan areas in which it has entered, offers services that is “typically as fast as most home broadband connections,” and supports streaming video. Unlimited home service plans begin at \$25 per month.²⁸ Clearwire has also announced its plans to launch Clear 4G services in Los Angeles, Miami, St. Louis, Cincinnati, Cleveland, Pittsburgh, and Salt Lake City in 2010.²⁹ MetroPCS announced that its 4G wireless service will be deployed in the second half of 2010.³⁰ Sprint announced plans to launch its dual mode 3G/4G service in at least ten markets in 2009 and that it will continue to add markets in 2010.³¹ As of August 2010, Sprint offers 4G service in 45 markets.³² AT&T announced that it will begin trials of its 4G LTE wireless broadband technology in 2010 and will launch service in 2011. AT&T also announced that its U-Verse Fiber/DSL service will pass 30 million homes by 2011.³³ Cincinnati Bell launched its fiber-to-the-home service in 2009.³⁴ Verizon announced that it will offer 4G LTE wireless broadband technology to 100 million people in 2010 and to virtually its entire service area by 2013.³⁵ Comcast and Time Warner and others have deployed, or have announced plans to deploy, 4G

²⁶ For an overview, see Robert C. Atkinson & Ivy E. Schultz, Columbia Inst. for Tele-Information, *Broadband in America: Where It Is and Where It Is Going*, Preliminary Report Prepared for the Staff of the FCC’s Omnibus Broadband Initiative, at 51–52 (Nov. 11, 2009) [hereinafter CITI Report].

²⁷ Clear, Check Clear Coverage, <http://www.clear.com/coverage> (last visited Aug. 6, 2010).

²⁸ Clear, Rates and Plans, <http://www.clear.com/callnow/plans> (last visited Aug. 6, 2010).

²⁹ Press Release, Clearwire, Clearwire Extends 4G Leadership in the United States (Mar. 23, 2010), <http://newsroom.clearwire.com/phoenix.zhtml?c=214419&p=irol-newsArticle&ID=1404906&highlight=>.

³⁰ CITI Report, *supra* note 26, at 51–52.

³¹ *Id.*

³² Sprint, First and Only Wireless 4G from a National Carrier, <http://now.sprint.com/nownetwork/4G/?ECID=vanity:4G> (last visited Aug. 6, 2010).

³³ CITI Report, *supra* note 26, at 51–52.

³⁴ *Id.*

³⁵ *Id.* at A-35.

services.³⁶ ViaSat and Hughes Communications have each announced plans to deploy “high throughput” satellite-based broadband access services. Each firm is expected to have the capacity to provide broadband services to roughly 2 million homes.³⁷

The Columbia Institute for Tele-Information (CITI) Report also concludes that 4G deployments will compete directly with wireline and other existing broadband providers. For example, it shows that 4G wireless broadband offerings will have downstream speeds of 4–12 Mbps, which are comparable with or higher than those offered by wireline broadband services providers.³⁸ It also shows that prices for early 4G deployments are comparable with those for wireline broadband services.³⁹

The CITI Report further shows that entry and deployment of upgraded services are not limited to major metropolitan areas. CITI also tracks the activity of wireless Internet service providers (WISPs) that provide wireless broadband services in rural areas using Wi-Max technology and reports that “the 350 members of the WISP Association—far from the total number of WISPs—provide fixed broadband wireless services to over 2 million locations.”⁴⁰ CITI also reports that OpenRange, a WISP funded by private and public sources, has “plans to use Wi-MAX to initially serve 6 million people in 546 communities in 17 states and recently began offering its first services.”⁴¹ The credibility of these announcements is reinforced by CITI’s analysis that compares the initially projected and actual deployment dates for broadband projects publicly announced from 2004 to 2005. CITI’s analysis demonstrates that all of the projects announced in that period were completed and that the large majority of them were launched within a few months of the date initially projected.⁴²

As these examples indicate, broadband access providers typically face significant competition, and a wide range of firms are entering and/or upgrading their service offerings. Given these alternatives, access providers that fail to satisfy consumers’ preferences risk losing substantial numbers of subscribers to rivals. These circumstances reduce the risk that attempts by broadband access providers to engage in discrimination would succeed in impairing competition and further suggest that the net neutrality proponents’ competitive concerns are overstated.

More generally, the rapid growth and dynamic nature of broadband Internet services provide existing market participants and entrants with strong incentives to compete and attract new customers, even when there are

³⁶ *Id.* at 51–52.

³⁷ *Id.* at 57.

³⁸ *Id.* at 24.

³⁹ *Id.* at 34–35.

⁴⁰ *Id.* at 24.

⁴¹ *Id.* (citations omitted).

⁴² *Id.* at 41.

a limited number of suppliers.⁴³ Under these conditions, firms compete to attract new customers and retain existing ones by attempting to be the first to offer higher service quality as well as through price competition. Given the large investments being undertaken by broadband Internet access providers to support the expansion in output, regulatory policies that discourage investments supporting network upgrades can result in significant long-term harm to consumer welfare.

C. Alternatives to Net Neutrality for Deterring the Potential Anticompetitive Conduct by Broadband Access Providers

In support of their competitive concerns, net neutrality proponents highlight two examples in which broadband access providers have allegedly attempted to degrade services provided by rival content providers. The first is Comcast's alleged attempt to degrade Internet traffic generated using "BitTorrent," a bandwidth-intensive technology that uses multiple sources in delivering large video files to a single user.⁴⁴ Comcast's action is viewed by some as anticompetitive (as opposed to an efficient mechanism to manage network congestion) because the video delivered using BitTorrent may compete with programming provided through Comcast's cable-TV service. Net neutrality proponents also have highlighted attempts by Madison River, a small local exchange carrier, to block its DSL subscribers from accessing VoIP providers, such as Vonage, which compete with telephone service provided by Madison River.⁴⁵ Net neutrality proponents stress that neither Comcast nor Madison River had disclosed to subscribers that they had engaged in these network management practices.⁴⁶

Comcast contended that its actions were undertaken to relieve network congestion caused by the high traffic volume generated by BitTorrent users. In response to the complaint about these practices, Comcast developed an alternative network management plan that, instead of selectively blocking BitTorrent traffic, caps usage by subscribers that are intensive consumers of

⁴³ Even limited competition when networks were first deploying service has been found to have significant positive effects on adoption rates. For example, the early adoption of broadband was significantly higher in areas served by both cable modem and DSL providers compared with those served by only one technology. As Robert W. Crandall discussed in *Broadband Communications*, in 2 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 177 (Summit K. Majumdar, Ingo Vogelsang & Martin E. Cave eds., North-Holland Publishing Co. 2005), David Burnstein and Debra Aron show that in 2002, 14.5 percent of households in areas served by both cable and DSL providers received broadband compared with 8 percent of households in areas served by only one technology. See David E. Burnstein & Debra J. Aron, *Broadband Adoption in the United States: An Empirical Analysis*, in DOWN TO THE WIRE: STUDIES IN THE DIFFUSION AND REGULATION OF TELECOMMUNICATIONS TECHNOLOGY 119 (Allan Shampine ed., Nova Publishing 2003).

⁴⁴ NPRM, *supra* note 1, ¶ 37.

⁴⁵ *Id.* ¶ 32.

⁴⁶ *Id.* ¶¶ 37–123.

bandwidth.⁴⁷ More specifically, during periods of congestion, the highest volume users have their traffic assigned a lower priority until the period of congestion ends.⁴⁸ Although the facts of the *Madison River* case are less clear, *Madison River* entered into a consent decree with the FCC, made a “voluntary” payment of \$15,000, and agreed to cease its practice of attempting to block subscribers’ access to VoIP services.⁴⁹

The *Comcast* and *Madison River* cases do not, by themselves, suggest that broadband access providers to date have engaged in widespread efforts to degrade Internet traffic by rival content providers. We understand that both Comcast and *Madison River* modified their network management practices shortly after detection, even though the FCC’s authority to require any such modification remains uncertain. These circumstances suggest that both Comcast and *Madison River* were concerned that, once public, information about their actions could lead to customer complaints or result in the loss of subscribers.

This, in turn, suggests that the ability of content providers and others to detect (and publicize) efforts by access providers to block or degrade content can help deter these activities. Content providers undertake significant efforts to monitor the quality of services provided by backbone and access providers, and their ability to detect discrimination is facilitated by their ability to compare network performance in different geographic areas. A variety of organizations are active in monitoring Internet performance and offer tools to achieve this goal. For example, Akamai’s Site Analyzer allows detailed analysis of each Internet transaction step and the localization of any problems by type, location, and network.⁵⁰ Users can even “set up alerts on performance degradation and availability.”⁵¹ Measurement Lab, also known as M-Lab, “is an open, distributed server platform for researchers to deploy Internet measurement tools. The goal of

⁴⁷ Comcast complied with the FCC’s order to modify its network management plan but appealed the decision, contending, among other things, that the FCC lacked jurisdiction to order this remedy. The United States Court of Appeals for the District of Columbia Circuit recently ruled in Comcast’s favor, agreeing that the FCC lacked proper jurisdiction. *Comcast Corp. v. FCC*, 600 F.3d 642 (D.C. Cir. 2010).

⁴⁸ Letter from Comcast to Marlene H. Dortch, FCC, Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications, File No. EB-08-IH-1518; Comcast Corporation Description of Planned Network Management Practices to be Deployed Following the Termination of Current Practices, Broadband Industry Practices; Petition of Free Press et al. for Declaratory Ruling that Degrading an Internet Application Violates the FCC’s Internet Policy Statement and Does Not Meet an Exception for “Reasonable Network Management,” WC Dkt. No. 07-52, attachment B, at 2 (Sept. 19, 2008) [hereinafter Comcast Network Management Plan].

⁴⁹ J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet*, 2 J. COMPETITION L. & ECON. 349, 415 (2006).

⁵⁰ See AKAMAI, AKAMAI SITE ANALYZER: SERVICE DESCRIPTION (2009), available at http://www.akamai.com/dl/feature_sheets/Akamai_Site_Analyzer_Service_Description.pdf.

⁵¹ *Id.* at 12.

M-Lab is to advance network research and empower the public with useful information about their broadband connections.”⁵² M-Lab supports a variety of network diagnostic tools and was founded by the Open Technology Institute, the PlanetLab Consortium, Google Inc., and academic researchers.⁵³

Antitrust enforcement provides the standard approach to addressing the competitive concerns cited by net neutrality proponents. The FCC’s NPRM recognizes that discrimination can either benefit or harm consumer welfare and acknowledges that “[t]he key issue we face is distinguishing socially beneficial discrimination from socially harmful discrimination in a workable manner.”⁵⁴ Attempting to determine when “discriminatory” business practices harm competition and lower consumer welfare can be difficult and typically requires detailed, fact-specific analysis that attempts to account for (1) the impact of discrimination on competition in both upstream (content) and downstream (broadband access) markets, (2) the efficiency rationale for such practices, and (3) the potentially adverse impact of a remedy (such as imposing a duty to deal with a rival) on incentives for investment and innovation. Analysis of the impact of discrimination on competition is a common focus of antitrust analysis by economists and courts, and antitrust enforcement provides a mechanism for addressing competitive concerns of the type raised by net neutrality proponents.

Alternatively, forms of regulation short of net neutrality may be used to address specific anticompetitive circumstances if and when such circumstances may arise. Limited regulatory responses tailored to specific harms actually observed in the marketplace, as opposed to imposition of expansive and pre-emptive regulatory rules based on competitive circumstances not widely observed in the marketplace, would be more likely to protect competition while reducing the risk of harm to consumer welfare. Pre-emptive imposition of net neutrality regulation limits or eliminates network service providers’ ability to experiment with new business models and network management practices and can result in significant long-term harm to consumer welfare. At the same time, lack of widespread competitive problems to date, availability of multiple broadband access providers, and growth in competitive alternatives indicate that such far-reaching regulatory intervention today is not necessary to protect competition.

⁵² Measurement Lab, About Measurement Lab, <http://www.measurementlab.net/about> (last visited Aug. 6, 2010).

⁵³ *Id.*

⁵⁴ NPRM, *supra* note 1, ¶ 103.

D. Can Regulators Specify Business Practices That Maximize Consumer Welfare in Times of Rapidly Changing Technology?

Net neutrality proponents have the goal of maintaining current Internet network management practices into the indefinite future. However, the business models and network management practices widely used today may not best promote consumer welfare in the future. History indicates that it is not realistic to expect that even well-meaning regulators can determine which business models and network management practices are likely to work best in the future. Current practices have been driven by market factors, not regulation, and it should not be assumed without evidence that markets will fail to create the appropriate incentives for Internet service providers to adopt efficient business practices that promote consumer welfare.

A variety of studies show that attempts to regulate new or rapidly changing technologies can result in significant harm to consumer welfare. A 2002 paper by Robert Crandall, Robert Hahn, and Timothy Tardiff reviewed the impact of regulation on new technologies through six case studies involving telephone service, television programming, cable television, wireless services, information services, and converged telephone/video services. The authors conclude that:

These six cases illustrate four important points. First, regulation has often served to suppress innovation. Second, the delay in the introduction of new services can be quite costly to consumers. Third, deregulation can result in significant benefits when markets are workably competitive or even when there is arguably market power, as there was in the cable industry. Fourth, vertical integration by even large, dominant firms is often essential to the efficient development of new goods and services.⁵⁵

One of the studies reviewed by Crandall, Hahn, and Tardiff is the 1997 analysis by Jerry Hausman that estimates the loss to consumers resulting from regulation-induced delays in the introduction of new telecommunications technologies. Hausman analyzes costs relating to delays in the introduction of voice messaging services, which resulted from the line-of-business restrictions imposed on the former Bell companies following the AT&T divestitures. He also considers the cost to consumers of delays in the introduction of cellular telephone service due to “regulatory indecision and the subsequent licensing procedure used by the FCC, which was in charge of the cellular spectrum.”⁵⁶ Hausman concludes that delays in new telecommunications services caused by regulation imposed multibillion dollar losses on consumers:

⁵⁵ Robert Crandall, Robert Hahn & Timothy Tardiff, *The Benefits of Broadband and the Effect of Regulation*, in BROADBAND: SHOULD WE REGULATE HIGH-SPEED INTERNET ACCESS? 324 (Robert Crandall & James Alleman eds., AEI-Brookings Joint Center for Regulatory Studies 2002).

⁵⁶ Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, 1997 BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS 1, 17.

If, as I estimate, the consumer value from [voice messaging] services was \$1.27 billion in 1994, then the approximate ten-year regulatory delay cost consumers billions of dollars. Applying the methodology to the cost of regulatory delay in the introduction of cellular telephone service, I estimate the cost to consumers to be closer to \$100 billion in total, with more than \$25 billion lost in a single year.⁵⁷

The unregulated Internet marketplace has resulted in rapid output growth, improved service quality, and declining prices. An unregulated market also would likely result in experimentation with different business models and network management practices as broadband access providers respond to the anticipated growth in bandwidth demand, which is discussed below. If consumers prefer the business models and network management practices currently in use, service providers will have strong incentives to maintain them.

III. IMPACT OF NETWORK NEUTRALITY RULES ON INVESTMENT AND INNOVATION

A. Are Current Network Management Practices Compatible with Expected Growth in Internet Demand?

The ongoing evolution of Internet services has contributed to the tremendous growth in the use of the Internet. As noted above, the number of high-speed broadband access lines in the United States grew from 16 million to nearly 133 million between 2002 and 2008, and Internet traffic roughly tripled between 2007 and 2009 alone.⁵⁸ The growth of broadband access and the capacity of backbone networks have contributed to growth in the availability and use of bandwidth-intensive video services, and this growth is expected to continue and even accelerate. In a May 2009 report, Goldman Sachs noted that “[b]roadband access has reached mass market levels and is progressing toward near universal adoption. Online video is emerging as a dominant application of the incremental bandwidth.”⁵⁹ The ability to view Internet-based video services on television sets is expected to greatly increase demand for these services, but relatively few households today have the capability of accessing “Internet-to-TV” services. Goldman Sachs estimates that less than 5 percent of homes had adopted Internet-to-TV technology in 2009, but projects that this figure will increase to 20 percent within two to four years, and that adoption will then continue to grow rapidly.⁶⁰

The growth of high-bandwidth video services is expected to result in enormous increases in the demand for Internet bandwidth. CITI projected

⁵⁷ *Id.* at 3.

⁵⁸ Goldman Sachs, *supra* note 18, at 5; FCC High Speed Services Report, *supra* note 17 (follow 2/10 Release Tables to view Tables 1 and 3); Univ. of Minn., *supra* note 18.

⁵⁹ Goldman Sachs, *supra* note 18, at 3.

⁶⁰ *Id.* at 9.

that (nonmobile) North American consumer Internet traffic would increase from just over 1 petabit per month in 2008 to more than 7 petabits per month by 2013.⁶¹ The same report projects that the Internet bandwidth use per U.S. subscriber will grow by 360 percent between 2008 and 2013.⁶² Goldman Sachs notes that “a minute spent with streaming video consumes almost 20 times the bandwidth of a minute with a typical web page without video”⁶³ and also projects that video services will account for more than 75 percent of Internet traffic by 2012.⁶⁴

The growth in bandwidth demand creates the risk of increased network congestion. Capacity constraints may have relatively little adverse impact on the quality of services such as e-mail and web-surfing but can significantly harm the quality of high-bandwidth, time-sensitive services such as streaming video. Various cable-based broadband access providers have considered usage-based pricing for broadband as one alternative solution to this problem.⁶⁵ Others, including Comcast, have imposed caps on individual subscribers with high levels of broadband use.⁶⁶

The rapid growth of bandwidth-intensive services has already changed how high-bandwidth content is delivered to subscribers. Major providers of bandwidth-intensive content today often use content delivery networks (CDNs) to improve efficiency in delivering Internet traffic to end-users. CDNs, such as Akamai, attempt to improve the quality of Internet-based video services by positioning video files to servers at geographic locations near subscribers. Although existing mechanisms are typically consistent with net neutrality rules, the manner in which delivery mechanisms may evolve and be priced (in the absence of net neutrality regulation) has been the subject of widespread discussion among analysts and industry observers.⁶⁷ In response to change in Internet demand and technology, service providers may prioritize traffic, charge on the basis of content, or offer differential pricing based on the technology utilized, with the most bandwidth intensive technologies facing the highest prices.

A variety of new Internet-based services, such as new medical and gaming services, may result in significant consumer benefits, but it may be impossible to efficiently provide them under the proposed net neutrality rules. For example, certain medical diagnostic and imaging services require high bandwidth and low latency and cannot be reliably offered without the

⁶¹ CITI Report, *supra* note 26, at 49. A petabit is a unit of information equal to 1000 terabits or one quadrillion bits.

⁶² *Id.* at 50.

⁶³ Goldman Sachs, *supra* note 18, at 7.

⁶⁴ *Id.* at 8.

⁶⁵ *Id.* at 17.

⁶⁶ See Comcast Network Management Plan, *supra* note 48.

⁶⁷ Various alternatives are discussed in Jon M. Peña, *The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy*, 1 INT’L J. COMM. 644 (2007).

availability of priority Internet routing. More generally, the adoption of restrictions on network operations and business models can inhibit the development of innovative services that otherwise might be developed in the future.

To date, Internet service providers have generally maintained a “first-in-first-out” approach to network management, but this business model may not be efficient given the expected growth in demand. The choice of network management practices depends on a variety of factors including, among other things: (1) the cost of transport capacity, (2) the cost to consumers and content providers resulting from network latency and congestion, (3) the cost of distributing and storing content at multiple geographic locations, and (4) the cost of using compression technologies in transmitting data traffic. Net neutrality rules interfere with pricing mechanisms that provide signals for network providers to add capacity or for content providers to adopt efficient data-compression practices. For example, in the absence of net neutrality regulation, the adoption of priority service depends both on consumers’ and content providers’ willingness to pay for higher service quality (through prioritized services) and the costs to network operators for providing such services. Net neutrality rules can prevent service providers, content providers, and consumers from entering into mutually beneficial transactions.

The potential importance of non-neutral network management practices for Internet services can be appreciated by examining the current approaches used in managing private data networks in which a user can prioritize its own internal traffic. The widespread use of “enhanced traffic management” practices in private data networks suggests that consumer welfare might be enhanced if network service providers can offer priority services. For example, Verizon’s Private IP Service, which is used by firms and organizations to link distant locations and is in widespread use today, enables a user to assign different priority levels to its various types of traffic.⁶⁸ Typically, Private IP Service networks assign top priority status to time-sensitive applications such as video and voice for which latency can result in a significant decline in service quality; lower priority is assigned to applications such as “business critical” traffic flows (for example, SAP or PeopleSoft applications) and less time-sensitive video; and still lower priority is typically assigned to e-mail, file transfer, and web-browsing. Verizon’s Private IP Service customers can choose not to set priority levels for different types of services (and Verizon could have chosen not to offer this option). The decisions by carriers to allow a customer to choose whether and how to prioritize its own private network traffic demonstrate that this feature enhances consumer welfare.

⁶⁸ See Verizon, Fact Sheet Private IP, http://www.verizonbusiness.com/resources/factsheets/fs_converged-access-private-ip_en_xg.pdf (last visited Aug. 6, 2010).

There are a variety of other changes in business models that have the potential of promoting consumer welfare. For example, network service providers may find it efficient to charge different fees to providers of different types of services or may choose to establish relationships with content providers for differentiated offerings. Although net neutrality proponents argue that such actions are inherently anticompetitive, non-neutral business models may benefit consumers by expanding the output of Internet services. For example, payments from certain content providers to broadband access providers may enable access providers to offer lower prices to consumers, expand the number of broadband subscribers, and provide access providers incentives to expand their network footprint. At the same time, broadband access providers may choose to offer multiple service options to consumers, including services comparable with those offered today with nonprioritized access to content available on the public Internet, and enhanced services with features such as prioritized access and exclusive content.

B. Net Neutrality Requirements and Network Investment

Imposition of net neutrality rules that limit experimentation with new business models and network management practices will reduce the incentive of network operators to enhance the functionality of their networks and thereby undermine the business case for investing in higher capacity broadband networks. Such restrictions may adversely affect consumer welfare by (1) reducing the geographic scope of broadband access networks, (2) reducing backbone capacity, (3) increasing congestion and reducing service quality, (4) reducing the number of service providers in a given geographic area, and (5) raising prices.

In a 2010 filing in a related FCC proceeding, the Department of Justice (DOJ) acknowledged that price regulation is likely to deter investment and innovation. The DOJ warned that “care must be taken to avoid stifling the infrastructure investments needed to expand broadband access. In particular, price regulation would be appropriate only where necessary to protect consumers from the exercise of monopoly power and where such regulation would not stifle incentives to invest in infrastructure deployment.”⁶⁹ Net neutrality, however, is properly considered a form of price regulation because it limits the form of pricing that can be practiced. Such regulations thus limit a broadband provider’s revenue opportunities and its ability to differentiate itself from competitors, and thereby stifle incentives to invest and innovate.

⁶⁹ See *Ex Parte* Submission of the United States Department of Justice, *Economic Issues in Broadband Competition: A National Broadband Plan for Our Future*, GN Dkt. No. 09-51, at 28 (Jan. 4, 2010) [hereinafter DOJ *Ex Parte* Submission].

The importance of maintaining the appropriate investment incentives for broadband network providers is highlighted by the large scale of capital expenditures that telecommunications carriers are expected to undertake in coming years. CITI estimates that telecommunications providers, including wireline carriers, wireless carriers, and cable operators, made capital expenditures of \$63 billion in 2008, excluding payments related to spectrum auctions.⁷⁰ CITI also estimates that the top ten telecommunications companies had expenditures of roughly \$58.9 billion and that in 2009, despite the recession and financial crisis, these large companies had capital expenditures of \$51.5 billion.⁷¹ CITI also reports that AT&T estimated that two-thirds of its 2009 total investment (for wireless and wireline networks) is to expand its broadband capacity.⁷² Finally, CITI reports that the capital expenditures of the major wireline carriers will grow from \$22 billion in 2009 to \$24 billion in 2011, and that the share of these investments allocated to expanding broadband will increase from 52 to 58 percent.⁷³

Some net neutrality proponents argue that new technologies such as 4G wireless Internet access will have less of a procompetitive effect than otherwise expected, because some firms deploying these services already provide broadband Internet access with other technologies and are significant providers of network services used as inputs by other 4G providers. The DOJ, for example, has argued that the competitive potential of 4G may be overstated because “two of the major providers of these services (Verizon and AT&T) also offer wireline services in major portions of the country, raising the question of whether they will position their [next-generation wireless Internet access] services as replacements for wireline services, either in the regions where they provide wireline services or elsewhere.”⁷⁴

Economic logic and available data do not support the view that providers of landline services, such as Verizon and AT&T, will delay the introduction of 4G services due to potential “cannibalization” of wireline subscribers. Such concerns could make sense in the absence of competitive pressures. However, incumbent landline providers of broadband Internet access, including Verizon and AT&T, have strong incentives to deploy 4G services everywhere given the deployment now being undertaken by wireless firms, cable firms, and others noted above. As discussed above, Clearwire is aggressively deploying mobile 4G services (which are also marketed by Sprint under its own name), and Verizon and AT&T will need to match this deployment or risk losing customers to Clearwire and other entrants. Verizon’s own recently announced plans to deploy next-generation wireless

⁷⁰ CITI Report, *supra* note 26, at 29.

⁷¹ *Id.*

⁷² *Id.* at 30.

⁷³ *Id.*

⁷⁴ See DOJ *Ex Parte* Submission, *supra* note 69, at 11.

Table 1. Verizon's cumulative 3G wireless deployment by incumbency status

Year	Verizon status in MSA (percent)		
	Incumbent	Nonincumbent	Partial incumbent
2006	31.1	27.8	48.2
2007	100.0	100.0	90.1
2008	100.0	100.0	100.0

Source: Verizon proprietary information.

Notes: Percentages reflect population-weighted average across MSAs. Excludes 49 MSAs with missing introduction year or incumbency status.

Internet access services make it clear that it is in fact moving aggressively to do so.

Data from Verizon on the historic dates of its rollout of EV-DO (3G) wireless broadband services for the metropolitan areas in which it operates can be used to compare the speed of deployment of wireless services in areas in which it is a landline service provider compared with other areas, and thus to test the DOJ's concerns. The metropolitan statistical areas (MSAs) in which Verizon offers wireless service include: (1) areas where Verizon Communications provides wireline services throughout the MSA ("incumbent"); (2) areas where Verizon Communications does not provide wireline services in the MSA ("nonincumbent"); and (3) areas where Verizon Communications provides wireline services in some, but not all, portions of the MSA ("partial incumbent").⁷⁵ Verizon identified the year in which EV-DO became available in each MSA.⁷⁶

The cannibalization concerns would imply that Verizon would roll out new wireless technologies more slowly in areas where Verizon Communications is the incumbent provider. The evidence provides no support for this view. Table 1 shows that 3G services tended to be introduced earlier in those MSAs in which Verizon Communications is the incumbent provider of wireline services (and at about the same speed in nonincumbent and partial incumbent MSAs).

Verizon's early plans for rolling out its 4G services also are inconsistent with suggestions that Verizon will roll out 4G more slowly in areas where it is the incumbent wireline provider. Verizon has been testing its new 4G wireless broadband service in Boston and Seattle, both areas where it is the

⁷⁵ There are 363 MSAs in the United States. Verizon was identified as the incumbent in 87 MSAs, non-incumbent in 209, and partial incumbent in 65.

⁷⁶ The available data report the date on which EV-DO service became available by basic trading area (BTA). This information was mapped into the MSA information. Because there are 487 BTAs in the United States, more than one BTA can be mapped into an MSA. In those cases, the MSA launch date was defined based on the earliest date on which EV-DO service became available in at least one BTA in the MSA.

incumbent wireline provider,⁷⁷ and we understand that these will be among the first areas where Verizon launches 4G service.

C. Net Neutrality Requirements and Content Investment

As discussed above, net neutrality proponents claim that deviations from neutrality would adversely affect incentives to invest in content. They argue that incentives to undertake such investments would be harmed in the absence of net neutrality regulation due to economic “spillovers” between the demand for Internet content and the demand for broadband access services. In the view of net neutrality proponents, fees charged by broadband access providers to content providers (such as fees to access subscribers or fees for priority delivery) decrease content providers’ incentives to invest. This, in turn, reduces content available to all broadband subscribers, including those that are not customers of the access provider imposing the fee.

According to this view, because individual broadband access providers do not consider this spillover effect, they will charge prices to content providers that are “too high” and depress investment by content providers below the economically efficient level. Net neutrality proponents argue that net neutrality rules that prohibit broadband access providers from charging fees to content providers are necessary to promote an efficient level of investment in content.⁷⁸ Alternatively stated, proponents argue that net neutrality regulation is required to preserve the benefits that accrue to all broadband access providers resulting from investments by content providers.

The analysis of externalities presented by net neutrality proponents is incomplete and fails to account for all spillovers between the demand for Internet content and the demand for broadband access services.⁷⁹ As a result, the analysis by net neutrality proponents fails to provide a basis for concluding that regulation is needed to preserve content providers’ investment incentives. The proponents’ argument fails to consider a second spillover that is generated by access providers’ investments that works to offset the spillover proponents have identified.

⁷⁷ Press Release, Verizon Wireless, Verizon Wireless’ 4G LTE Network Testing Promises Significantly Faster Speeds Than Current 3G Networks (Mar. 8, 2010).

⁷⁸ See, e.g., Nicholas Economides, *Why Imposing New Tolls on Third-Party Content and Applications Threatens Innovation and Will Not Improve Broadband Providers’ Investment* 3–4, submitted on behalf of Google Inc., in Preserving the Open Internet and Broadband Industry Practices, GN Dkt. No. 09-191, WC Dkt. No. 07-52 (Jan. 14, 2010); Christiaan Hogendorn, *Spillovers and Network Neutrality* 9, 12–13, submitted on behalf of Google Inc., in Preserving the Open Internet and Broadband Industry Practices, GN Dkt. No. 09-191, WC Dkt. No. 07-52 (Jan. 14, 2010).

⁷⁹ These points are noted in the Declaration of Marius Schwartz, at 22–23 (Jan. 14, 2010), submitted on behalf of AT&T, in Preserving the Open Internet and Broadband Industry Practices, GN Dkt. No. 09-191, WC Dkt. No. 07-52 (Jan. 14, 2010).

Investments by access providers expand the number of broadband subscribers and enable content providers to reach a larger audience. This second spillover, which benefits content providers, increases their incentive to invest (which, in turn, benefits subscribers of other broadband access providers). Net neutrality regulation that prevents access providers from charging content providers and prevents access providers from realizing the full value of their investment depresses investment in broadband access services. As a result, net neutrality regulation would also depress investment by content providers.

Moreover, net neutrality rules also would be expected to result in higher prices to broadband subscribers (and thus lower broadband penetration) than would be expected in the absence of such regulation. As mentioned above, net neutrality rules are properly considered a form of price regulation because they put a cap (of zero) on the prices that broadband access providers can charge to content providers. Restricting the ability of a broadband access provider to charge content providers would be expected to result in higher prices to broadband subscribers.⁸⁰ Higher prices to subscribers and lower broadband penetration resulting from net neutrality would decrease content providers' incentives to invest.

As this suggests, spillovers between content and access services are complex and run in multiple directions. Evaluation of the impact of net neutrality regulation on investment incentives faced by providers of content and broadband access services depends on the size of these spillover effects and other factors. We are unaware of any evidence on the magnitude of various spillover effects and also are unaware of any empirical analysis that supports the view that net neutrality regulation is required to preserve the appropriate incentives for investment in Internet content. Externalities are a common consequence of economic activity. However, the mere existence of externalities typically does not justify the imposition of taxes or subsidies as desirable public policy. For example, network externalities associated with fax machines, which have often been noted, are due to the fact that one person's purchase of a fax machine increases the value of fax machines to others (by increasing the number of persons that can be reached by this technology). However, few (if any) argued at the time that it was necessary for the government to subsidize initial users of fax machines to remedy this externality, and

⁸⁰ Nicholas Economides and Joacim Tåg, for example, conclude that "removing net neutrality regulation will lead to an increase in the fee content providers must pay for access and hence, less content is provided. The price consumers pay for Internet access decreases, so that a larger number of consumers purchase Internet access, but they have access to less content." Nicholas Economides & Joacim Tåg, *Net Neutrality on the Internet: A Two-sided Market Analysis* 22 (Research Inst. of Indus. Econ., IFN Working Paper No. 727, 2009).

fax technology expanded quickly in the absence of government intervention.⁸¹

Arguments that non-neutrality will adversely affect investment by content providers assume that there is a clear distinction between investments in content and networks. Over time, however, that line has become increasingly blurred. As a result, policies such as net neutrality that, according to proponents, promote investment in content can have complex and unanticipated consequences. As mentioned above, providers of bandwidth-intensive content today often use CDNs such as Akamai to distribute large files to servers at geographic locations near subscribers. This delivery mechanism, paid for by content providers, improves service quality and increases demand for content providers' services. But as this example suggests, investments by content providers can take the form of expenditures for improved delivery services. Although CDNs may be an efficient mechanism for delivering some Internet content, alternative approaches may be more efficient in other circumstances and may be blocked by the proposed net neutrality regulations. Should this be the case, net neutrality regulation intended to promote investment by content providers could prevent the use of efficient delivery mechanisms.

More generally, there is no basis to conclude that non-neutral Internet business models and network management practices would harm innovation. Restrictions that limit the ability of network operators to realize the full value of their investments also limit their incentives to innovate. The dramatic growth of applications for Apple's iPhone demonstrates that rapid innovation is possible in a differentiated or managed environment. Apple's iPhone now operates only on AT&T's network but has fostered the development of a wide variety of iPhone-specific applications. Application providers need approval to be carried in the iPhone "App Store," pricing must be approved by Apple, and revenue must be shared with Apple. Similarly, Verizon's FiOS service provides "widgets" that enable subscribers to access particular websites and Internet services such as Facebook through television screens. These types of innovations are likely to be of value to consumers, but we understand that they might not be available under net neutrality rules because they cannot be used to access all Internet content.

Net neutrality rules also can deter investment in the development of new content and applications. First, network management practices that differentiate between types of traffic may improve the utilization and quality of high-bandwidth services and encourage investment in innovations that take advantage of improved network performance. For example, network performance had to improve before streaming HD video applications could be

⁸¹ Liebowitz and Margolis show that externalities are common and do not necessarily justify government intervention. S.J. Liebowitz & Stephen E. Margolis, *Network Externality: An Uncommon Tragedy*, 8 J. ECON. PERSP. 133, 136–39 (1994).

developed, and they will need to improve again before streaming 3-D HD video applications can be deployed. The ability of broadband access providers to enter differentiated arrangements with content or application partners may promote investment in the development of innovations and new services that would not otherwise be undertaken.

IV. CONCLUSION

The FCC's net neutrality rules are motivated by the concern that broadband access providers will harm competition by disadvantaging rival content providers. We conclude that this concern does not justify the imposition of net neutrality rules today due, in part, to the existence of competition in the provision of broadband access service and new competition now emerging due to entry, expansion, and upgrades of existing broadband networks. Under these circumstances, broadband access providers have strong incentives to retain subscribers by providing services and pricing models that promote consumer welfare. Given the lack of widespread competitive problems of the type specified by the FCC to date, it is likely that remedies to future competitive problems, if such problems occur, can be better addressed by antitrust enforcement and/or more limited regulatory mechanisms instead of promulgation today of regulations that are likely to impede the development of efficient business models and products.

The Internet is dynamic and is undergoing dramatic increases in demand and changes in the nature of services provided. It is highly unlikely that a regulator can correctly identify the business model and network management practices that maximize consumer welfare. Indeed, history indicates that interventions by regulators can delay the introduction of new technologies and result in significant harm to consumers. Net neutrality rules would freeze in place the business models and network management practices that currently characterize the provision of Internet services and would artificially restrict the ability of Internet service providers to respond to changes in technology and demand. As a result, consumer welfare is likely to be harmed and service providers will face weakened incentives to invest and innovate.