Before the
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Washington, DC 20554

In the Matter of	)	
	)	WC Docket No. 07-52
Broadband Industry Practices	)	

COMMENTS OF AT&T INC.

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EXECUTIVE SUMMARY

For decades, Congress and the Commission have followed a basic policy of "unregulation" for the Internet. As that policy recognizes, the free play of market forces, rather than command-and-control regulation, is the best guardian of consumer interests in the uniquely dynamic Internet ecosystem. Faithful adherence to that policy has reaped incalculable rewards. Free to evolve without regulatory distortions, the Internet has become the most successful engine of consumer value ever created.

Against this backdrop, the "net neutrality" agenda is a profoundly misguided "solution" in search of a problem. Beneath the empty rhetoric, that agenda is a reckless invitation to subject the Internet to intrusive regulation despite the lack of any market failure. The Commission should decline that invitation. When "[s]tripped of verbiage," net neutrality is—as the Seventh Circuit once said of another ill-conceived regulatory idea—"like a Persian cat with its fur shaved, . . . alarmingly pale and thin."[1]

Precisely because there is no problem for regulation to solve, net neutrality advocates are all over the map in trying to articulate the purpose and content of their proposed rules. As shown in these comments, none of the various proposals for net neutrality regulation is remotely defensible.

Some net neutrality proponents urge the Commission to preserve what they view as "the fundamental idea on the Internet since its inception . . . that every Web site, every feature, and

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[1] *Schurz Commc'ns, Inc. v. FCC*, 982 F.2d 1043, 1050 (7th Cir. 1992) (invalidating "fin-syn" rules).

every service should be treated exactly the same."[2] But this "dumb pipes" vision of the Internet is irresponsible nonsense. Some real-time Internet applications—such as video, voice, and telemedicine—have a much greater need for high service quality than other applications, such as ordinary e-mail. The Internet's constituent networks can satisfy consumer needs only by treating such applications differently. If the government now sought to guarantee equality of treatment for all Internet data, it would deny consumers the high-quality, real-time applications that are the Internet's greatest promise for the future, and it would absurdly forbid a network operator "to favor traffic from, say, a patient's heart monitor over traffic delivering a music download."[3]

In fact, the Internet was never intended to be and has never been a collection of "dumb pipes." The Internet's founders specifically envisioned that the Internet would offer differentiated service capabilities, and they built those capabilities into the very structure of the Internet Protocol. And the Internet today treats various applications and content providers quite differently depending on their capital resources. For example, applications and content providers that can afford access to the content distribution networks of Akamai, CacheLogic, and others—or that can build their own such networks, as Google and Microsoft have done—enjoy marked performance advantages over rivals that *cannot* afford the use of such networks. No one suggests that this inequality of treatment for Internet traffic is a "problem," much less one that warrants a regulatory solution. In short, the "dumb pipes" brand of net neutrality advocacy is so detached from the realities and necessities of today's Internet that it collapses of its own weight.

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[2] SavetheInternet.com Coalition, *Net Neutrality 101* (http://www.savetheinternet.com/=101) (visited June 14, 2007).

[3] David Farber & Michael Katz, *Hold Off On Net Neutrality*, Wash. Post, Jan. 19, 2007, at A19 (http://www.washingtonpost.com/wp-dyn/content/article/2007/01/18/AR2007011801508.html).

Other net neutrality advocates call on the Commission to adopt "nondiscrimination" rules. These proposals go well beyond—and indeed have little to do with—the *consumer-oriented* anti-"blocking" principles the Commission has already set forth in its 2005 Broadband Policy Statement. Instead, advocates of "nondiscrimination" rules would restrict or altogether prohibit broadband providers from selling performance-enhancing services to applications and content providers in competition with content delivery networks and others. Such rules would be both (i) completely unnecessary and (ii) affirmatively harmful to consumers.

The lack of any need for nondiscrimination rules. As an initial matter, there is no *need* to subject the Internet to a scheme of "nondiscrimination" rules to protect anyone against anticompetitive conduct. In its 2005 *Wireline Broadband Order*, the Commission determined that, in the Internet context, such rules serve no positive function that could possibly outweigh the substantial costs of regulatory intervention, because competition already enables consumers to vote with their feet against a broadband provider that disserves their interests. There is no basis for turning that conclusion on its head, as net neutrality advocates propose to do.

Indeed, the net neutrality agenda would *reduce competition* on the Internet, and compromise its efficiency, by inhibiting operators of broadband access and backbone networks from competing with content delivery networks and others for the provision of performance-enhancing services to applications and content providers. Shutting off such competition might well benefit some applications providers like Google, which dominates its rivals in part because it owns a content delivery network of unequalled scope, but it would create no discernible benefit for consumers.

The consumer harms of nondiscrimination rules. Any nondiscrimination regime would be not only unnecessary to protect consumers, but affirmatively *harmful* to consumers in several

independent respects. *First*, by forcing broadband networks to commoditize their services, it would reduce consumer choice and undermine the incentives of broadband providers to continue investing billions of dollars in next-generation infrastructure. That investment-deterring effect would fall especially hard on underserved communities and would undermine the Commission's core mandate to bridge the "digital divide."

Second, the net neutrality agenda would force broadband providers to recover the network costs of accommodating bandwidth-intensive applications *from subscribers alone* rather than from the providers of those applications. It would thus raise broadband rates, depress broadband subscribership, and introduce debilitating inefficiencies into the Internet marketplace. Only if broadband providers retain flexibility to negotiate quality-of-service terms with the *providers* of these bandwidth-intensive applications—who are, after all, generally in the best position to understand the optimal service-quality needs of their offerings—can the Commission achieve what should be its two overriding goals for the 21st century Internet: affordable consumer prices for basic broadband connectivity *and* the proliferation of high-quality real-time applications over the Internet platform.

Third, the common-carrier-type "nondiscrimination" rules favored by some net neutrality advocates would chill the free-wheeling experimentation at the heart of the Internet's success and would embroil the industry in years of indeterminate litigation about the reasonableness of highly technical network-management decisions made in a rapidly evolving business environment. That litigation could make implementation of the Telecommunications Act of 1996 seem predictable and low-cost by comparison.

In sum, there is no market failure that could warrant regulatory intervention in the Internet, and the downside risk of such intervention would be enormous. As in other contexts

where *ex ante* regulation could produce severe unintended consequences, the Commission should allow market forces to continue doing what they do best—build consumer value—and should limit any intervention to *ex post* enforcement remedies if and when a market failure arises.

Finally, the Commission could not rationally impose "nondiscrimination" rules only on broadband Internet access providers without also applying those rules to other information service providers that exert greater structural influences on the Internet. For example, the Commission would need to impose such rules on content delivery networks, which specialize in ensuring that the Internet will *not* treat all applications and content alike; on peer-to-peer network providers such as BitTorrent and KaZaA; and on Google and other providers of Internet advertising and search services. Indeed, more than any access or backbone network, Google affects where end users will go on-line and which Internet sites will succeed and which will fail, and which voices will be heard or not. Of course, AT&T does not advocate that *any* Internet participant be subject to nondiscrimination rules: the Internet has succeeded precisely *because* the government has kept information services free from regulation. Nonetheless, the Commission could not responsibly impose such rules on broadband access or backbone networks but not on other providers of IP-based networks, services, applications, or content operating within the Internet's complex ecosystem.

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INTRODUCTION

In little more than fifteen years since its commercial debut in the early 1990s, the Internet has succeeded beyond anyone's wildest imagination. More than 200 million people in the United States, and over one billion worldwide, rely on the Internet and its constituent Internet Protocol (IP) networks to fulfill a vast range of communications needs.[1] Sending e-mails, browsing the World Wide Web, making phone calls, watching streaming video, telecommuting, transacting secure business-to-business e-commerce, and performing remote medical procedures over IP-based networks were all unimaginable feats less than a generation ago, but now they are just a small hint of the many capabilities available from the global Internet. In short, the Internet has become the most dynamic and successful communications medium the world has ever known.

The Internet was born in the United States, and it has succeeded here as an engine of unparalleled economic expansion precisely because, for four decades, the government has fostered the growth of information services with a "hands-off" policy of *unregulation*. Despite that policy's overwhelming success, a vocal band of advocates has been telling policymakers for several years that something is amiss and that a new form of "net neutrality" regulation is needed to "save" the Internet. Although the details are murky, this net neutrality agenda would restrict or altogether prohibit business-to-business quality-of-service agreements to ensure that, no matter what *consumers* may prefer, "every Web site, every feature, and every service [will] be

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[1] *See* Internet World Stats, Usage and Population Statistics (http://www.internetworldstats.com/stats14.htm) (visited June 6, 2007).

treated exactly the same" over the Internet.[2] And they claim that if the government does not preemptively straitjacket the industry with such regulation now, before any actual problem appears, the operators of the Internet's constituent IP networks might create a two-tiered Internet: one tier a superhighway for their own preferred content and applications, and the other tier a "winding dirt road" for all remaining content and applications.

That fear is a sham, but the persistent demagoguery has misled a number of policymakers, inducing one of them to declare in 2003 that the Internet "may be dying." Four years have passed since that assessment, and—to paraphrase Mark Twain—the reports of the Internet's death are greatly exaggerated. Since 2003, U.S. broadband subscribership has nearly tripled, from 23 million to 65 million; more than 1300 companies now provide broadband service in this country, over 800 of whom use a platform technology *other than* cable modem or ADSL; and broadband providers have slashed retail rates while ratcheting up connection speeds.[3] In 2003, Vonage, Skype, YouTube, and MySpace either did not exist or were obscure start-ups; today, they are household names. In 2003, Google was still privately owned; today, it is publicly traded, has a market capitalization of more than $150 billion, and reportedly owns the most valuable brand on Earth.[4] All of this occurred, moreover, while leading net neutrality proponents were predicting "the end of the Internet."[5]

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[2] SavetheInternet.com Coalition, *Net Neutrality 101* (http://www.savetheinternet.com/=101) (visited May 27, 2007).

[3] *See High-Speed Services for Internet Access: Status as of June 30, 2006*, Indus. Analysis and Tech. Div., WCB (Jan. 31, 2007) ("*June 2006 High-Speed Status Report*"), at Table 8; AT&T Reply Comments, WC Docket No. 07-45, at 2-9 (May 31, 2007).

[4] *Google beats Microsoft, Coke in brand stakes*, CNET News.com (Apr. 23, 2007) (http://news.com.com/Google+beats+Microsoft%2C+Coke+in+brand+stakes/2100-1014_3-

With net neutrality rhetoric reaching a fever pitch, this proceeding is a welcome opportunity to separate that rhetoric from marketplace reality, and AT&T commends the Commission for providing that opportunity. Given the robust competition in today's broadband marketplace and the absence of any demonstrable market failure, AT&T urges all members of the Commission to proceed with healthy skepticism as they evaluate far-reaching proposals to abandon the Commission's wildly successful hands-off policy toward the Internet in favor of new net neutrality regulation. The Commission should gather a full and accurate factual record upon which it can make informed decisions about the technical, economic, and legal merits of current broadband industry practices *before* it reaches any conclusions about whether regulatory intervention is warranted.

Once the Commission has assembled that record, we are confident it will agree that the net neutrality agenda is a counterproductive "solution" to a non-existent problem—a conclusion already reached by the international Organisation for Economic Co-operation and Development (OECD)[6] and by leading economists, engineers, and policy veterans.[7] In the OECD's words,

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6178310.html?tag=item) ("Google has knocked Microsoft off the top spot and been named the most powerful global brand of 2007 in a recently published brand ranking.").

5 Jeff Chester, *The End of the Internet?*, The Nation (Feb. 1, 2006).

6 OECD Report, *Internet Traffic Prioritisation: An overview* (Apr. 6, 2007) (http://www.oecd.org/dataoecd/43/63/38405781.pdf).

7 *See, e.g.*, Gerald Faulhaber, David Farber, Michael Katz, and Christopher Yoo, *Common Sense on Net Neutrality* (2006) (http://www.interesting-people.org/archives/interesting-people/200606/msg00014.html); David Farber & Michael Katz, *Hold Off on Net Neutrality*, Wash. Post, Jan. 19, 2007, at A19 (http://www.washingtonpost.com/wp-dyn/content/article/2007/01/18/ AR2007011801508.html); William E. Kennard, *Spreading the Broadband Revolution*, N.Y. Times, Oct. 21, 2006, at A13; Andrew Orlowski, *Father of internet [Robert Kahn] warns against Net Neutrality*, The Register, Jan. 18, 2007 (http://www.theregister.com/2007/01/18/kahn_net_neutrality_warning/) ("Robert Kahn, the most senior figure in the development of the internet, has delivered a strong warning against 'Net Neutrality'

"[t]here is little evidence of anti-competitive conduct to date," and "it seems premature for governments to become involved at the level of network-to-network traffic exchange and demand neutral packet treatment for content providers."[8]

BACKGROUND

To help the Commission understand the net neutrality debate in its technological context, this section addresses the engineering dimension of that debate and, in the process, refutes several popular misconceptions that accompany much of the rhetoric for net neutrality regulation. As we will discuss:

- The "Internet" is not a single network or public infrastructure. Rather, it is a collection of thousands of individual networks, most of which are privately owned and operated, that have voluntarily adopted a common protocol and addressing scheme—the Internet Protocol (IP).
- The Internet has never been a collection of "dumb pipes." The Internet's founders built differentiated service capability into the very structure of the Internet Protocol.
- The Internet has never been neutral to economic disparities among applications providers. For example, applications providers that can buy access to content distribution networks from Akamai, Limelight Networks, and others—or that, like Google, can build their own such networks—enjoy clear performance advantages over rival providers that cannot afford to do so. No one suggests that this is a problem in need of a solution.
- There is no clear distinction between the "edge" of the Internet and access and backbone networks. Some of today's "edge" networks—owned by the likes of Google, Akamai and others—rival some of the largest backbone networks in global transmission and

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legislation."); Robert Pepper, *Net neutrality debate sets out a false choice*, Network World, June 12, 2006 (http://www.networkworld.com/columnists/2006/061206-net-neutrality-no.html); William J. Baumol, Martin Cave, Peter Cramton, Robert Hahn, Thomas W. Hazlett, Paul L. Joskow, Alfred E. Kahn, Robert Litan, John Mayo, Patrick A. Messerlin, Bruce M. Owen, Robert S. Pindyck, Scott J. Savage, Vernon L. Smith, Scott Wallsten, Leonard Waverman, and Lawrence J. White, *Economists' Statement on Network Neutrality Policy*, AEI-Brookings Joint Center (2007) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id= 976889#PaperDownload).

[8] OECD Report, *supra*, at 5.

processing capacity. Proposals to regulate backbone networks but not "edge" networks are thus both arbitrary and unworkable.

- Network capacity is finite. Network engineers are constantly challenged to keep up with the surging popularity of streaming video and other bandwidth-intensive applications. To meet these bandwidth demands, it will be necessary—but *not sufficient*—for investors to underwrite more networks and fatter pipes. It will also be necessary to build *smarter* networks capable of efficiently providing the high quality-of-service guarantees needed to run some, but not all, applications on converged IP platforms. These smarter networks will enable the vast majority of consumers and start-up applications developers to receive service at a much lower cost and much higher quality than they could otherwise obtain.

- The technology, topography, and traffic patterns of the Internet's constituent IP networks are constantly evolving. Network engineers need all the tools in their toolbox to satisfy consumer demands for secure and high-quality services in this increasingly convergent environment. The government can meddle with the contents of that toolbox only at the peril of the consumers those engineers wish to serve.

I. A SURVEY OF THE INTERNET'S CONSTITUENT IP NETWORKS.

A. Defining "the Internet"—and the Scope of This Proceeding.

The *Notice* seeks "a fuller understanding of the behavior of broadband market participants today, including network platform providers, broadband Internet access providers, other broadband transmission providers, Internet service providers, Internet backbone providers, content and application service providers, and others."[9] The Commission is right to focus not on "the Internet" in the abstract, but on the interaction among the Internet's constituent networks. What we call "the Internet" is neither a single network nor a public infrastructure, although advocates of government intervention often speak as though it were.[10] The Internet is instead an interconnected global network of thousands upon thousands of networks, most of which are privately owned and operated. Each of these constituent networks has voluntarily adopted a

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[9] Notice of Inquiry, *Broadband Industry Practices*, 22 FCC Rcd 7894, ¶ 8 (2007) ("*Notice*").

[10] *E.g.*, Timothy Wu, *Network Neutrality, Broadband Discrimination*, 2 J. Telecomm. & High Tech. L. 141, 148-49 (2003) (referring to Internet as "public network").

common protocol and addressing scheme—the Internet Protocol—that enables its customers to communicate with customers connected to other networks for purposes of exchanging higher-layer applications and content.[11] "The Internet," as that term is commonly used, is a conceptual aggregation of these mostly private IP-based networks spread across the world.

Connectivity to the publicly accessible Internet is only one function—albeit a substantial one—that an individual IP network can provide to its users. For example, a bank might use its IP-based network infrastructure (*e.g.*, a corporate "intranet") not only for Internet-bound traffic, but also for internal communications among employees working at headquarters, between headquarters and far-flung branch offices, and between one branch office and another. A local provider of multichannel video distribution services might use its IP-based network to transmit video streams—whether live television or movies on demand—to subscribers over routes designed specifically to handle that bandwidth-intensive and latency-sensitive application, while also using a substantial portion of that same network to provide Internet access to those same subscribers. Or the owner of a global IP-based network might manage its network capacity to assure the operation of real-time videoconferencing among the dispersed offices of multinational firms at the same time it provides those firms with Internet access services using the same IP-based network infrastructure.

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[11] *See* Resolution of the Federal Networking Council, Oct. 24, 1995 (*quoted in* http://www.isoc.org/internet/history/brief.shtml) ("'Internet' refers to the global information system that—(i) is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-owns; (ii) is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and (iii) provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein.").

Long before the Internet's commercial applications became widespread, companies built and managed such private IP networks for their own use, and other companies hired third-party providers to build and manage such networks for them. These privately managed networks abound today because the use of a single network infrastructure permits security features and a level of service quality unavailable for traffic that crosses multiple networks on the Internet.[12] On each of these private networks, moreover, managed IP traffic often uses the same physical infrastructure as that used for Internet traffic, and a network provider may assign customer traffic to different logical classes to ensure the most efficient use of the underlying infrastructure.

This unification of "managed" and "Internet" traffic within the same IP network infrastructure should be welcomed. As discussed below, it fulfills the long-deferred promise of technological convergence and opens the door to unprecedented innovation, economic efficiency, and intermodal competition. But it also underscores an often overlooked danger posed by any proposal to intervene in the IP services marketplace. There can be no serious argument that the government should impose any form of net neutrality regulation on private IP networks such as those used for corporate intranets or managed multichannel television services. By its nature, each such network is designed to connect customers to a designated set of servers, applications, and other users on the same network, not to provide "open-ended Internet connectivity."[13] Instead, the net neutrality debate focuses on the routing and transmission on one

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[12] *See, e.g.*, Report to Congress, *Federal-State Joint Board on Universal Service*, 13 FCC Rcd 11501, ¶ 63 (1998) ("[M]any of the networks connected to the Internet are 'intranets,' or private data networks, that offer better performance or security to a limited set of users, but can still communicate with the Internet using IP.").

[13] *Id.*

IP network of traffic received from a different IP network over the publicly accessible Internet.[14] But if the government begins regulating IP network infrastructure to the extent it is used for that one purpose, it will be difficult or impossible to keep the effects of that regulation from severely constraining the use of the *same overlapping infrastructure* for managed IP services.

Such regulation could preclude providers from meeting their regulatory obligations through a shared infrastructure and could thus give them perverse incentives to keep their managed IP networks *physically separate* from the IP networks used for Internet access: that is, to create redundant networks in order to ensure that their consumers retain the service quality they need for applications that must be run on a managed network. That result would introduce radical inefficiencies into the communications market; it would lead to higher prices for all network customers, who must ultimately pay for these unnecessary costs; it would artificially deprive mass market consumers of innovations developed for the high-end business market; and, by forcing different services back onto physically distinct, "siloed" platforms, it would defeat the promise of convergence. We return to these points at pp. 31-36 below.

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[14] *See* Letter from Timothy Wu and Lawrence Lessig to Marlene H. Dortch, CS Docket No. 02-52, at 14 (Aug. 22, 2003) ("Wu-Lessig 2003 *Ex Parte* Letter") (asserting that network providers "should not discriminate in how they treat traffic on their broadband network on the basis of internetwork criteria," but they should be able to "police what they own," such that network providers "generally *may* discriminate in their treatment of traffic on the basis of *local* network criteria," such as "bandwidth, jitter, or other local Quality of Service indicia") (emphasis in original); Testimony of Timothy Wu before the House Comm. on the Judiciary, Telecom & Antitrust Task Force, at 7 (Apr. 25, 2006) (http://judiciary.house.gov/media/pdfs/wu042506.pdf) (asserting that "[t]he best proposals for network neutrality rules . . . . leave open legitimate network services that the Bells and Cable operators want to provide, such as offering cable television services and voice services along with a neutral internet offering").

B. A Taxonomy of the Internet's Constituent IP networks.

The intertwined private networks of the Internet are all part of an evolving global ecosystem. A given network's role in that ecosystem is complex and dynamic, and it may play several roles at once. Nonetheless, popular discussions of the Internet tend to classify its constituent networks into three basic categories:

- *Backbone* networks, including the current Tier 1 peering networks (such as, in the United States, AT&T, Verizon, Sprint, Level 3, Qwest, Global Crossing, SAVVIS, and Cogent)[15] and hundreds of backbones in Tiers 2 and 3;
- *Access* networks, such as Comcast, Time Warner, Cox, Cablevision, AT&T, Verizon, Qwest, Sprint-Nextel, T-Mobile, Clearwire, HughesNet, WildBlue, Wayport, EarthLink and many others; and
- *Edge* networks ranging from the very small (e.g., a home Wi-Fi network) to the very large (Google, Akamai, Limelight, eBay, Amazon.com, and others).

As we will discuss, this is an artificial trichotomy, because networks in each category increasingly perform tasks that are traditionally associated with networks in the other categories. For example, while much of the net neutrality debate has focused on access and backbone networks, edge networks now rival these other networks for importance in the Internet ecosystem, and they often bear little resemblance to the server-in-the-garage stereotype of small "edge" innovators popularized in the 1990s. Some of the largest edge networks, known as *content delivery networks*, span the globe with dedicated fiber-optic transmission capacity, perform packet-distribution functions similar to those of backbone networks, and use much the same equipment and architecture as backbone networks. As discussed below, the services

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[15] Mem. Op. and Order, *AT&T Inc. and BellSouth Corporation Application for Transfer of Control*, 22 FCC Rcd 5662, ¶ 127 (2007) ("*AT&T-BellSouth Merger Order*"); *see also* Mem. Op. and Order, *SBC and AT&T Inc. Application for Transfer of Control*, 20 FCC Rcd 18290, ¶ 123 ("*SBC-AT&T Merger Order*").

provided by these overlay networks play a critical role in the performance of particular applications and content, and they can affect a customer's Internet experience as much as, or more than, performance-enhancement techniques used by providers of access or backbone networks. In addition, peer-to-peer technology has spawned a range of *virtual* overlay networks that have, among other things, blurred traditional distinctions between "access" and "backbone" networks.

In short, the Internet's constituent IP networks resist easy classification, and any attempt to attach regulatory significance to traditional categories would be doomed to failure. With those caveats, we discuss the evolution of these IP networks by reference to the traditional trichotomy among backbone, access, and "edge" networks.

1. Backbone networks.

An Internet backbone network uses high-capacity routers and long-distance fiber-optic cable to connect other, geographically dispersed networks, including the networks of large businesses, Internet access providers, and other backbone providers. A backbone network can connect two networks *directly*, entirely through its own facilities, or *indirectly*, by contracting with another backbone provider to help it bridge the geographic gap between the networks on each end of a data session. These backbone-to-backbone agreements commonly follow one of two different business models. Under *peering* arrangements between two networks, each network agrees to interconnect for purposes of terminating packets delivered by the other. The typical implicit assumption in such peering arrangements is that the traffic moving between the two networks is roughly symmetrical, such that each backbone network incurs approximately the same cost when handling the traffic of the other network. In these circumstances, no money changes hands. Under *transit* arrangements, Network X pays Network Y to arrange delivery of

Network X's packets to any destination on the Internet and to accept delivery of packets destined for Network X's customers from any location on the Internet.[16]

From their inception, these peering and transit relationships have been unregulated. The Commission does not set or even monitor transit rates, and it does not have rules requiring specific Internet backbones to interconnect. In this unregulated environment, the market for peering and transit has functioned efficiently. A key reason is that the larger backbones "compete for the transit business of smaller backbones in order to increase their revenues," and this competition keeps transit prices in check.[17] The Commission recently reaffirmed that the Internet backbone market remains competitive and efficient, and that any given backbone has little incentive or ability to engage in anticompetitive conduct.[18] This competition will only increase as edge providers like Google, Akamai, and Limelight continue to deploy the functional equivalents of their own Internet backbones (see below) and as parallel internetworking projects such as Internet2 reach maturity.[19] At the same time, the growing volume of traffic on the Internet, which we discuss below, will require backbone providers to explore new technologies and business models for the cost-effective management of the increasing loads on their networks.

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16 *See* Michael Kende, *The Digital Handshake: Connecting Internet Backbones*, OPP Working Paper No. 32, at 7 (2000) (http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp32.pdf) ("Transit and peering are differentiated in two main ways. First, in a transit arrangement, one backbone pays another backbone for interconnection, and therefore becomes a wholesale customer of the other backbone. Second, unlike in a peering relationship, with transit, the backbone selling the transit services will route traffic from the transit customer to its peering partners.").

17 *Id.* at 20.

18 *AT&T-BellSouth Merger Order*, ¶¶ 144-49; *SBC-AT&T Merger Order*, ¶¶ 116-39.

19 *See* Internet2, *Building Tomorrow's Internet* (http://www.internet2.edu/).

2. Access networks.

Although many large businesses contract directly with Internet backbone providers (or build their own backbones), many Internet users rely on *access networks* to connect them to a backbone provider and, from there, to the rest of the Internet. In the early days of the commercialized Internet, the public switched telephone network served as the access network for most residential customers.[20] Because that circuit-switched network is optimized to carry voice calls over fixed-capacity circuits, however, it limits each end user's bandwidth. By contrast, broadband access networks can give end users much greater bandwidth by connecting them directly to packet-switched data networks. Many technologies have evolved for accomplishing that task, including digital subscriber line (DSL), cable modem, satellite, fixed and mobile wireless, and broadband over powerline (BPL).

Since its inception in the late 1990s, broadband Internet access has taken root throughout the United States. According to the Commission's most recent data, the number of broadband lines in the United States nearly tripled between June 2003 and June 2006 to 64.6 million lines, and there are now more than 1300 broadband providers offering service across the country, more than 800 of which do *not* rely on cable modem or ADSL technologies.[21] As discussed more fully below,[22] broadband has grown rapidly because of the "competitive nature of the broadband

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[20] That is, the modem on a customer's computer would dial a telephone number associated with a conventional Internet service provider ("ISP"); the call would be routed through the telephone company's circuit switch to a compatible modem at the ISP's location; and the ISP would pass packets between the customer's computer and an Internet backbone network, which would route the packets to the access network serving the recipient of the packets.

[21] *June 2006 High-Speed Status Report*, at Table 8.

[22] *See* pp. 56-62, *infra*.

market, including new entrants using new technologies, [which] is driving broadband providers to offer increasingly faster service at the same or even lower retail prices."[23] And competition has flourished because, for the past few years, the Commission has maintained a policy of "minimal regulation."[24] As recent market developments confirm, that is precisely the right call: "competition for mass market high-speed Internet access services" is "strong and increasing," and this "competition limits the ability of providers to engage in anticompetitive conduct[.]"[25]

3. "Edge" networks—and the blurring distinction among edge, backbone, and access functionalities.

Edge networks are typically divided into two subcategories: (i) private "local area" and "wide area" networks (LANs and WANs) used by residential and business end users, and (ii) networks deployed by or for the providers of Internet applications and content. In the Internet's early years, the stereotypical edge network used by an applications or content provider consisted of a server or two operated by a small entrepreneur working in a garage or in low-rent office space. Although that stereotype persists among some net neutrality pundits, today's leading edge networks have evolved into something radically different: transnational facilities-based networks with an unprecedented combination of transmission capacity, processing power, and data storage. Below we explain how this new generation of "edge" networks plays at least as

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[23] Fourth Report to Congress, *Inquiry Concerning the Deployment of Advanced Telecomm. Capability in the United States*, 19 FCC Rcd 20540, 20552 (Sept. 9, 2004) (*"Fourth 706 Report"*).

[24] *Id.* at 20548.

[25] *AT&T-BellSouth Merger Order*, ¶ 117; *see also* Mem. Op. and Order, *Applications for Consent to the Assignment and/or Transfer of Control of Licenses, Adelphia Communications Corp., Assignors*, 21 FCC Rcd 8203, ¶¶ 217-18 (2006) (*"Adelphia Transaction Order"*) (finding that "competition among providers of broadband service is vigorous" and "cable modem service and DSL service are facing emerging competition from deployments of cellular, WiFi, and WiMAX-based competitors, and [BPL] providers").

important a role as access and backbone networks in ensuring the quality of an end user's experience with particular Internet applications. First, however, we address end-user networks, which are themselves undergoing a major transformation as well.

End User Networks. Perhaps the simplest example of an end-user network is a home Wi-Fi configuration, which consists of Internet-addressable hardware such as a modem and various end-user devices, such as personal computers, VoIP terminals, and personal digital assistants.[26] Another, more complex example of an end-user network is a corporate or university LAN, with its hundreds of computers and other devices connected by copper, coaxial, or fiber-optic cables and sometimes unlicensed wireless spectrum. The market for supplying equipment to end-user networks is intensely competitive, and features such diverse companies as Avaya, Westell, Motorola, Cisco, NetGear, D-link, Homeplug, Palm, RIM, LG, Samsung, Dell, Apple, HP, and many others.

End-user networks have traditionally received more data *from* other networks on the Internet than they provide *to* other networks. But that is far less true today than it used to be. End users increasingly generate bandwidth-intensive content of their own, particularly through the use of peer-to-peer (P2P) technologies, which allow each end user's hard drive to serve as a content cache for other end users throughout the Internet.[27] Such technologies thus confound traditional engineering expectations about network load.

Content delivery networks. The other major type of "edge" network consists of the networks used to provide services, applications, and content to others on the Internet. Like end-

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[26] Even a single device with a routable IP address that is connected to an access network (e.g., a 3G wireless handset) is part of the edge of the Internet.

[27] *See* pp. 23-24, *infra*.

user networks, these range from the very small (such as a single server hosting a small business website) to the very large. Among the largest are the massive "server farms" and caching networks developed by companies as diverse as service-providers Akamai and Level 3, on-line retailers Amazon.com and eBay, Internet portals Yahoo! and MSN, and—largest of them all—Google. These "content delivery networks" (CDNs) use much the same technology and perform many of the same routing and long-haul transmission functions as Internet backbones and allow applications and content providers to divert their traffic around points of congestion en route to their customers.

Google, for example, maintains a sprawling network consisting of hundreds of thousands of servers, many of them clumped in massive data centers or server farms, connected by high-capacity fiber-optic cable.[28] Building and maintaining this network is enormously capital-intensive, and it is transforming the manipulation and routing of data on the Internet. As Google CEO Eric Schmidt recently explained, "It's pretty clear that there's an architectural shift going on," of a magnitude that "occur[s] every 10 or 20 years," and Google can claim much of the credit.[29] Schmidt notes that Google has "dozens" of data centers in undisclosed locations, some

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[28] *See* George Gilder, *The Information Factories*, Wired, Oct. 2006 (http://www.wired.com/wired/archive/14.10/cloudware_pr.html). In addition to Google, other major Internet companies, including Microsoft and Yahoo!, are likewise constructing enormous networks of their own and, like Google, are revolutionizing the role of these ostensible "edge" networks within the Internet. *See*, *e.g.*, Blaine Harden, *Tech Firms Go Mining for Megawatts: Companies Rush to Exploit Region's Cheap Electricity*, Wash. Post, July 9, 2006, at A3 (http://www.washingtonpost.com/wp-dyn/content/article/2006/07/08/AR2006070800973_pf.html); Rich Miller, *Microsoft Plans $500M Dublin Data Center*, Data Center Knowledge, May 16, 2007 (http://www.datacenterknowledge.com/archives/2007/May/16/microsoft_plans_500m_dublin_data_center.html); *New Yahoo data center in Washington State*, Data Center J., Feb. 13, 2006 (http://www.datacenterjournal.com/News/ Article.asp?article_id=464).

[29] *Text of Wired's Interview with Google CEO Eric Schmidt*, Wired, Apr. 9, 2007 (http://www.wired.com/print/techbiz/people/news/2007/04/mag_schmidt_trans).

of which are "very large," and "in a year or two the very large ones will be the small ones because the growth rate is such that we keep building even larger ones, and that's where a lot of the capital spending in the company is going."[30] In addition, "we have not only data centers, but we have fiber that interconnect[s] those data centers, and connect[s] to the ISPs. At Google, speed is critical. And part of the way we get that speed is with that fiber."[31]

Specifically, Google uses this fiber-based transmission network not just to allow its data centers to communicate with one another, but also to ensure the close geographic proximity of its content to as many end users as possible. Google "is building a network so massive that several service provider specialists believe it could end up with one of the world's largest core transport networks, effectively building its own private Internet" and "controlling distribution of much of the world's Internet traffic."[32] Indeed, even referring to Google's infrastructure as an "edge" network is a misnomer. In essence, Google has built its own global backbone network, and that network now peers with a substantial number of other backbone networks.[33] Combined with Google's multi-billion dollar investment in data storage and processing power, this "edge"

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30 *Id.*

31 *Id.*

32 R. Scott Raynovich, *Google's Own Private Internet*, Light Reading, Sept. 20, 2005 (http://www.lightreading.com/document.asp?doc_id=80968).

33 *See* Mark Sullivan, *Google: Dark Fiber Story Not So Dark*, Light Reading, Oct. 11, 2006 (http://www.lightreading.com/document.asp?doc_id=107080). According to PeeringDB.com, Google peers with other network operators at more than sixty public and private peering points around the world. *See* http://www.peeringdb.com/private/index.php. Google also recently sought applications for the position of "Peering Coordinator" on its "Global Infrastructure" team; the successful candidate will "work[] closely with network carriers to obtain capacity for expansion and growth of both Google's global backbone and Google's voice capabilities." *See* http://www.google.com/support/jobs/bin/answer.py?answer=40723 (visited May 21, 2007).

network enables Google to outperform its rivals in the delivery of (for example) split-second search results to end users throughout the world.

This phenomenon exemplifies the growing power of CDNs on the Internet. Traditionally known as "caching" networks, CDNs distribute and store copies of content on servers at multiple locations across the Internet and thus enable end users to gain access to that content more quickly and reliably. Although Google and a number of other large Internet companies self-provision their own CDNs, many applications and content providers hire third-party CDN providers to perform this function.

Of these CDNs, the most prominent today are probably Akamai and Limelight. Akamai maintains an overlay network of 20,000 servers in 71 countries and handles up to *20% of the traffic on the Internet*.[34] When a typical end user types "www.apple.com" or "www.bestbuy.com" into an Internet browser,[35] the data request is directed to a nearby Akamai server, where the content of those websites has been stored or "cached," thus enabling the end user and the website to exchange data far more quickly and efficiently than if the data were stored on a single, centrally located server far from the end user. As Akamai explains: "Edge delivery solves the peering bottleneck problem by making it unnecessary for web requests and data to traverse multiple networks and thus encounter peering points. Of course, in order to accomplish this goal, the edge delivery servers must be deployed inside ALL networks that have access to customers."[36]

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34 *See* Akamai, Customer Stories (http://www.akamai.com/html/customers/index.html).

35 *See* http://www.akamai.com/html/customers/customer_list.html.

36 Akamai, *Internet Bottlenecks: The Case for Edge Delivery Services* 7 (2000).

Akamai and other CDN providers such as Limelight, Internap, CacheLogic, AT&T and (more recently) Level 3 have thus built geographically comprehensive content delivery networks on a global scale.[37] And they are recouping the considerable costs of those networks from applications and content providers eager to set themselves apart from their rivals. As Akamai explains, the performance improvements such providers gain well justifies the price of CDN services:

> Let's assume someone has ten minutes to spend at your Web site: some are able to access 10+ pages, while some can't stand the wait and give up after two requests. If page speed were to be increased by as little as five times, these visitors would have the ability to view 50+ pages during the same short session, ensuring a better user experience—critical to your efforts to acquire and retain customers and partners. Increasing page performance reduces the likelihood of bailout, boosts the likelihood of multiple page views and purchases, increases cross-sell conversion opportunities and leaves impressions that are worthy of return visits. On the Web, the experience is the brand, and you want to offer the best one possible.[38]

In addition to building CDNs on a massive scale, some CDN providers are also adding greater intelligence to their networks. CacheLogic, for example, recently announced the deployment of "a unique, configurable class of service solution" that "enables different service

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[37] After acquiring the content delivery assets of Savvis (another Tier 1 backbone peer) in January 2007, CEO James Crowe announced that Level 3 now "carries 10 percent to 20 percent of the world's Internet traffic." Jeff Smith, *Level 3 CEO says firm is ready to be bigger player*, Rocky Mountain News, May 25, 2007 (http://www.rockymountainnews.com/drmn/tech/article/0,2777,DRMN_23910_5554583,00.html).

[38] Akamai White Paper, *Why Performance Matters*, at 1 (2002) (http://www.akamai.com/dl/whitepapers/Akamai_Why_Performance_Matters_Whitepaper.pdf). Akamai's website contains an interactive illustration of how much its CDN can improve an applications provider's performance along specified routes. *See* http://www.akamai.com/html/technology/dataviz2.html.

levels to be assigned to different traffic or end users."[39] This new capability "allow[s] the CDN customer to create 'delivery tiers' for assets requiring different cost/performance characteristics" so that, for example, "ad-supported users can be given one delivery service for all content whereas premium users can be treated to a high-performance offering[.]"[40]

The success of Akamai and other CDN providers reflects their prescient understanding—now conventional wisdom among Internet engineers—that the capacity on the publicly accessible Internet is finite, and that content and applications providers are "willing to pay Akamai [and other CDNs] a premium to deliver their content faster and more reliably" to end users.[41] Indeed, the incipient flood of streaming video and other bandwidth-intensive applications makes the deployment of CDNs all the more essential to the future of the Internet. "[B]y rewriting the Internet's basic rules—making some computers smarter and more equal than others—[Akamai] can let the Net grow infinitely large without breaking down."[42]

The role of CDNs also explodes a popular myth circulated by advocates of net neutrality regulation. According to that myth, the Internet serves as a radically egalitarian leveler of wealth disparities, it ensures consumer access to "any Web site, . . . at the fastest speed, whether it's a corporate or mom-and-pop site,"[43] and the only threat to the Internet's solicitude for small

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39 *See* CacheLogic Upends Traditional "One-Size Fits All" CDN Business Model with Configurable Class of Service Capabilities, CacheLogic Press Release (May 15, 2007) (http://www.cachelogic.com/home/pages/news/pr150507.php).

40 *Id.*

41 Scott Woolley, *Video Prophet*, Forbes, Apr. 23, 2007 (http://www.forbes.com/forbes/2007/0423/068_print.html).

42 *Id.*

43 SavetheInternet.com Coalition, *Frequently Asked Questions* (http://www.savetheinternet.com/=faq) (visited May 27, 2007).

business comes from the plans of access networks to prioritize some packets over others. That is wrong. Quite apart from anything access or backbone networks might do, applications and content providers with the capital resources needed to buy CDN services from firms like Akamai, CacheLogic, Limelight, or other CDN providers—or to build out their own global networks, as Google has done—will provide consumers with better performance than can any "mom-and-pop site"[44] that lacks such resources. No one claims that the government should intervene to neutralize this differential treatment—even though some net neutrality advocates incongruously define net neutrality as a program to "prevent Internet providers from speeding up or slowing down Web content based on its source, ownership or destination."[45] We return to this topic below.

In sum, as the proliferation of edge technologies reveals, the Internet is not some homogenous "cloud" surrounded by hermetically isolated users at the edge, nor do those users rely passively on forces within the cloud to connect them with other users. The Internet is more aptly depicted as a growing, ever-shifting spaghetti tangle of thousands upon thousands of networks that interconnect in unpredictable ways, through efficient commercial arrangements, to forge better connections among their respective users.[46] And, despite their name, the "edge" networks within that spaghetti tangle play as central a role as conventional access and backbone networks in ensuring that applications and content providers can reach end users quickly and reliably. These points should remain foremost in policymakers' minds as they confront one of

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44 *Id.*

45 *Id.*

46 For graphic illustrations of the immensely complex physical architecture on which the Internet rides, *see*, *e.g.*, http://www.cheswick.com/ches/map/gallery/index.html and http://www.opte.org/maps.

the great challenges of the new century: the unprecedented demands that streaming video and a myriad of other bandwidth-intensive applications will place on the Internet's finite infrastructure.

II. MANAGING BANDWIDTH SCARCITY.

A. The Explosive Growth of Bandwidth-Intensive Internet Applications.

Until recently, the most popular Internet activities consisted of surfing mostly text-oriented webpages, conducting basic e-commerce, exchanging e-mails, and downloading document files. Although none of these activities consumed enormous bandwidth by today's standards, networks still had to make substantial capacity upgrades over time in order to accommodate increasing traffic volumes. Access and backbone networks were built to accommodate those consumer needs quickly and efficiently, and they succeeded. Over the past few years, however, bandwidth-intensive applications such as streaming video have exploded in popularity. These applications have dramatically increased the volume of Internet traffic—both downstream and upstream—and have begun placing unprecedented demands on the capacity of the Internet's access and backbone networks.

YouTube graphically illustrates this phenomenon. That company, which Google recently acquired for $1.65 billion, did not even exist in January 2005. One year after its inception, in February 2006, it had begun purchasing backbone transit services for 20 Gbps of video traffic—equivalent to about two million simultaneous emails—with a growth rate of 20% *compounded monthly*.[47] Today, users download more than 100 million video clips from YouTube per day,[48] and the trajectory of that service's bandwidth consumption is staggering:

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[47] William B. Norton, *Video Internet: The Next Wave of Massive Disruption to the U.S. Peering Ecosystem*, v1.3, at 2 (Equinix 2007) ("*Video Internet*").

> Each year the original content on the world's radio, cable and broadcast television channels adds up to about 75 petabytes of data—or, 10 to the 15th power. If current estimates are correct, the two-year-old YouTube streams that much data in about *three months.* But a shift to high-definition video clips by YouTube users would flood the Internet with enough data to more than double the traffic of the entire cybersphere.[49]

YouTube is just the vanguard of the streaming video business. More generally, Yankee Group projects that the number of video streams viewed will double over the next five years (from 86 billion in 2006 to 166 billion in 2011) and that the average length of each video stream will increase more than five-fold during the same period (from 4.87 minutes per stream to 25.09 minutes).[50]

Other types of Internet-based video technologies and business models are rapidly taking root as well. For example, Joost—created in January 2007 by the founders of Skype—delivers peer-to-peer video programming under contractual arrangements with major programmers, including CBS, Viacom, Time Warner, Sony, and the National Hockey League.[51] Netflix plans to shift its massive distribution of feature-length movies from the postal service to the Internet,[52] and Microsoft has announced that Xbox 360 users will soon be able to download movies directly

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[48] Rob Hof, *YouTube: 100 Million Videos a Day*, BusinessWeek, July 14, 2006 (http://www.businessweek.com/the_thread/techbeat/archives/2006/07/youtube_100_mil.html).

[49] Bret Swanson, *The Coming Exaflood*, Wall St. J., Jan. 20, 2007, at A11.

[50] Yankee Group, *2006 Internet Video Forecast: Broadband Emerges as an Alternative Channel for Video Distribution* 6-7 (Dec. 2006).

[51] Alex Pham, *Joost Strikes TV Deals with Sony, Time Warner, NHL and Hasbro*, L.A. Times, May 2, 2007, at 3.

[52] *See* Press Release, *Netflix Offers Subscribers the Option of Instantly Watching Movies on Their PCs*, Jan. 16, 2007 (http://www.netflix.com/MediaCenter?id=5384).

to their gaming consoles over the Internet.[53] Overall, industry experts expect that "video traffic will represent at least 80 percent of all Internet traffic" by 2010.[54]

Video is only one of several bandwidth-intensive applications that are placing new demands on the Internet's access and backbone networks. Others include such music downloading services as iTunes, which have supplanted compact discs as the primary means of music distribution; on-line printing and photo-sharing services such as Kodak, Snapfish, Shutterfly, and Photobucket; and the enormously popular class of "massively multiplayer online role-playing games," such as Sony's *EverQuest* and Blizzard Entertainment's *World of Warcraft.* These "MMORPGs" are graphics-intensive, three-dimensional on-line video games played simultaneously by thousands of end users dispersed throughout the Internet. Because the end users are playing the same games with one another in real time, these applications require an unusually high quality of service from the networks over which they are provided.[55]

P2P technologies such as KaZaA and BitTorrent, which now account for a large percentage of all traffic on the publicly accessible Internet,[56] likewise present intense bandwidth challenges. These technologies disassemble content into small files and widely distribute those files to different end-user computers for storage and subsequent retrieval by other end users.[57] The result is the functional equivalent of a massively distributed server network. By converting

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53 *See* Robert Levine, *Microsoft to offer Xbox movie downloads*, New York Times, Nov. 7, 2006 (http://www.iht.com/articles/2006/11/07/business/xbox.php).

54 Norton, *Video Internet, supra*, at 2.

55 *See* Robert Litan & Hal Singer, *Unintended Consequences of Net Neutrality Regulation*, (forthcoming J. Telecomm. & High Tech. L. (2007)).

56 David Vorhaus, *Confronting the Albatross of P2P*, Yankee Group (May 31, 2007).

57 *See, e.g.*, Detlef Schoder, Kai Fischbach, & Christian Schmitt, *Core Concepts in Peer-to-Peer Networking* (2005) (http://www.idea-group.com/downloads/excerpts/Subramanian01.pdf).

end user devices into content caches for other end users, P2P technology offers a cheap distribution option for content providers, but imposes enormous upstream traffic burdens on Internet access networks, particularly with the rise of shared video. "Peer-2-Peer file sharing users around the world have shifted from sharing 4MB music files to sharing 700MB movies on the Internet. These applications *relentlessly consume all of the end user's available Internet bandwidth* attempting to download chunks of the files from any sources on-line at the time. . . . [T]he access networks are filling up 24/7, resulting in significant costs to the access-heavy ISPs (Cable Companies and DSL Providers in particular)."[58]

The network-management challenges posed by bandwidth-intensive applications arise, moreover, not just from an increase in the *total* volume of Internet traffic, but also from the escalating magnitude of unpredictable *spikes* in Internet traffic. Like conventional telephone networks, IP networks are sized to handle demand during periods of peak usage. The closer that peak usage is to average usage, the more efficient the network's cost structure will be, and the more predictably the network operator can recover those costs from the users of its network. According to some estimates, however, video applications roughly double the "peak-to-mean" ratio of traffic on IP networks.[59]

The reason relates in part to the "viral" (self-intensifying) nature of popular video files. A video clip accompanying a breaking news or entertainment story often triggers unexpected network congestion by "generating massive 'Flash Crowd' effects," and "Viral Amplifiers (sites that do not host but rather highlight the most popular videos) amplify any viral properties a video

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[58] *See, e.g.,* William B. Norton, *The Evolution of the U.S. Internet Peering Ecosystem*, at 8 (2003) (http://www.equinix.com/pdf/ whitepapers/PeeringEcosystem.pdf).

[59] *See* Norton, *Video Internet, supra*, at 3.

may have."[60] Similar demand spikes can appear after the release of popular new products. For example, data traffic associated with Xbox Live surged 80% during the week after Microsoft released six new games for that platform in November 2006, and "North American broadband service providers saw an approximate 140% peak increase attributed to iTunes bandwidth usage" just after "Apple released iTunes 7, enabling users to download full feature-length films onto their iPods."[61] Predictably, traffic associated with these same products surged again starting on Christmas day.[62] With less warning, Internet traffic would also spike in the wake of a pandemic, terrorist attack, or other emergency that suddenly causes millions of people to turn to the Internet for information and, subsequently, to become telecommuters. For example, industry executives warn that, in the event of a bird flu outbreak, "the demand for communication will soar," and the Internet's ability to handle that surge is "definitely the most vulnerable part of the equation."[63]

On top of the escalating *volume* of Internet traffic and the increasingly unpredictable *spikes* in that volume, an increasing number of applications rely on certain protocols that aggressively consume available bandwidth at the expense of other applications using different protocols. For example, the Internet is often described as using the "TCP-IP protocol suite," with IP at Layer 3 (the "network" layer) and TCP at Layer 4 (the "transport" layer). TCP is

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60 *Id.* at 1.

61 Sandvine Press Release, *Sandvine Identifies Surge in Xbox Live and iTunes Traffic* (Dec. 4, 2006) (http://www.sandvine.com/news/pr_detail.asp?ID=111).

62 Sandvine Press Release, *Sandvine Observes Sustained Surge of Xbox Live and iTunes Traffic* (Feb. 5, 2007) (http://www.sandvine.com/news/pr_detail.asp?ID=117).

63 Patrick Thibodeau, *Flu pandemic could choke Internet, requiring usage restrictions,* ComputerWorld, Feb. 12, 2007 (http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9011125) (quoting Renate Noone, vice president of professional services at SunGard's Availability Services unit, and Bernard O'Neill, vice president and chief network officer at Prudential Financial Inc.).

considered a "polite" transport protocol because it can sense congestion and "throttles back" transmission rates until after the congestion lifts. But not all Internet applications use TCP. Some use the User Datagram Protocol ("UDP") at Layer 4. UDP omits the error-correction functions of TCP and, unlike TCP, does not throttle back in the face of network congestion.[64] In the words of one network engineer, "UDP is an inherently brutish, congestion ignorant protocol. It blindly blasts data at the rate desired with no built-in notion of loss or bandwidth hijacking. Effective measures must be added in order to send UDP datagrams in a congestion sensitive environment."[65] Moreover, even applications that use TCP can and do aggressively consume disproportionate amounts of subscriber bandwidth simply by opening up multiple streams (or "torrents," as featured in the BitTorrent P2P technology) to seize capacity for themselves.[66]

Absent effective network-management measures, the bandwidth-hogging nature of UDP and some applications can create a classic tragedy-of-the-commons dynamic, in which each network user has every incentive to hoard shared bandwidth for itself at the expense of others. To avoid this result, each network provider—the party ultimately responsible for managing shared network resources—needs to ensure that sufficient network resources are available for all

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64 UDP applications thus "send out data as fast as [they] can," even when they encounter congestion, "while [conventional] TCP-friendly applications deliberately send fewer and fewer packets" and may thus end up "starved of network resources." Jon M. Peha, *The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy*, at 7 (2006) ("Benefits and Risks") (http://web.si.umich.edu/tprc/papers/2006/574/Peha_balanced_net_neutrality_policy.pdf). Nonetheless, when properly managed, UDP's attributes can be beneficial for a range of purposes, including Domain Name System (DNS) queries.

65 William Strathearn, *A Fair and Balanced Method of Controlling UDP Congestion* (2003) (http://strathearns.org/wds/papers/UDPCongestiionControl.pdf).

66 *See, e.g.*, Bob Briscoe, *Flow rate fairness: Dismantling a Religion*, 37 Computer Commc'n Rev. 63 (2007) (http://portal.acm.org/citation.cfm?doid=1232919.1232926).

of its customers on an equitable basis and that no single customer (or group of customers) diminishes the value of the network for others.

B. Tracking the "Exaflood."

As the preceding discussion makes clear, broadband providers are constantly challenged to keep up with the accelerating demands the new bandwidth-intensive applications are placing on their networks. Earlier this year, Deloitte Touche Tohmatsu reported a growing consensus among engineering experts that the upsurge in Internet traffic due to new bandwidth-intensive applications "will likely require considerable investment in new infrastructure."[67] Deloitte noted the increase in the total number of Internet users, which "breached the one billion mark in 2006," and the sudden popularity of video applications, including "peer-to-peer video," "video chat," "video downloads, user-generated video content and IPTV."[68] Although Deloitte avoided taking sides in the net neutrality debate, it concluded that, "[c]learly, something has to change in the economics of Internet access, such that network operators and ISPs can continue to invest in new infrastructure and maintain service quality, and consumers can continue to enjoy the Internet as they know it today."[69]

There is nothing speculative about Deloitte's concern. Other parties, from all corners of the industry, have expressed exactly the same concern. Vincent Dureau, Google's head of TV technology, warned: "The web infrastructure—and even Google's—doesn't scale. It's not

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67 Deloitte Touche Tohmatsu, *Telecommunications Predictions: TMT Trends 2007,* at 6 (2007) (http://www.deloitte.com/dtt/cda/doc/content/dtt_TelecomPredictions011107.pdf).

68 *Id.*

69 *Id.* at 7.

going to offer the quality of service that consumers expect."[70] Former Assistant Secretaries of Commerce Larry Irving and Bruce Mehlman—now co-chairmen of the Internet Innovation Alliance—observed:

> [A]s new content proliferates, today's high-speed connection could be tomorrow's traffic jam. The strain on broadband capabilities and the looming data deluge is often called the *Internet exaflood*. "Exaflood" stems from the term exabyte, or 1.074 billion gigabytes. Two exabytes equal the total volume of information generated in 1999. The Internet currently handles one exabyte of data *every hour*. This mushrooming amalgamation of data is pushing the Internet to its limits. . . . The Internet infrastructure must be robust enough to handle all of the new data; this is often a challenge because the Internet is really thousands of privately owned, individual networks stitched together. It requires constant investment so that it will continue to grow and run smoothly.[71]

And William Norton of Equinix, a leading provider of data centers and Internet exchange services, predicts "a new wave of disruption that potentially dwarfs currently peered Internet traffic," causing "a serious supply side problem in the Internet today."[72]

C. Engineering Solutions to the Exaflood.

The Internet can rise to the exaflood challenge, and, when it does, it will radically enhance the Internet experience of American consumers. For the Internet to get from here to there, however, it must continue evolving in three basic ways. First, *more* IP networks need to

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[70] Bobbie Johnson, *Rise of video downloads threatens gridlock on net*, The Guardian, Feb. 10, 2007 (http://www.guardian.co.uk/uk_news/story/0,,2010031,00.html) (quoting Vincent Dureau, Google's head of TV Technology).

[71] Bruce Mehlman & Larry Irving, *Bring on the Exaflood!*, Wash. Post, May 24, 2007, at A31 (http://www.washingtonpost.com/wp-dyn/content/article/2007/05/23/AR2007052301418.html); *see also* Internet Innovation Alliance, *Leading Internet Alliance Says Web's Capacity Is Nearing Its Limit*, Apr. 18, 2007 (http://www.internetinnovation.org/iia/page/show/news_clips_041807b). One exabyte equals 1024 petabytes, or 1,048,576 terabytes, or 1,073,741,824 gigabytes. "[F]ive exabytes are equal to all the words ever spoken by human beings." *Id.* By comparison, "[t]he information added annually to the digital universe between 2006 and 2010 is expected to increase more than six fold—to 988 exabytes." *Id.*

[72] Norton, *Video Internet*, *supra*, at 1, 15.

be built in order to handle the surging data flow. Second, the data-carrying capacity on existing IP networks needs to be *bigger*. Third, each IP network also needs to be *smarter*.

We have already addressed how "edge" providers like Google, Akamai, and Limelight have begun responding to the call for *more* IP networks. They have built the functional equivalent of new global backbones to ensure exceedingly efficient connectivity between the providers and end users of Internet applications and content. At the same time, policymakers have properly stressed the need for more access networks and capabilities to connect more Americans to the Internet and to handle the accelerating traffic flows in the last mile. As we discuss below, the best route to that outcome is to promote a stable deregulatory environment that encourages such capital-intensive ventures.

That is also the best way to encourage existing network providers to invest in making their pipes *bigger*. In the favorable deregulatory climate maintained by the current Commission, those providers have invested many billions of dollars in facilities upgrades. For example, AT&T is investing $6.5 billion in its IP-based Project Lightspeed network, which extends fiber-optic cable deep into individual neighborhoods and will give tens of millions of Americans, among many other things, a much-needed alternative to the cable incumbents for the delivery of multi-channel video programming.[73] AT&T is also investing substantial sums to quadruple the capacity of its global backbone network by upgrading to OC-768 pipes with speeds of 40 gigabytes per second.[74] Verizon is investing billions of its own to deploy its FiOS broadband

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[73] *See* Dionne Searcey & Peter Grant, *AT&T Says Costs Rise for TV System's Launch*, Wall St. J., May 8, 2007, at B4.

[74] *See* Craig Matsumoto, *AT&T Readies 40-Gig Backbone*, Light Reading (June 6, 2006) (http://www.lightreading.com/document.asp?doc_id=96564&site=globalcomm).

and video distribution network, which extends fiber-optic cables to individual homes and businesses.[75] Cable providers, too, have reportedly spent more than $110 billion over the last decade to build out "a 21st century platform for advanced services."[76] At the same time, Sprint and Clearwire are investing heavily in WiMAX technology, and they are aggressively deploying nationwide broadband networks that will each be capable of serving more than 100 million customers.[77]

Private companies have made these investments without any guarantee of cost-recovery. Indeed, competition and the unpredictability of consumer demand make these investments—however essential to the Internet's future—exceptionally risky for the companies that underwrite them. Fearful that the telecom crash of the early 2000s will repeat itself, many on Wall Street respond with great skepticism to the increased capital spending needed for these capacity upgrades. For example, "Comcast shares fell more than 3 percent on Feb. 1 when the company gave a higher than expected outlook of $5.7 billion on capital spend for 2007."[78] As a Sanford Bernstein analyst explained, "Comcast can talk till it's blue in the face about what the marginal return on investor capital is, but investors are so nervous about capital spending that they're almost hoping for slower growth[.]"[79] Likewise, as a Lehman Brothers analyst observes, "[t]he

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75 *See* Verizon press release, Sept. 26, 2006 (http://investor.verizon.com/news/view.aspx?NewsID=773).

76 NCTA Comments, WC Docket No. 07-45, at 2-3 (May 16, 2007).

77 *See* Sprint Comments, WC Docket No. 07-45, at 8 (May 16, 2007); Clearwire Comments, WC Docket No. 07-45, at 3, 5 (May 16, 2007).

78 Yinka Adegoke (Reuters), *Comcast sees cable rev rising, capex steady*, May 1, 2007 (http://today.reuters.com/news/articleinvesting.aspx?type=companyNews&storyid=220959+01-May-2007+RTRS&WTmodLoc=InvArt-L2-CompanyNews-3).

79 *Id.*

market is very skeptical of [Verizon's] FiOS spending" as well.[80] Wharton professor Kevin Werbach adds: "Verizon is making a smart long-term bet on fiber to the home, but it's a risky bet. The capital costs are substantial and the payback scenarios are uncertain[.]"[81]

While these risky, capital-intensive capacity upgrades are *necessary* steps that any network provider must take to keep pace with escalating bandwidth demands, they are not *sufficient* steps. Each provider must also make its network *smarter*. This critical need for network intelligence provides the key to answering the Commission's twin questions about "[h]ow and why" providers manage their networks and services.[82] Those two questions are important, but they are properly addressed in the reverse order. Below we summarize "why" IP networks must be smart enough to treat packets differently, and then we address "how" they do so.

1. *Why* providers manage their IP networks.

Internet-related service providers must carefully manage their networks in order to deliver reliable, high-quality services to their customers. That task is challenging precisely because the Internet Protocol has made the dream of convergence a reality.

In the past, voice, video, and data services were, for the most part, provided over separate, single-purpose networks. IP changes all of that. Now, any type of electronic communications can be offered over a unified IP platform. This *convergence* of multiple services onto a single platform carries many advantages beyond the obvious economies of scale

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80 Ed Gubbins, *Lehman: Verizon may want to rethink FTTP*, Telephony Online, Jan. 4, 2006 (http://telephonyonline.com/fttp/news/lehman_verizon_fttp_010406/).

81 Knowledge@Wharton, *Verizon's High-Speed Network: If They Build It, Will You Come?* (Mar. 21, 2007) (http://knowledge.wharton.upenn.edu/article.cfm?articleid=1689).

82 *Notice*, ¶ 8.

and scope derived from building one network rather than several. It also allows for the integration of voice, video, and text into feature-rich multimedia applications. And it facilitates greater competition among service providers. For example, cable and telephone companies, once siloed from mutual competition because of their single-purpose networks, now compete fiercely to offer the "triple play" of voice, video, and Internet access services.

But the benefits of convergence come with a potential cost. Because related packets within an Internet data session may follow different routes to their destination, encounter congestion along the way, and arrive out of sequence, it may take a few moments for an end user's computer (or other device) to buffer, reorganize, and assure a consistent delivery rate for the packets received for given applications. The complexity of that process increases with delays in packet transmission ("latency"), inconsistent packet delivery intervals ("jitter"), and packet loss. The more time that packets spend en route, the less time the application has to compensate for irregularities in their arrival.

Under typical operating conditions, this is not a serious problem for traditional non-real-time applications such as webpage downloads or e-mail exchanges. If a webpage takes a second or two to load, consumers will hardly notice. But network latency, jitter, and packet loss *do* matter a great deal for many of the new real-time Internet applications such as VoIP, on-line gaming, and video. Consumers will cancel their subscriptions to multiplayer gaming services if inconsistent network handling prevents their on-line characters from reacting quickly enough to surprise attacks. They will be similarly upset if, because of poor network performance, the real-

time video stream for a football game freezes during a third-and-long pass into the endzone. And an interruption in a real-time telemedicine session could imperil a patient's life.[83]

Thus, while convergence is an achievement of historic proportions, it poses a fundamental engineering challenge. How can engineers structure a unified IP platform to maintain the cost-reducing *efficiency* of packet-switched IP networks and also assure the *quality of service* consumers demand for real-time services, such as voice and video, now that the signals for those services no longer travel on service-specific transmission networks? The answer cannot be that IP networks must blindly treat all packets alike by subjecting them equally to the best-efforts delivery principles used today for downloading ordinary webpages or delivering e-mails. Again, that approach would produce unacceptably poor quality for real-time applications like voice and video and would thwart the promise of convergence.

The answer likewise cannot be that network providers, on top of their already enormous capital investments, must so radically enlarge the capacity of their IP networks as to guarantee *all* packets—including those associated with *non*-real time applications (those reasonably tolerant of latency and jitter)—the same nearly instantaneous delivery needed for high-quality video services. *That* approach would rob IP networks of the efficiency characteristics that make Internet usage affordable. Indeed, economic studies have shown that, as IP video services escalate in popularity, this "dumb network" approach would raise the network costs of broadband access somewhere between $100 and $400 *per subscriber*.[84] Of course, one can

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83 *See* pp. 34-35, *infra*.

84 *See, e.g.*, George Ford, Thomas Koutsky & Lawrence Spiwak, *The Efficiency Risk of Network Neutrality Rules*, Phoenix Center Policy Bulletin No. 16 (2006) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=925347); Richard N. Clarke, *Costs of Neutral/Unmanaged IP Networks* 21 (2006) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=903433); *see also*

debate the precise magnitude of these extra costs, but there can be no dispute that a "dumb network" approach to the exaflood would needlessly and enormously magnify those costs—and that consumers would end up footing the bill.

In short, the answer to the exaflood lies not only in more networks and fatter pipes, but in greater network intelligence as well, including an ability to distinguish between packets that *do* and those that do *not* need special handling to make their associated applications valuable to end users. Such network intelligence is indispensable, moreover, not just to consumer broadband networks, but also to the next generation of IP services such as videoconferencing, rural health care, telemedicine, distance learning, and high-quality telecommuting capabilities. To ensure quality of service, these bandwidth-intensive applications are mainly offered today over specialized virtual private networks (VPNs) operated by broadband providers on a single managed IP network. As noted in Section I.A, most net neutrality advocates do not explicitly seek regulation of managed IP networks, but the breadth of their regulatory agenda raises serious questions about whether net neutrality rules would spill over to these network-based VPN applications, given that the physical infrastructure used for these "managed" services overlaps extensively with the physical infrastructure used for network-to-network traffic over the publicly accessible Internet.

The medical and disabilities communities in particular, which increasingly rely on innovative applications now available only on managed networks, have thus reacted with concern to net neutrality proposals. Dr. David Charles, Chairman of the National Alliance of Medical Researchers and Teaching Physicians, explains:

Steven Pociask, *Net Neutrality and the Effects on Consumers*, American Consumer Institute 14(2007) (http://www.theamericanconsumer.org/ ACI%20NN%20Final.pdf).

> [T]he medical community is taking a wary look at efforts in Washington to pass "Net Neutrality" legislation that would discourage further private investment in advanced broadband networks. . . . [T]he broadband connections required for telemedicine are not the same as the high-speed connection that brings me my e-mail. Telemedicine applications require extra broadband capacity to deliver broadcast quality video so a psychiatrist can observe the facial expressions of a patient. They need to move data fast enough to capture high-resolution images so MRI results can be evaluated online. These are premium connections that must be not only super fast but extra secure. They need priority handling by network operators and that is just the kind of handling that Net Neutrality would forbid.[85]

Hofstra professor Frank Bowe likewise warns that "Americans with disabilities need, and would benefit greatly from, intelligence in the network and not just at its edges. An open and intelligent network may meet the needs of this population much better, at much lower end-user costs, than the [dumb] network sought by some net neutrality promoters."[86] As examples of bandwidth-intensive applications that require network intelligence, he cites "telepresence" (*i.e.*, the remote monitoring that allows many people with disabilities to live in their own homes, away from health care facilities) and "video signing."[87]

Finally, to protect their users and the public interest more generally, broadband providers must differentiate among packets by filtering out those associated with viruses, worms, spyware, denial-of-service attacks, and other threats to network security. Indeed, if broadband providers were barred from performing these tasks, the Internet would likely come to a grinding halt. AT&T estimates that more than 80 percent of the e-mail bound for its network is spam and that approximately one million home computers today are infected with "bots" that reach out to other

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85 David Charles, M.D., *The Broadband Path to Health Care Access* (July 12, 2006) (http://www.medicalresearchers.org/node/49).

86 Frank G. Bowe, *Net Neutrality and People with Disabilities* 23 (May 2006) (http://people.hofstra.edu/faculty/frank_g_bowe/NetNeutralityWhitePaper.doc).

87 *Id.*

computers to propagate malicious code.[88] As network threats grow more sophisticated, network owners must adopt sophisticated tools of their own to counteract them. Regulators can limit such network security measures only at the public's peril.

Ultimately, there can be no serious debate about whether IP networks should remain free to differentiate among packets, because banning that practice would have catastrophic consequences for the public welfare. Even Timothy Wu, a key exponent of net neutrality regulation, acknowledges that "no one really believes in systems that ban discrimination completely," including on the Internet.[89] The only question is whether, without the slightest hint of market failure, the government should put itself in the business of prejudging the marketplace and distinguishing preemptively between "good" and "bad" differentiation—and then banning the so-called "bad" differentiation before it happens.[90] As discussed in the Argument below, the answer to that question is no.

2. *How* providers manage their IP networks.

Having addressed the "why" of packet differentiation, we now discuss the "how." Two overarching themes are worth noting up front. *First*, many of the most successful techniques for optimizing the performance of given Internet applications today occur in edge and backbone networks, not in access networks, and there is no principled reason to disfavor some, but not all, of these techniques, given their similar competitive effects. *Second*, to meet the complex and changing needs of their customers, providers use many network-management techniques, often

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88 Sarah D. Scalet, *Introducing AT&T, Your Internet Security Company*, CIO, May 17, 2007 (http://www.cio.com/article/110250/Introducing_AT_T_Your_Internet_Security_Company).

89 *Keeping the Internet Neutral?: Tim Wu and Christopher Yoo Debate*, 59 Fed. Commun. L.J. 575, 577 (2007).

90 *Id.*

in combination, and there is no single "right" way to manage a network or service. Applications providers and network engineers alike need all the tools in their toolbox to satisfy those preferences as quickly and efficiently as possible.

At the outset, it is necessary to debunk one particularly irresponsible myth circulated by net neutrality advocates—the myth that the Internet is, and has always been, a collection of "dumb pipes." The SavetheInternet.com Coalition, for example, claims that "[t]he fundamental idea on the Internet since its inception is that every Web site, every feature, and every service *should be treated exactly the same*."[91] The Coalition adds: "With Net Neutrality, the network's only job is to move data—*not choose which data to privilege with higher quality service*."[92] This "dumb pipes" rhetoric—which has crept into the speeches of some of the nation's top policymakers—is unhinged from reality.

Since the early days of the Internet, engineers have recognized the need to build intelligence into the Internet Protocol to enable networks to distinguish among packets on the basis of their associated applications. They recognized that different applications would have different needs but that those needs could be addressed in part by dividing applications into different handling classes within an IP network. While much of the traffic on the Internet in those early days was not particularly sensitive to latency and jitter and thus did not need to exploit these differentiation capabilities, the Internet's designers intended for the Internet to evolve to support new applications and services that *would* require differentiated treatment.

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91 SavetheInternet.com Coalition, *Net Neutrality 101* (http://www.savetheinternet.com/=101) (visited June 14, 2007) (emphasis added).

92 *Id*. at *Frequently Asked Questions* (http://www.savetheinternet.com/=faq) (emphasis added).

In fact, the original blueprint for a key aspect of the Internet Protocol—contained in a 1981 "request for comment" (RFC 791)[93] and subsequently adopted by the Internet Engineering Task Force as Internet Standard 5—established a mechanism for labeling packets by handling class so that networks could give applications within each class at least the minimum level of performance they need. Specifically, RFC 791 describes the 8-bit "Type of Service" segment on packet headers as "provid[ing] an indication of the abstract parameters of the quality of service desired. . . . Several networks offer service precedence, which somehow treats high precedence traffic as more important than other traffic (generally by accepting only traffic above a certain precedence at time of high load)."[94] The RFC adds that "[t]he actual use and control of that [precedence] designation is up to each network," and "[i]f the actual use of these precedence designations is of concern to a particular network, it is the responsibility of that network to control the access to, and use of, those precedence designations."[95]

Later, in 1994, before most Americans had even heard of the Internet, another RFC noted that, in addition to the "simple priority" described in the 1981 RFC, more work needed to be done to facilitate latency-sensitive Internet applications.[96] "[R]eal-time applications," it

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93 *See* http://www.ietf.org/rfc/rfc0791.txt.

94 Information Sciences Inst., *IP DARPA Internet Program Protocol Specification,* RFC 791, at 11, Sept. 1981 (http://www.ietf.org/rfc/rfc0791.txt) ("RFC 791"); *see also* Vinton Cerf, Yogen Dalai & Carl Sunshine, *Specifications of Internet Transmission Control Program*, RFC 675, § 4.4.1, Dec. 1974 (http://www.faqs.org/rfcs/rfc675.html) ("From the standpoint of controlling buffer congestion, it appears better to treat incoming packets with higher priority than outgoing packets").

95 RFC 791, *supra*, at 12.

96 Robert Braden, David Clark & Scott Shenker, *Integrated Services in the Internet Architecture: An Overview*, RFC 1633, June 1994, at 3-4 (http://www.ietf.org/rfc/rfc1633.txt) ("The essence of real-time service is the requirement for some service guarantees, and we argue that guarantees cannot be achieved without reservations. . . . [T]he user must be able to get a

explained, "often do not work well across the Internet because of variable queuing delays and congestion losses," and thus "[b]efore real-time applications such as remote video, multimedia conferencing, visualization, and virtual reality can be broadly used, the Internet infrastructure must be modified to support real-time QoS, which provides some control over end-to-end packet delays."[97] The 1994 RFC further endorsed the use of various traffic-management techniques: "Real-time QoS is not the only issue for a next generation of traffic management in the Internet. Network operators are requesting the ability to control the sharing of bandwidth on a particular link among different traffic classes. They want to be able to divide traffic into a few administrative classes and assign to each a minimum percentage of the link bandwidth under conditions of overload, while allowing 'unused' bandwidth to be available at other times."[98]

In short, IP was always intended to be a *flexible* (not "dumb") protocol that could be adapted to meet the specific needs of the applications running over it, and engineers have never sought to limit the Internet to providing only undifferentiated service for all applications. To its credit, the Commission has avoided restricting this inherent flexibility and has chosen not to meddle in "standard-setting issues for the Internet Protocol language itself."[99] Instead, the Internet Protocol has continued to evolve without government intervention to meet the changing

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service whose quality is sufficiently predictable that the application can operate in an acceptable way over a duration of time determined by the user.").

97 *Id.* at 1.

98 *Id.*; *see also* F. Le Faucheur & W. Lai, *Requirements for Support of Differentiated Services-aware MPLS Traffic Engineering*, RFC 3564, at 2 (2003) (http://www.ietf.org/rfc/rfc3564.txt) ("To achieve fine-grained optimization of transmission resources and further enhanced network performance and efficiency, . . . it may be desirable to perform traffic engineering at a per-class level instead of at an aggregate level.").

99 Notice of Proposed Rulemaking, *IP-Enabled Services*, 19 FCC Rcd 4863, ¶ 1 n.1 (2004).

needs of the broadband marketplace. As a result, packet differentiation has become a routine and increasingly essential aspect of network management, including for the managed IP services used by many large business customers. Against this historical backdrop, we now discuss some of the common network management techniques providers use to provide high-quality services to their customers.

Congestion Avoidance. One effective way an applications provider can assure better treatment for its packets than others on the Internet is to avoid sending those packets through network congestion. Perhaps the most prevalent method involves *caching* a provider's data (such as webpages and media files) in multiple locations near its geographically dispersed end users. When an end user requests the data, the cache servers can convey the requested packets quickly and reliably from a nearby location, thereby sparing them a long, multiple-hop trip through potential bottlenecks on any of several different networks. As discussed in Section I.C above, some companies, such as Akamai and Limelight, provide this CDN service commercially to third parties, whereas others, such as Google, build CDNs of their own.

Compression. Digital compression techniques enable applications and content providers to reduce the potential for congestion by reducing the load they impose on IP networks. These techniques involve the use of sophisticated algorithms to use as few bits as possible to represent transmitted information—such as an image, an audio clip, or a text file—while maintaining the desired degree of fidelity to the original.[100] Different applications vary in the extent to which

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[100] A simplified example illustrates the basic idea. If the anchorperson in a video news clip is shown sitting behind a desk and against a fixed background, the provider conveying that news clip to end users need not lengthen its bitstream with the same detailed information about the desk and fixed background for every frame in the clip. It may instead transmit that information for the first frame and use a brief code to signal that the same desk and background should be

they can tolerate the information loss that accompanies some compression techniques.[101] A downloaded movie could tolerate some degree of information loss; an X-ray image might not.

Differentiated service handling, buffering, and queuing. To manage latency and jitter for real-time applications like voice and video, network engineers can configure routers to handle network congestion by giving packets a greater probability of accessing link bandwidth if they have markings that indicate a high sensitivity to jitter and latency.[102] The primary technique of this type involves *buffering* and *queuing*. As noted, the costs of networks that employ these techniques are substantially lower for all users than the costs of a network that addresses performance needs solely through increases in capacity.[103]

Networks move packets in time intervals typically measured in a few milliseconds. It is not uncommon for the packet load on a particular link to spike for a brief instant above the link's capacity. When this happens, more packets may arrive at the link than can be placed immediately on the link. To handle this situation, network engineers deploy "buffers," which can very briefly store excess packets until capacity on the link becomes available; once the buffer fills up, newly arriving packets are dropped and must be resent.

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shown for all other frames as well. This is the basic approach of the MPEG-2 and MPEG-4 compression algorithms.

[101] For that reason, whereas an applications or content provider can implement both "lossless" and "lossy" compression techniques, a network provider is typically confined to lossless techniques.

[102] *See generally* Murat Yuksel, *et al.*, *Value of Supporting Class-of-Service in IP Backbones* (http://www.cse.unr.edu/~yuksem/my-papers/iwqos07.pdf).

[103] *See* pp. 33-34, *supra*; Murat Yuksel, *et al.*, *Value of Supporting Class-of-Service in IP Backbones*, *supra.*

"Queuing" involves deciding the order in which buffers release packets onto a link connecting two routers.[104] If a packet is labeled to indicate that its associated application can tolerate some degree of latency and jitter, it is likely to be kept in a buffer longer than are packets labeled to indicate that their applications are highly sensitive to latency and jitter and thus need to be transmitted immediately. Because latency and jitter impair the value of real-time applications much more than non-real-time applications, this technique—which is used today mainly on managed IP networks, but could potentially be used for Internet traffic as well—ensures the most efficient and pro-consumer allocation of scarce network resources. Significantly, however, such techniques affect applications only during brief periods of transient congestion; under ordinary conditions, a network need not employ queuing techniques because it can process packets as fast as they are received.

Choices among queuing techniques are inherently provider-specific, and there "are no real industry standards" for queuing.[105] Moreover, queuing methodologies are highly dynamic—

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[104] *See, e.g.*, Chuck Semeria, *Supporting Differentiated Service Classes: Active Queue Memory Management*, at 5, Juniper Networks (2002) (http://www.juniper.net/solutions/literature/white_papers/200021.pdf); OpenBSD, *PF: Packet Queuing and Prioritization* (2007) (http://www.openbsd.org/faq/pf/queueing.html). Network engineers have developed a variety of different queuing methodologies. Each is designed to maximize use of the network while minimizing packet loss, and each has its own strengths and weaknesses. Some queuing methodologies—such as "first-in-first-out" (FIFO) and "fair queuing" (FQ)—assign little or no priority to the packets associated with particular types of applications. Because these methodologies subject all applications to latency and jitter during periods of congestion, they are best suited for networks that do not handle real-time applications. In contrast, other techniques, such as "weighted round robin" (WRR) and "class-based queuing" (CBQ), establish different queues for packets associated with different types of applications. Each queue is then assigned sufficient bandwidth to manage latency and jitter, and each may "borrow" momentarily unused bandwidth allocated to other queues. Such dynamic bandwidth allocation facilitates the efficient use of finite network capacity.

[105] Semeria, *Supporting Differentiated Service Classes*, *supra*, at 4.

equipment vendors and network providers are constantly improving existing methodologies and inventing new ones. Thus, each network provider must balance the costs and benefits of the various queuing methodologies to select the one that best meets the needs of its customers.

Security Screening. As discussed, protection from spam, worms, viruses, distributed denial-of-service attacks, and other malicious behavior on the Internet is critically important to network management, and no net neutrality advocate seriously contends otherwise. An important but often overlooked fringe benefit of these robust network security practices is that keeping harmful traffic out of a network in the first place can significantly reduce network congestion by conserving network resources for traffic from legitimate sources.

According to recent reports from Verizon Wireless, for example, a single spammer recently tried to send 12 million text messages to its wireless customers.[106] As Verizon Wireless explained, wireless spam "impairs the delivery of legitimate messages, and because spam is often sent in high volume over short periods of time, it can place a strain on overall performance of the wireless network," and "[t]here's a lot of time and money that goes into blocking all of that."[107]

With multiple petabytes of data passing through its network each business day, the first crucial step to effective network security for AT&T or any other network provider is rapid identification of illegitimate packets. By closely monitoring the traffic coming into and out of its network, a network provider like AT&T can take steps to detect the early stages of attacks on

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[106] *See* Verizon press release, June 1, 2007 (http://news.vzw.com/news/2007/06/pr2007-06-01b.html).

[107] Howard Buskirk, *Verizon Wireless Says Filters Cut Wireless Spam's Impact*, Communications Daily, June 4, 2007.

network integrity and can take steps to minimize the effects of those attacks. "Before a worm strikes, technicians see strange spikes of traffic going to normally obscure ports, as malware developers test and tweak their code. A sudden, sharp increase in the amount of Web traffic worldwide could mean breaking news—or a distributed denial-of-service attack being lobbed at a single company halfway around the world."[108] For example, "AT&T security analysts knew about the 2003 Slammer worm before it hit, because of strange traffic going to port 1434."[109] Any net neutrality regulations that would restrict network providers from performing these critical functions would strike a serious blow to network security and consumer safety.

D. The Marketplace for Performance Enhancements.

Providers of the diverse network-management techniques described in this section are addressing the same basic market need: a need to treat some packets differently from others in order to provide optimal service quality to all their customers in the most cost-efficient manner possible. Providers can meet that need in a variety of alternative ways, each of which presents its own costs and benefits. For example, an applications provider today can enhance the performance of its products by purchasing CDN services from Akamai, Limelight, or a similar provider; or by building its own CDN (as Google has done); or by arranging for distribution through a P2P network;[110] or by purchasing managed services from a network provider that

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108 Scalet, *Introducing AT&T, Your Internet Security Company*, *supra*.

109 *Id.*

110 *See Confronting the Albatross of P2P*, Yankee Group, *supra*, at 3 ("P2P solutions from companies such as BitTorrent, Solid State Networks and Red Swoosh (part of Akamai) are marketing themselves directly to content owners as a more efficient and cost-effective way to disseminate content. Additionally, hybrid P2P-CDN solutions . . . appeal to service providers by calling out the ways that P2P caching can alleviate the concerns brought by increased traffic flow."); *see also* Joost Press Release, *Viacom to be key content partner with Joost, the world's*

honors class-of-service markings attached to packets; or by a combination of these and many other techniques.

Google, for example, leverages "the power of [its] global computer network" to offer a "web accelerator" service that enables broadband Internet access users to improve their web browsing performance.[111] As Google's website explains:

> Google Web Accelerator uses various strategies to make your web pages load faster, including:
>
> - Sending your page requests through Google machines dedicated to handling Google Web Accelerator traffic.
> - Storing copies of frequently looked at pages to make them quickly accessible.
> - Downloading only the updates if a web page has changed slightly since you last viewed it.
> - Prefetching certain pages onto your computer in advance.
> - Managing your Internet connection to reduce delays.
> - Compressing data before sending it to your computer.[112]

With Google's web accelerator, "[w]eb pages load even more quickly on DSL and cable connections."[113] Moreover, the service is also "easy to use—simply install and enjoy faster web browsing in seconds."[114] According to Google, its web accelerator service "could save two to

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first online global tv distribution platform (Feb. 20, 2007) (http://www.joost.com/press/2007/02/) ("Viacom's divisions—MTV Networks, BET Networks and Paramount Pictures—will provide television and theatrical programming on the Joost platform," which "enables premium interactive video experiences while guaranteeing copyright protection for content owners and creators.").

111 *See* http://webaccelerator.google.com/support.html.

112 *Id.*

113 *See* http://webaccelerator.google.com/index.html#basics1.

114 *See id.* While Google offers its web accelerator as a free, downloadable service to end users, it candidly acknowledges that this service can impose additional costs on network and website operators. According to Google, unless website operators take affirmative steps to configure their websites to work properly with Google's web accelerator, "prefetching can

three hours per month in browsing time" for frequent Internet users,[115] thus providing a substantial performance enhancement to end users and the websites Google chooses to "accelerate."[116]

The proliferation of different techniques to enhance service quality precludes a need for regulatory intervention, and it highlights the rent-seeking character of proposals for such intervention. When CDN-equipped companies like Google ask the Commission to ban paid packet-differentiation by access and backbone networks, they are really asking the government to create an arbitrary regulatory preference for one commercial performance-enhancement strategy—theirs—by forbidding key alternatives, even though their strategy is no more "neutral" than the alternatives in its disparate impact on applications and content providers. Put differently, net neutrality proponents like Google invite the Commission, for no good reason, to empty the engineer's toolbox of all performance-enhancement tools except the ones that Google and similar companies have manufactured. As discussed below, the Commission should decline that invitation.

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increase the overall load on a website" and "overload your users' connections with too large a download." *See* http://webaccelerator.google.com/webmasterhelp.html.

115 *See* Stefanie Olsen, *FAQ: Hard facts about Google's Web Accelerator*, CNET News (May 11, 2005).

116 Other companies provide similar web-acceleration services, both to end users and to ISPs for broadband and narrowband services. *See* Propel Accelerator, *The BEST Internet Accelerator and Network Optimizer* (http://propel.com/index.html); *see also* Alex Goldman, *Propel Delivers Wireless Acceleration*, ISP-Planet (June 5, 2007) ("ISP-Planet has been following the accelerator industry for some time now and it remains interesting because each company has a slightly different technological approach. In most of the industries we write about, there's only one core technology, but in acceleration, capitalism prevails, providing several different approaches.").

ARGUMENT

I. NET NEUTRALITY RULES WOULD VIOLATE THE COMMISSION'S STATUTORY DUTIES AND UNDERMINE ITS POLICY OF KEEPING THE INTERNET UNREGULATED.

A. The Congressional Mandate for Deregulation and Its Roots in FCC Policy.

Congress has repeatedly underscored the Commission's duty to rely first on market forces, rather than regulation, to promote the Internet's evolution and the deployment of advanced services to all Americans, including those in underserved communities. In the preamble to the 1996 Act, Congress explained that the Act's overarching purpose is "[t]o promote competition and *reduce regulation* in order to secure lower prices and *higher quality* services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies."[117] Congress emphasized the same deregulatory message in Section 230(b)(2), also added in 1996, declaring that "the policy of the United States" is "to preserve the vibrant and competitive *free market* that presently exists for the Internet and other interactive computer services, *unfettered by Federal or State regulation*."[118]

In addition to this overarching theme of promoting competition through deregulation, Congress gave the Commission specific direction, in Section 706 of the 1996 Act, to "encourage the deployment on a reasonable and timely basis of advanced telecommunications capability—defined as the ability to send and receive "*high-quality* voice, data, graphics, and video telecommunications using *any technology*"—by adopting a policy of "regulatory forbearance"

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117 Preamble to the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (emphasis added).

118 47 U.S.C. § 230(b)(2) (emphasis added).

and other measures to "remove barriers to infrastructure investment."[119] And in section 7 of the Communications Act, Congress placed a heavy "burden" on any party that "oppose[s]" the "provision of new technologies or services to the public."[120]

These provisions codify the Commission's own longstanding policy of "unregulation" for the Internet, and they foreclose deviations from that policy in the absence of a demonstrated market failure.[121] The Commission adopted that policy decades ago when it decided to insulate the dynamic field of information services (then called "enhanced services") from Title II common carrier regulation.[122] That decision—rightly credited with fostering the transformative

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119 Pub. L. 104-104, Title VII, § 706, 110 Stat. 153 (47 U.S.C. § 157 note) (emphasis added).

120 47 U.S.C. § 157.

121 *See, e.g.,* Report and Order and Notice of Proposed Rulemaking, *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, 20 FCC Rcd 14853, ¶ 44 (2005) ("*Wireline Broadband Order*") (finding that common carrier regulation of wireline access networks would have a "negative impact on deployment and innovation" and would thus violate "Congress' clear and express policy goal [in Section 706] of ensuring broadband deployment, and its directive that we remove barriers to that deployment"); Mem. Op. and Order, *Petition for Declaratory Ruling that pulver.com's Free World Dialup is Neither Telecommunications Nor a Telecommunications Service*, 19 FCC Rcd. 3307, ¶ 19 n.69 (2004) ("*pulver.com Petition Order*") (finding that common carrier regulation of information services "would not only run counter to our decades old goals and objectives to enable information services to function in a freely competitive, unregulated environment, but would directly contravene Congress's express directives in sections 706 and 230 of the Act that services such as [this] not be subject to such regulation").

122 *See* Jason Oxman, *The FCC and the Unregulation of the Internet*, OPP Working Paper No. 31, Office of Plans and Policy, FCC (July 1999); Notice of Proposed Rulemaking, *Local Competition and Broadband Reporting*, 14 FCC Rcd 18100, 18130 ¶ 61 (1999) (affirming that Commission "does not regulate internet services); Report to Congress, *Federal-State Joint Board on Universal Service*, 13 FCC Rcd 11501, 11540 ¶ 82 (1998) ("We recognize the unique qualities of the Internet, and do not presume that legacy regulatory frameworks are appropriately applied to it."); Final Decision, *Amendment of Section 64.702 of the Commission's Rules and Regulations (Second Computer Inquiry)*, 77 F.C.C.2d 384, 387 ¶ 7 (1980) ("*Computer II*") ("[T]he absence of traditional public utility regulation of enhanced services offers the greatest potential for efficient utilization and full exploitation of the interstate telecommunications

growth of the Internet—is all the more relevant now that the Internet has taken center stage in global communications. As one seminal FCC white paper explained:

> Perhaps the most important contribution to the success of the Internet that the FCC has made has been its consistent treatment of IP-based services as unregulated information services. . . . The FCC did not seek to apply legacy Title II regulations to the Internet as it developed and flourished . . . The next generation of Internet technologies should be treated in a similar manner. . . . The FCC should permit market forces to work without interference from inappropriate regulation.[123]

The Commission has so fully embraced that policy of unregulation that, in 1999, under a program initiated by former Chairman William Kennard, it urged regulators in *all nations* to exercise similar regulatory restraint:

> 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.[124]

More recently, the Commission has taken this same policy of unregulation to its logical conclusion. In a series of orders, the Commission has declared that cable modem service,[125]

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network."); *id.* at 431-32 ¶ 123 (concluding that subjecting information services "to a common carrier scheme of regulation . . . would negate the dynamics of . . . this area").

[123] Oxman, *Unregulation of the Internet*, *supra*, at 24-25.

[124] FCC, Connecting the Globe: A Regulator's Guide to Building a Global Information Community, at Section IX (1999) (http://www.fcc.gov/connectglobe/sec9.html).

[125] Declaratory Ruling and Notice of Proposed Rulemaking, *Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, 17 FCC Rcd 4798 (2002) (*Cable Modem Declaratory Ruling*).

wireline broadband Internet access,[126] broadband over powerlines,[127] and wireless broadband Internet access[128] are all information services exempt from the investment-deterring strictures of Title II common carrier regulation, including the Commission's antiquated *Computer Inquiry* regime. In its 2005 *Wireline Broadband Order*, for example, the Commission explained that, in today's Internet environment, economic regulation of broadband access networks has a "negative impact on deployment and innovation" and thus violates "Congress' clear and express policy goal [in Section 706] of ensuring broadband deployment, and its directive that we remove barriers to that deployment[.]"[129]

B. The Net Neutrality Agenda.

The longstanding, bipartisan consensus of Congress and the Commission in favor of a hands-off approach to the Internet has fueled phenomenal growth and reaped incalculable consumer dividends. Nonetheless, some interest groups ask the Commission to scrap this policy in favor of an amorphous interventionist scheme they inaptly call "net neutrality." Although "net neutrality" proponents all agree that the Commission should intervene in the Internet market's dynamics, they speak with one voice on little else—including, even, what the term "net neutrality" means and what concern it is supposed to address. Their lack of common ground is

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126 *Wireline Broadband Order*, *supra*.

127 Mem. Op. and Order, *United Power Line Council's Petition for Declaratory Ruling Regarding the Classification of Broadband over Power Line Internet Access as an Information Service*, 21 FCC Rcd 13281 (2006).

128 Declaratory Ruling, *Appropriate Treatment for Broadband Access to the Internet Over Wireless Networks*, 22 FCC Rcd 5901 (2007).

129 *Wireline Broadband Order*, ¶ 44; *see also id.*, at ¶ 19 (finding that nondiscrimination obligations "constrain technological advances and deter broadband infrastructure investment by creating disincentives to the deployment of facilities capable of providing innovative broadband Internet access services"); *id.* at ¶¶ 77-80.

hardly surprising. In the absence of any market failure, they cannot readily articulate exactly what the problem is that they want regulators to solve—much less why regulators should address any such problem now, through preemptive *ex ante* regulation, before it actually arises.[130] Although net neutrality has become a potent political rallying cry, there is little coherence or substance behind the rhetoric. As one antitrust scholar recently observed, "'net neutrality' has become an epithet devoid of any analytical content."[131]

As best AT&T can determine, there are essentially three brands of net neutrality proposals: (1) proposals to ban all packet differentiation in order to reduce the Internet to a collection of "dumb pipes," (2) proposals to allow broadband providers to prioritize packets only for all applications in broadly defined categories, and to bar them from reaching commercial arrangements with application or content providers for the sale of such services, and (3) proposals to permit commercial agreements for such enhancements, but subject to a common-carrier style nondiscrimination obligation. We address each in turn.

Net neutrality proposal No. 1: mandatory "dumb pipes." Some net neutrality advocates urge the Commission to intervene in the market to preserve what they view as "the fundamental idea on the Internet since its inception . . . that every Web site, every feature, and every service

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130 Indeed, in their more candid moments, net neutrality advocates acknowledge that there *is* no reason to act preemptively. As Vint Cerf remarked on Google's behalf during last year's legislative debate: "If the legislators . . . insist on neutrality, we will be happy. If they do not put it in, we will be less happy, but then we will have to wait and see whether or not there actually is any abuse. . . . [W]e will simply have to wait until something bad happens, and then we will make known our case to the Department of Justice's antitrust division." Reuters, *Google says bill could spark antitrust battle*, Computerworld, July 5, 2006 (http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9001570).

131 Statement of Timothy J. Muris, Foundation Professor, The George Mason University School of Law, Before the Workshop on Broadband Connectivity Competition Policy, U.S. Federal Trade Commission, Feb. 28, 2007 ("Muris FTC Statement"), at 18.

should be treated exactly the same."[132] As we have discussed, however, that "dumb pipes" view of the Internet is false as historical matter and absurd as a policy prescription.[133] It would require, among other things, abolishing the content delivery networks of firms such as Akamai, Limelight, and Google; regulating the use of certain transmission protocols (such as UDP) and P2P services; banning any priority for latency-sensitive applications like voice and video over non-latency-sensitive applications like e-mail; and forbidding a network operator "to favor traffic from, say, a patient's heart monitor over traffic delivering a music download."[134] No one can seriously advocate those outcomes.

The "dumb pipes" school of net neutrality rhetoric further warns that, once *some* latency-sensitive traffic receives priority, *all other* traffic will be consigned "to the digital equivalent of a winding dirt road."[135] This argument is nonsense. It assumes that, to meet surging traffic demands, network providers will increase their networks' intelligence but not overall capacity. That assumption is incorrect, as amply illustrated by the multi-billion-dollar investments that providers of access and backbone networks are making to upgrade their total transmission capacity, even as they also work to enhance their networks' intelligence. Thus, although application and content providers who do not purchase performance enhancements from any

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132 SavetheInternet.com Coalition, *Net Neutrality 101*, *supra.*

133 *See* pp. 14-20, 37-40, 44-46, *supra.*

134 Farber & Katz, *Hold Off On Net Neutrality*, *supra* (http://www.washingtonpost.com/wp-dyn/content/article/2007/01/18/ AR2007011801508.html).

135 Lawrence Lessig & Robert W. McChesney, *No Tolls on the Internet*, Wash. Post, June 8, 2006, at A23; *see also* SavetheInternet.com Coalition, *Frequently Asked Questions* (http://www.savetheinternet.com/=faq).

network provider may not receive the fastest possible delivery of their applications and content, they will likely receive *much better* absolute quality of service than they receive today.[136]

Ultimately, the "dumb pipes" version of net neutrality is so detached from reality that it collapses of its own weight. Even leading net neutrality proponent Timothy Wu concedes that "certain classes of applications will never function properly unless bandwidth and quality of service are guaranteed," and he cautions that the absence of network management "can interfere with application development and competition."[137] That leaves two basic types of proposals for "nondiscrimination" rules, which we briefly describe below and then address at length in Sections II and III below.[138]

Net neutrality proposal No. 2: a ban on business-to-business QoS agreements. Under one version of the rule, network operators would be forbidden to enter into business-to-business agreements with applications and content providers for the paid provision of performance enhancements. Advocates of this position might permit an access or backbone network to grant

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136 *See, e.g.*, J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet*, 2 J. Competition L. & Econ. 349, 355 (2006) ("*Consumer-Welfare Approach"*) ("Because access speeds will continue to increase, the default quality of service will continue to improve. . . . Rather than being forced down [the] 'digital equivalent of a winding dirt road,' [non-prioritized packets] would be relegated to something more like a business-class seat on a flight to Paris."); *see also* Litan & Singer, *Net Neutrality Regulation*, *supra*, at 8.

137 Wu, *Network Neutrality, Broadband Discrimination*, *supra*, at 154.

138 In addition to advocating for nondiscrimination rules, net neutrality pundits sometimes argue that the Commission must intervene now in the Internet's market dynamics to prevent broadband networks from "block[ing] the Web site of a competitor, or slow[ing] it down so much that it's unusable," SavetheInternet.com Coalition, *Net Neutrality 101*, *supra*, or skewing the marketplace of ideas by "push[ing]" disfavored political speech "to the end of a commercial digital queue," Chester, *The End of the Internet*, *supra.* These "blocking" concerns are a sham. As discussed in Section II.B below, no major broadband provider has engaged in anticompetitive blocking since the dawn of broadband services ten years ago, and *ex post* enforcement remedies are more than adequate to address such anticompetitive conduct if it ever arises.

transmission priority to, say, all real-time applications over non-real-time applications. But they would forbid the network to compete with CDNs and others for the sale of performance-enhancing services to particular applications and content providers.[139]

Net neutrality proposal No. 3: common carrier obligations. Under an alternative version of the nondiscrimination principle, access networks could strike business-to-business agreements for enhanced quality of service with applications and content providers, but only subject to a principle of *common carrier nondiscrimination*.[140] Although proposals of this type remain sketchy, a typical proposal would require access networks, upon reaching an agreement for enhanced service quality with one application provider, to file the agreement as a sort of "contract tariff" and then offer the same contractual terms to *other* willing buyers.[141]

Both versions of this "nondiscrimination" agenda fail any rational cost-benefit analysis, because there are no benefits to be gained from that agenda, and the costs of implementing it would be disastrous. First, as we discuss in Section II, competition precludes any *need* to subject broadband networks to the sort of preemptive economic regulation that the Commission deemed unnecessary and counterproductive in the slew of broadband-related orders it issued over the last

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139 That ban on compensation for providing performance enhancements has been a central feature of some net neutrality bills proposed in Congress. *See, e.g.*, S. 215, 110th Cong. § 12(a)(4)(C), (5) (2007); H.R. 5273, 109th Cong. § 4(a)(6), (7) (2006); H.R. 5417, 109th Cong. § 3 (2006).

140 *See* Sidak, *Consumer-Welfare Approach*, *supra*, at 426-27 (noting that, at AEI event on network neutrality, Lawrence Lessig "advocated a strong ban on access tiering in his presentation but, when answering a question from the audience, conceded that he would accept a weak ban on access tiering in which a network operator would be allowed to charge content providers for prioritization under the condition that the network operator did not price discriminate within a category of similar content providers").

141 *See* 47 U.S.C. § 211; *see generally* Report & Order, *Competition in the Interstate Interexchange Marketplace*, 6 FCC Rcd 5880 (1991).

five years. Second, as we discuss in Section III, such needless intervention in broadband networks would not only violate the congressional mandate for deregulation, but *affirmatively harm* consumer welfare by, among other things, creating grave regulatory uncertainty, chilling investment incentives, and exacerbating the digital divide.

II. COMPETITION PRECLUDES ANY NEED FOR PREEMPTIVE REGULATION OF BUSINESS-TO-BUSINESS QOS RELATIONSHIPS.

Both of the nondiscrimination proposals discussed above presuppose that there is some *need* for regulatory intervention—and, in particular, that there is some competitive problem to be fixed in the market for broadband Internet access. That is wrong in two respects, discussed in turn below. First, as the Commission has repeatedly found, broadband providers face substantial competition in the provision of broadband services to consumers, and those consumers can vote with their feet if broadband providers act against their interests. Second, there is also substantial competition (from CDNs and others) for the provision of performance-enhancement services to *applications and content providers*. Broadband providers could only increase market efficiency—and promote consumer welfare—by offering their own performance-enhancing solutions on competitive terms with the CDNs and P2P services that already provide them. In short, as in other competitive markets, consumer interests are best served not by regulation, but by the free play of market forces, subject only to *ex post* intervention in the event of a market failure.[142]

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[142] *See, e.g.*, Mem. Op. and Order, *Petition for Forbearance of the Verizon Telephone Cos. Pursuant to 47 U.S.C. 160(c)*, 19 FCC Rcd. 21,496, ¶ 24 ("[C]ompetition . . . ensur[es] just, reasonable, and nondiscriminatory charges and practices for broadband services."); Mem. Op. and Order, *Petition of U S WEST Communications, Inc. for a Declaratory Ruling Regarding the Provision of National Directory Assistance*, 14 FCC Rcd 16252, ¶ 31 (1999) ("[C]ompetition is the most effective means of ensuring that . . . charges, practices, classifications, and regulations

A. Competition in the Provision of Broadband Services to Consumers Obviates Any Need for Regulation.

The basic premise of all net neutrality proposals is that the Commission and the courts have been wrong in determining, in multiple recent orders, that the broadband market is sufficiently competitive that regulation would serve no valid purpose (and could cause much needless harm). But the Commission has no basis for reversing course on that fundamental issue.

Largely because of the Commission's own hands-off policy, the Internet access market is now characterized by fierce intermodal competition, the emergence of "new entrants using new technologies," and "increasingly faster service at the same or even lower retail prices."[143] As the Commission explained in its 2005 *Wireline Broadband Order*, given this "strong and increasing" competition in the broadband access market,[144] it no longer makes sense to subject wireline

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. . . are just and reasonable."); First Report and Order, *Access Charge Reform*, 12 FCC Rcd 15982, 16094 ¶ 263 (1997) ("Competitive markets are superior mechanisms for protecting consumers by ensuring that goods and services are provided to consumers in the most efficient manner possible and at prices that reflect the cost of production."); Yoo, *Mandating Broadband Network Neutrality*, *supra*, at 67 ("Once a sufficient number of alternative last-mile providers exist, the danger of anticompetitive effects disappears, as any attempt to use an exclusivity arrangement to harm competition will simply induce consumers to obtain their services from another last-mile provider.").

143 *Fourth 706 Report*, at 20552; *see also* Remarks of FCC Chairman Kevin J. Martin, US Telecoms 2006 Symposium, Dec. 6, 2006, at 1-2 (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-268845A1.pdf) ("[T]he Commission has worked hard to create a regulatory environment that promotes broadband deployment. We have removed legacy regulations, like tariffs and price controls, that discourage carriers from investing in their broadband networks . . . . We have begun to see some success as a result of the Commission's policies."); Address of Commissioner Robert M. McDowell, Broadband Policy Summit III, June 7, 2007, at 15 (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-273742A1.pdf) ("I have great faith that, in the next few years, we will witness a tremendous explosion of entrepreneurial brilliance when it comes to broadband, if the government doesn't micromanage.").

144 *AT&T-BellSouth Merger Order*, ¶ 117.

broadband access to the vestigial economic regulation it adopted decades ago, when the rate-regulated telephone network was the sole means of access to information services. Regulation of any provider in this highly "dynamic" market would be perverse because "a wide variety of competitive and potentially competitive providers and offerings are emerging," and "[t]hese emerging broadband platforms exert competitive pressure" on cable modem and wireline broadband providers to keep prices low and service quality high.[145] The Commission added that such regulation would harm consumers far more than it could possibly help them because it would needlessly suppress incentives for innovation and investment.[146] And less than six months ago, the Commission reaffirmed that "competition for mass market high-speed Internet access services" is "strong and increasing," and this "competition limits the ability of providers to engage in anticompetitive conduct[.]"[147]

The Commission is hardly alone in drawing these conclusions. The Supreme Court and the D.C. Circuit have consistently agreed that the broadband Internet access market is now so competitive that economic regulation would be not only unnecessary, but affirmatively counterproductive. For example, in *National Cable & Telecommunications Ass'n v. Brand-X Internet Services*, the Supreme Court affirmed the Commission's finding that "'robust competition . . . in the broadband market'" over "multiple electronic platforms, including

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145 *Wireline Broadband Order* ¶¶ 50, 58; *see also id.*, Statement of Chairman Martin, at 1 ("the broadband Internet access market today is characterized by multiple platforms that are vigorously competing for customers").

146 *Id.* at ¶¶ 19, 44.

147 *AT&T-BellSouth Merger Order*, ¶ 117; *see also Adelphia Transaction Order*, ¶¶ 217-18 (finding that "competition among providers of broadband service is vigorous" and "cable modem service and DSL service are facing emerging competition from deployments of cellular, WiFi, and WiMAX-based competitors, and [BPL] providers").

wireline, cable, terrestrial wireless and satellite," justifies the conclusion that "broadband services should exist in a minimal regulatory environment that promotes investment and innovation in a competitive market."[148] Likewise, in *Earthlink v. FCC*, the D.C. Circuit endorsed the Commission's findings that "[t]he broadband market is still an emerging and changing market" characterized by "actual and potential . . . competition" among intermodal competitors, and that "[a]nti-competitive coordination among competitors is difficult in such markets."[149] And in *United States Telecom Ass'n v. FCC*, the D.C. Circuit affirmed the Commission's elimination of line-sharing obligations on the ground that "intermodal competition . . . ensures the persistence of substantial competition in broadband."[150]

But if any lingering doubt remained about the wisdom of the Commission's "hands-off" approach to the Internet, the marketplace has put it to rest. In the wake of the Commission's decisions to cabin off broadband Internet access services from legacy economic regulation, broadband providers have been competing vigorously to deploy new broadband services. While initial broadband network deployments fostered cable-telco competition in the provision of broadband Internet access services, these new broadband platforms are now enabling cable companies to add voice services to their product mix at the same time telephone companies are beginning to offer video services of their own. Thus, not only do consumers benefit from the ability to purchase a "triple play" of voice, video and Internet services from a single provider at a bundled discount, but they also benefit from triple competition: head-to-head cable-telco

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148 125 S. Ct. 2688, 2711 (2005) (citing *United States Telecom Ass'n v. FCC*, 290 F.3d 415, 428 (D.C. Cir. 2002)) (some internal quotation marks and citations omitted).

149 462 F.3d 1, 11-12 (D.C. Cir. 2006) (upholding decision to forbear from application of Section 271 unbundling obligations to broadband elements).

150 359 F.3d 554, 585 (D.C. Cir. 2004).

competition across three different services. On top of that, cable companies are now offering mobile wireless services in a concerted effort to market the "quadruple play"—voice, video, Internet, and wireless—in direct competition with the leading telco providers.[151]

Aside from delivering direct consumer benefits, this head-to-head competition is also spurring job-producing economic growth. As explained in a recent press account from San Francisco, "rivals Comcast Corp. and AT&T Inc. are on a Bay Area-wide hiring binge as they battle each other and roll out new products in an effort to come out on top in an industry where customer service will be a key deciding factor."[152] According to the report, Comcast "is adding 400 jobs over the next three months to help roll out its bundled product offering of cable TV, high-speed Internet and phone service," while AT&T "has hired almost 200 employees" since the beginning of the year to deploy its U-verse IPTV service and plans to "hire another 100 employees through May and hundreds more by year's end as part of its efforts to expand U-verse TV."[153]

While this vigorous cable-telco rivalry is certainly beneficial to consumers and the economy, it is only the beginning of the competitive story in the broadband marketplace. A variety of intermodal broadband providers are vigorously competing today for subscribers. AT&T, Verizon, and Sprint have all invested heavily to deploy nationwide 3G wireless

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151 *See* Ryan Kim, *Triple play not enough? Say hey to quad play*, San Fran. Chron., at C1 (May 28, 2007); Bob Keefe, *Cable TV looks for new ways to move onto rivals' turf*, Atlanta J.-Const., at B1 (May 10, 2007); *Time Warner makes wireless launch*, San Antonio Express-News (Apr. 24, 2007); Jason Gertzen, *Telecom giants roll out service; Sprint and Time Warner team up*, Kansas City Star, at D8 (Apr. 23, 2007).

152 Eve Mitchell, "Rivals AT&T and Comcast adding jobs, battling for customers," Insidebayarea.com (Apr. 20, 2007).

153 *Id*.

broadband Internet access services, while T-Mobile spent over $4 billion in the Commission's recent auction of spectrum for Advanced Wireless Services (AWS) and plans to begin offering 3G services in 2007.[154] In fact, the number of mobile wireless broadband lines in the U.S. more than tripled during the first six months of 2006, and now tops 11 million lines according the Commission's most recent data.[155]

These 3G networks, however, are not the only wireless broadband option for consumers. Sprint, for example, is deploying a "fourth-generation ('4G') nationwide broadband mobile network, using its 2.5 GHz spectrum holdings and the mobile WiMAX technology standard."[156] Relying on this network, Sprint will be able to "provide customers with high-quality, visual-centric, and interactive applications and content, with speeds of 2 to 4 Mbps."[157] Sprint intends to begin deploying its 4G WiMAX service by late 2007 and expects to be capable of serving 100 million consumers by 2008.[158] Clearwire, another provider of WiMAX-based broadband services, already offers service in 38 markets covering more than 9 million people in 400 municipalities from Florida to Alaska, and estimates that it could commercially launch its service over spectrum covering 117 million people and potentially far more as spectrally efficient technologies continue to be developed.[159]

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154 *See* CTIA Comments, WC Docket No. 07-45, at 4-8 (May 16, 2007); Verizon Comments, WC Docket No. 07-45, at 15-17 (May 16, 2007); FCC AWS auction results at http://wireless.fcc.gov/auctions/66/charts/ 66press_3.pdf.

155 *June 2006 High-Speed Status Report* at Table 1.

156 Sprint Nextel Comments, WC Docket No. 07-45, at 8 (May 16, 2007).

157 *Id.*

158 *Id.*

159 Clearwire Comments, WC Docket No. 07-45, at 3, 5 (May 16, 2007).

In addition to the deployment of Wi-MAX, Wi-Fi hot spots continue to proliferate across the U.S. with the financial backing of EarthLink, T-Mobile, Google, and other companies, including AT&T, as well as a growing number of municipalities.[160] There are now approximately 50,000 U.S. Wi-Fi hot spots, accounting for more than one-third of all hot spots on the planet.[161] At the same time, the U.S. broadband market is served by three separate satellite broadband providers: WildBlue, HughesNet, and Starband, who were collectively serving almost 500,000 subscribers as of June 2006.[162] Broadband over powerline (BPL) is currently offered in several markets around the country, and a leading industry analyst predicts that as many as 2.5 million U.S. households will subscribe to BPL service by 2011.[163]

All of this competition has resulted in lower prices and more value for broadband consumers. According to a report by the Pew Internet and American Life Project, the average price of broadband Internet access service dropped $3 to $36 from February 2004 to December 2005, with average DSL Internet access prices dropping by twice that amount over the same period.[164] When viewed over a longer period, these price reductions have been even more

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160 *See* "EarthLink lands largest municipal Wi-Fi network deal," *Atlanta Bus. Chron.* (Apr. 13, 2007); T-Mobile HotSpot at http://hotspot.t-mobile.com/; What is Google WiFi? at http://wifi.google.com/support/bin/answer.py?answer=44967&topic=9087; Jon Van, "Wi-Fi fight in Chicago air; Earthlink, AT&T want to provide wireless Internet," *Chic. Trib.*, at C1 (Apr. 20, 2007).

161 *See* Verizon Comments, WC Docket No. 07-45, at 19 (May 16, 2007).

162 *June 2006 High-Speed Status Report* at Table 1.

163 *Growth of Broadband over Power Line to outpace Cable and DSL*, Parks Associates (Jan. 18, 2007) (http://www.metrics2.com/blog/2007/01/19/growth_of_broadband_over_power_line_to_outpace_cab.html).

164 *Home Broadband Adoption 2006*, Pew Internet & American Life Project at iv (May 28, 2006) (*Pew Broadband Report*) (http://www.pewinternet.org/pdfs/PIP_Broadband_trends2006.pdf).

significant. For example, one prominent market analyst reports that average DSL prices have fallen by approximately 30 percent from 2002 to 2006.[165] In fact, since 2003, when net neutrality advocates first began clamoring for Internet regulation, AT&T has lowered the monthly price of its 1.5 Mbps DSL service from $49.95 to $19.99.[166]

At the same time prices have been coming down, speeds have been going up. For example, just four years ago, AT&T's then-fastest residential DSL service (up to 1.5 Mbps) cost $49.95 per month. Today, AT&T offers DSL service with speeds up to 6 Mbps at a monthly rate of $34.99 – four times the top speed for 30 percent less money.[167] To stay competitive, the cable companies have substantially increased the speeds of their cable modem services while generally holding cable modem prices steady over the last several years. Leading cable companies now offer speeds ranging from 5 to 16 Mbps, with some offering capabilities reaching to 50 Mbps.[168]

These facts speak for themselves. They demonstrate, contrary to net neutrality rhetoric, that the broadband marketplace is robustly competitive and that the Commission's well-established policy of Internet unregulation is serving consumers well.

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165 *See* Verizon Comments, WC Docket No 07-45 (filed May 16) (citing *Broadband Update: "Value Share" and "Subscriber Share,"* C. Moffet, Bernstein Research (April 21, 2006)).

166 This service, which provides speeds up to 1.5 Mbps, was formerly offered by SBC Communications Inc.

167 *See* http://www.att.com/gen/general?pid=6431. Of course, broadband prices will undoubtedly fluctuate over time (both upwards and downwards) as broadband providers continually refine their products and pricing strategies to offer greater value to consumers. But there can be no mistake about the overall pricing trends: consumers are receiving more value at lower prices as the result of intense competition in the deregulated broadband marketplace.

168 NCTA Comments, WC Docket No. 07-45, at 8 (May 16, 2007).

B. Competition in the Provision of Performance-Enhancing Services to Applications and Content Providers Obviates Any Need for Regulation.

While robust competition for broadband subscribers itself provides a complete check against potential anticompetitive conduct, it is not the only check. Applications and content providers already have significant competitive options when they negotiate for performance-enhancing services, as illustrated by the explosive growth of CDNs.[169] That additional competition is all the more reason why net neutrality regulation is unnecessary and ill-advised.

Ultimately, the question presented here is whether broadband providers will be *free to compete* with CDNs, P2P networks, and others in the provision of performance-enhancing services to those applications and content providers.[170] From a consumer's perspective, the latency- and jitter-reducing effects of those services will appear similar to the performance-enhancing services that applications providers already obtain from CDNs like Akamai and Limelight; the question is who can provide them more efficiently for any given application.[171]

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169 *See* pp. 14-20, *supra.*

170 *See, e.g.*, note 110, *supra* (discussing distribution relationships content providers have begun striking with P2P providers like BitTorrent).

171 *See, e.g.*, Kevin Wehrbach, *Only Connect*, at 19 (Feb. 2007 Draft) (http://papers.ssrn.com/sol3/ papers.cfm?abstract_id=964991) (explaining that a CDN's services may affect an end user's Internet experience more than the end user's own ISP or backbone provider). Of course, different access networks may strike different deals with the same applications providers, and the differences in those deals may have distinct effects in the experiences of subscribers to those different networks. As we have discussed, however, that diversity is to be desired: product differentiation increases consumer welfare, and it is preferable to the one-size-fits-all agenda proposed by net neutrality advocates. *See* Benjamin E. Hermalin & Michael L. Katz, *The Economics of Product-Line Restrictions with an Application to the Network Neutrality Debate*, Competition Policy Center (2006) (http://repositories.cdlib.org/iber/cpc/CPC06-059) (*"Economics of Product-Line Restrictions"*); Christopher S. Yoo, *Beyond Network Neutrality*, 19 Harv. J. L. & Tech. 1 (2005); Christopher Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition? A Comment on the End-to-End Debate*, 3 J. Telecomm. & High Tech. L. 23 (2004).

Additional competition for the provision of such enhancements can only make the Internet more efficient—and more pro-consumer.

It is important at the outset to clear up a basic confusion that net neutrality advocates have introduced on this topic. They claim that broadband providers must be treated differently from CDNs, and must be restricted in their provision of these performance enhancements, on the theory that broadband providers, unlike CDNs, can keep disfavored data from ever reaching end users at all.[172] That argument is specious. In its *Broadband Policy Statement*, the Commission has already embraced the industry's consensus against anticompetitive blocking or degradation.[173] The issue here is not whether the Commission should adopt rules implementing that consensus. No major U.S. broadband provider has ever violated it, and *ex post* remedies are more than adequate to deal with any aberrations.[174] Instead, net neutrality advocates ask the Commission to add a fifth, *provider*-centric "non-discrimination" principle to the four *consumer*-oriented principles of the *Policy Statement*. That new principle would focus on business-to-business relationships, and it would specifically limit the ability of access networks to sell performance-enhancing services to content and applications providers.

The question, then, is whether allowing access networks to sell such services to applications and content providers would promote or hinder efficient competition. That question

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[172] *See* note 138, *supra*.

[173] Policy Statement, *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, 20 FCC Rcd 14986, ¶¶ 4, 5 n.15 (2005) (*"Broadband Policy Statement"*). Moreover, in conjunction with the AT&T-BellSouth merger proceeding, AT&T expressly committed that it would abide by these four principles and also agreed not to sell or provide certain services to Internet content, application or service providers for the duration of its two-year commitment. *See AT&T-BellSouth Merger Order*, Appx. F, at 5814-15.

[174] *See* Section II.C, *infra.*

answers itself. As we have discussed, there are a number of distinct network-management techniques available to help providers make the most efficient use of finite network resources in a world of increasing congestion and service-specific performance demands. Firms like Akamai and Limelight help applications providers accomplish that goal through one set of techniques: the use of global CDNs to cache data and avoid an unpredictable multiple-hop journey across several different networks. Those techniques are designed to, and do in fact, give a competitive advantage to the applications providers who pay for these services; all others must contend with the congestion. Google and Amazon.com own CDNs of their own and use them to perform essentially the same functions—except that, because those companies are vertically integrated, they use their CDNs primarily to advantage their own applications and content. There is nothing wrong with the competitive advantages that CDN-equipped companies provide to others or themselves. In general, well-functioning capital markets will support the ability of an applications provider to build for itself, or to buy from others, whatever cost-efficient performance enhancements consumers demand for the applications and content they value.

But the performance-enhancement techniques offered by CDNs are not the only means, and are not invariably the most efficient means, of accomplishing these pro-consumer objectives. As discussed, access and backbone networks may offer alternative techniques for ensuring that, despite increasing traffic loads, applications providers can deliver the service quality that customers demand.[175] Depending on the circumstances, those techniques could be used in conjunction with CDN services or instead of them, and ultimately the market will choose which techniques best meet consumer needs. If an access network can ensure service quality for a

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[175] *See* pp. 41-46, *supra.*

given application more efficiently than a CDN provider could, the access network will be able to undersell the CDN provider when offering its services to applications providers. In that event, applications providers will be able to pass the savings along to their customers in the form of lower prices and better services.

In short, greater competition for the provision of business-to-business performance-enhancement services, offered by a greater diversity of networks using a wide array of technologies, could only help consumers. Of course, CDNs and CDN-equipped applications and content providers would thrive best in a world where access networks are quarantined from providing those services, and where applications and content providers have few alternatives to CDNs for the delivery of high-quality services to consumers. But the business interests of those providers are no proxy for the interests of *consumers*. In the absence of a demonstrated market failure, consumers benefit from competition, not artificial regulatory constraints on competition. As the Commission has noted many times, its "statutory duty is to protect efficient competition, not competitors."[176]

C. Vertical Integration Creates No Need for Prophylactic Regulation.

Some advocates claim that net neutrality rules are necessary on the theory that, whenever broadband providers vertically integrate with content and applications providers, they will have special incentives to disadvantage rival content and applications providers.[177] But there is neither a theoretical nor an empirical basis for that conclusion. First, this concern about vertical integration, which hearkens back to some of the most irrational regulation of the mid-twentieth

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176 *AT&T-BellSouth Merger Order*, at ¶ 195 (citation omitted).

177 *See, e.g.*, Lawrence Lessig, *The Future of Ideas: The Fate of the Commons in a Connected World* 46-47 (2001).

century, overlooks 40 years of economic scholarship demonstrating that vertical integration produces important pro-consumer efficiencies and that, except in well-defined circumstances, vertically integrated companies generally have no greater incentive to engage in welfare-reducing anticompetitive conduct than non-vertically integrated companies.[178] Here, as the Commission has explained, robust broadband competition keeps any individual provider from sabotaging the value of its broadband platform to consumers by degrading the complementary applications that ride on top of it.[179] That competition is a complete answer to any "vertical leveraging" concern.

Second, even if there were some competitive defect in the broadband platform market—and the Commission's own orders foreclose that conclusion—there would still be no basis for concern that a vertically integrated broadband provider would act anticompetitively towards unaffiliated applications and content providers. Modern antitrust analysis recognizes that, except in very specific contexts, even a *monopolist* in a platform market generally has no incentive to act anticompetitively towards unaffiliated applications providers that wish to use its platform. In particular, a platform provider free from retail price regulation—as all broadband providers are today—will normally have incentives to deal evenhandedly with independent providers of complementary applications, because discrimination in the applications market would simply

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178 *See, e.g.*, Richard A. Posner, Antitrust Law 223-29 (2d ed. 2001); Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 Geo. L.J. 1847, 1885-87 (2006); Christopher S. Yoo, *Vertical Integration and Media Regulation in the New Economy*, 19 Yale J. on Reg. 171 (2002); *see generally* Herbert Hovenkamp, *Antitrust After Chicago*, 84 Mich. L. Rev. 213, 255-83 (1985).

179 *See, e.g.*, *AT&T-BellSouth Merger Order*, at ¶¶ 116-20; *Adelphia Transaction Order*, at ¶¶ 212-23; *see also Wireline Broadband Order*, at ¶¶ 61-64; Yoo, *Comment on the End-to-End Debate*, *supra*, 3 J. TELECOM. & HIGH TECH. L. at 67.

devalue the platform and, as a general matter, would not enable the provider to earn any profits it could not otherwise earn for the underlying platform itself.[180]

This point underscores a key distinction between the market conditions accompanying the 1984 break-up of the Bell System and today's market conditions. Quite apart from the radically greater *competition* in today's marketplace, which *independently* guards against anticompetitive conduct, the Bell System was subject to price regulation in the platform market (local telephone service). Thus, under an economic principle known as "Baxter's Law," the Bell System had every incentive to earn supracompetitive profits by excluding rivals in adjacent applications markets (such as long distance).[181] Baxter's Law has no application here because broadband providers are free from price regulation—and thus have no incentive to degrade the value of their platforms by harming providers of applications that could make those platforms more valuable to consumers.[182]

The ten-year history of residential broadband service in the United States confirms what economic theory would suggest. The only documented occasion in which a broadband provider appears to have acted anticompetitively against an unaffiliated applications provider involved the brief efforts of a small rural carrier—Madison River Communications—to block the ports its

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[180] *See, e.g.*, Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85, 104 (2003) ("*Modularity*"); *see also* Yoo, *Network Neutrality and the Economics of Congestion*, *supra*, 94 Geo. L.J. at 1888-89.

[181] Farrell & Weiser, *Modularity*, *supra*, at 105-07.

[182] Some net neutrality advocates have argued that, under certain conditions, wireline broadband providers may have incentives to discriminate against VoIP providers in order to protect their underlying wireline platform. That concern, however, is far-fetched—both because broadband competition keeps wireline providers from acting on any such alleged incentives and because antitrust and other *ex ante* enforcement remedies are more than adequate to protect against such conduct, as the Madison River case amply illustrates.

customers used for VoIP calls. Madison River promptly ended that practice and submitted to a consent decree after the Commission opened an investigation.[183] That there has been only one such episode in the long history of U.S. broadband Internet access confirms what common sense suggests: broadband providers are exceedingly unlikely to devalue their Internet platforms by anticompetitively degrading access to unaffiliated Internet applications and content.[184] In addition, the prompt resolution of the Madison River episode confirms that any future incidents of this type can be addressed through *ex post* enforcement actions without recourse to intrusive *ex ante* regulation.

The Organisation of Economic Co-operation and Development, an international agency representing thirty member nations, endorsed this *ex post* enforcement approach in a recent report on the topic of net neutrality. As it explained, "[t]here is little evidence of anti-competitive conduct to date and problems have typically been resolved quickly via market forces or through quick regulatory intervention in markets where they have appeared."[185] Thus, the OECD concluded, it would be "premature for governments to become involved at the level of network-to-network traffic exchange and demand neutral packet treatment for content

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183 *See* Order, *Madison River Communications LLC*, 20 FCC Rcd 4295 (2005). For an analysis of the Madison River case and its implications for the broader net neutrality debate, *see* Sidak, *Consumer-Welfare Approach*, *supra*, at 416-22.

184 *See generally* Tr. of Open Commission Meeting, Mar. 22, 2007 (http://www.fcc.gov/realaudio/mt032207.ram) (exchange between Commissioner McDowell and Wireline Competition Bureau Chief Tom Navin concerning this proceeding) (Commissioner McDowell: "[T]o the best of your knowledge, since the Madison River case and the adoption of the FCC's net neutrality principals, have any complaints, formal or informal, been filed with the Commission under the net neutrality umbrella?" Mr. Navin: "Not that we are aware. Indeed, *I think that is what made writing the NOI so difficult, is the lack of real world problems to base the NOI on*.") (emphasis added).

185 OECD Report, *Internet Traffic Prioritisation: An overview*, at 5 (Apr. 6, 2007) (http://www.oecd.org/dataoecd/43/63/38405781.pdf).

providers."[186] Similarly, in two recent merger orders, this Commission found that, in light of the strength of broadband competition, there is no "evidence that [given broadband providers] are likely to discriminate against Internet content, services, or applications," and that government intervention in the market would be premature unless and until "affected parties . . . file a complaint with the Commission" alleging specific market failures.[187] Even Google's Vint Cerf, a key net neutrality proponent, has acknowledged that, if the government rejects calls for preemptive rules, "we will be less happy, but then we will have to wait and see *whether or not there actually is any abuse*. . . . [W]e will simply have to wait until something bad happens, and then we will make known our case to the Department of Justice's antitrust division."[188]

Finally, whenever regulators *have* taken preemptive steps to address "vertical leveraging" concerns in recent years, the concerns turned out to have been false alarms. In the AOL/Time Warner merger, for example, the Commission imposed various interoperability requirements on the "next-generation" applications of AOL's instant messaging technology because of fears that AOL would dominate the underlying instant messaging market.[189] A few years later, the FCC found that *removing* these pointless rules had become necessary to "provide public interest benefits" by "enhancing competition" and thus "accelerat[ing] the pace of innovation for IM

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186 *Id.*

187 *Adelphia Transaction Order*, ¶ 220; *accord AT&T-BellSouth Merger Order*, *supra*, at ¶ 118.

188 Reuters, *Google says bill could spark antitrust battle*, *supra* (emphasis added).

189 *See* Mem. Op. and Order, *Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations by Time Warner Inc. and America Online, Inc., Transferors, to AOL Time Warner Inc., Transferee*, 16 FCC Rcd 6547, 6679 ¶ 325 (2001).

services."[190] In some cases, preemptive "safeguards" against vertical leveraging have turned out to be not just needless, but also anticompetitive. In the 1990s, for example, the Commission adopted so many prophylactic restrictions on video dialtone services that telephone companies never offered them at all.[191] In the end, consumers were far worse off for the lack of additional competition. The Commission should take pains to avoid a similar outcome here.

III. NET NEUTRALITY REGULATION WOULD HARM CONSUMERS.

For the reasons discussed above, there is no potential upside to net neutrality regulation. Such regulation, moreover, carries a tremendous downside: it could devastate consumer welfare.

A. Economic Regulation Would Deter Broadband Entry And Exacerbate The Digital Divide.

As discussed above, the explicit agenda of many net neutrality proposals is to commoditize broadband networks—to conform them, in Lawrence Lessig's words, to the same "end-to-end" design principle as the "electricity grid," which is ignorant of, and indifferent to, the appliances plugged into it.[192] This analogy is inapt because (among many other considerations) the electricity grid was built largely by regulated monopolies that were entitled to retail rates reflecting a reasonable return on their investments.[193] No one is promising broadband

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190 Mem. Op. and Order, *Petition of AOL Time Warner Inc. for Relief From the Condition Restricting Streaming Video AIHS*, 18 FCC Rcd 16835, 16839-40 ¶ 12 (2003) ("*AOL Time Warner Interoperability Relief*").

191 *See, e.g.*, Thomas W. Hazlett & George Bittlingmayer, *The Political Economy of Cable "Open Access,"* AEI-Brookings Joint Center, at 35-36 (2003) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=286652#PaperDownload).

192 Lawrence Lessig, *The Future of Ideas*, *supra*, at 39; *see also* Wu-Lessig 2003 *Ex Parte* Letter at 3.

193 *See generally* W. Kip Viscusi, John M. Vernon, & Joseph E. Harrington, Jr., *Economics of Regulation and Antitrust* 361-94 (3d ed. 2000).

companies a return on their multi-billion-dollar next-generation broadband infrastructure investments.[194] Indeed, as Wall Street is quick to add, these investments are high-risk, existential gambles.[195]

By commoditizing access services—by forcing each network to resemble the others as much as possible—net neutrality regulation would deprive these investment gambles of their economic logic.[196] Access networks would still face a serious downside risk of stranded investment, but regulation would also deny them the upside potential of the healthy margins that firms can earn in non-commoditized markets characterized by product differentiation.[197] Asking any firm, whether an incumbent or a would-be entrant, to risk its financial future under those regulatory conditions would be like asking ordinary investors to purchase bonds with low yields but a substantial risk of default. Bond investors would find a better use for their money, and so would prospective builders of competitive broadband networks.

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194 *See, e.g.*, Report and Order, *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, 18 FCC Rcd 16,978, ¶ 243 (2003) (noting that "[u]pgrading telecommunications loop plant" to facilitate broadband Internet access is a "costly, complex, and risky endeavor"), *aff'd in relevant part, United States Telecom Ass'n v. FCC*, 359 F.3d 554 (D.C. Cir. 2004); *see also Wireline Broadband Order*, ¶ 72.

195 *See* p. 30-31, *supra* (discussing investors' negative reactions to Verizon's and Comcast's capital expenditures).

196 *See, e.g.*, William J. Baumol, Martin Cave, Peter Cramton, Robert Hahn, Thomas W. Hazlett, Paul L. Joskow, Alfred E. Kahn, Robert Litan, John Mayo, Patrick A. Messerlin, Bruce M. Owen, Robert S. Pindyck, Scott J. Savage, Vernon L. Smith, Scott Wallsten, Leonard Waverman, and Lawrence J. White, *Economists' Statement on Network Neutrality Policy*, AEI-Brookings Joint Center, at 1 (2007) (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=976889#PaperDownload) ("introducing price regulation risks discouraging the healthy process of risk-taking innovation—which is especially important in telecommunications").

197 *See, e.g.*, Hermalin & Katz, *Economics of Product-Line Restrictions*, *supra*; Yoo, *Beyond Network Neutrality*, *supra*; Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition?*, *supra*.

Moreover, this forced commoditization would not only chill investment incentives, but deny consumers the economic value they would otherwise derive from product differentiation. Consumers benefit from product diversity in any market, from cars to breakfast cereals.[198] The Internet access market is no different. As David Farber and Michael Katz have explained, "Blocking premium pricing in the name of neutrality might have the unintended effect of blocking the premium services from which customers would benefit. No one would propose that the U.S. Postal Service be prohibited from [charging more for] Express Mail because a 'fast lane' mail service is 'undemocratic.' Yet some current proposals would do exactly this for Internet services."[199] And as Christopher Yoo observes, permitting such product differentiation is the most effective way for policymakers to keep the broadband access market "from devolving into [a] natural monopol[y]."[200] By forcing the standardization of such networks, net neutrality proposals merely increase the risk of excessive concentration in the access market.

In short, the interventionist commoditization agenda of net neutrality advocates would nip broadband investments in the bud. In this respect, the "nondiscrimination" principle that net neutrality advocates wish to add to the Policy Statement would thwart the fourth, consumer-oriented principle already in that Policy Statement: "To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are

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198 *See* William J. Baumol & Alan S. Blinder, *Economics: Principles and Policy* 248-52 (8th ed. 2000) (discussing consumer benefits of "monopolistic competition").

199 Farber & Katz, *Hold Off on Net Neutrality*, *supra*, at A19.

200 Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition?*, *supra*, at 61; *see also* Hermalin & Katz, *Economics of Product-Line Restrictions*, *supra*.

entitled to competition among network providers, application and service providers, and content providers."[201]

Finally, it would be especially perverse for the Commission to choose net neutrality regulation over investment incentives while, at the same time, professing the much more legitimate goal of bridging the "digital divide" by encouraging broadband deployment in underserved communities. The Commission should have no illusions about this fundamental trade-off. Net neutrality regulation would chill infrastructure deployment in areas that need it the most, and, as discussed in the next subsection, it would also price many consumers out of the broadband market even where infrastructure is deployed. As former Chairman William Kennard observes, "[p]olicymakers should rise above the net neutrality debate and focus on what America truly requires from the Internet: getting affordable broadband access to those who need it."[202]

B. Net Neutrality Proposals Would Harm Consumers by Arbitrarily Forcing Them Alone to Underwrite the Costs of the Network Upgrades Needed for Bandwidth-Intensive Applications.

Quite apart from its chilling effect on investment incentives, net neutrality regulation would harm consumers and exacerbate the digital divide in another respect as well. By prohibiting broadband providers from entering into agreements for enhanced service quality with applications providers, the net neutrality agenda would require broadband providers to recover *from consumers alone* all of the network costs of accommodating bandwidth-intensive applications. This is a most peculiar policy choice for a movement that describes itself as pro-consumer. Forcing broadband providers to recover those network costs from consumers—and

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201 *See Broadband Policy Statement*, *supra*, at ¶ 4 (emphasis omitted).

202 Kennard, *Spreading the Broadband Revolution*, *supra*, at A13.

none from the providers of the applications that cause those costs in the first place—would raise broadband rates, depress broadband subscribership, and introduce radical inefficiencies into the Internet marketplace.

Like credit card companies and travel agents, broadband providers operate in a classic "two-sided" marketplace. "The owner of a broadband network . . . needs content providers to supply content and applications on the Internet, and it also needs end-users to demand access to the Internet content. In this way, a network operator can be considered an intermediary who brings together two parties (the end-user and the content provider) to an exchange that occurs over the Internet."[203] And, like any other participant in a two-sided market, broadband providers must look to one side—or both—for cost-recovery. Different two-sided industries feature a wide variety of efficient cost-recovery schemes, hammered out through the free play of market forces. For example, newspapers and magazines recover their costs in part from subscribers (through subscription fees) but also from advertisers who pay for ad space. Credit card companies recover their costs in part from their customers (in the form of various fees and interest charges) but also from merchants in the form of percentage-based fees for each purchase. An intermediary's choice of cost-recovery models in a two-sided market turns on the most efficient means of "maximiz[ing] the appeal and use of the product to both groups of customers."[204]

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[203] Sidak, *Consumer-Welfare Approach*, *supra*, at 361; *see also* Muris, FTC Statement, *supra*, at 21 ("Broadband is a classic example of what economists call a two-sided industry. To exist, a two-sided product must appeal to two distinct sets of customers, and the value of the system to one group of customers is largely a function of its attractiveness to the other group. In the broadband industry, providers must create a platform that is attractive to both consumers of Internet access and Internet content providers."); George Ford, Thomas Koutsky & Lawrence Spiwak, *Network Neutrality and Foreclosing Market Exchange: A Transaction Cost Analysis*, Phoenix Center Policy Paper No. 28, at 7 (Mar. 2007).

[204] Muris, FTC Statement, *supra*, at 22.

Today, many broadband providers recover essentially all of the costs of access networks from fees imposed on subscribers. But this traditional cost-recovery model will become increasingly unsustainable as networks invest billions to accommodate the network demands imposed specifically by bandwidth-intensive applications and content that are used extensively by limited subsets of subscribers.[205] Ultimately, this proceeding comes down to whether the providers of applications and content—providers who cause a large share of access network costs—can persuade the government to displace market forces and obligate consumers to continue bearing all such costs no matter what the inefficiency or unfairness of that result.[206]

That would be the very *worst* policy decision the Commission could make during this critical period in the Internet's evolution. First, compelled adherence to the consumer-pays-all model championed by major applications providers would obviously subject consumers to higher broadband rates than they would pay if broadband providers could recover some of the costs of

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[205] Yankee Group, for example, estimates that the "top 5% of users account for roughly 50% of all downstream traffic" on the Internet. Vorhaus, *Confronting the Albatross*, *supra*, at 1. Nonetheless, under today's prevailing rate structure, two end users with equivalent broadband connections pay the same amount in monthly fees even if one of them imposes a far greater proportion of peak load on the network and is much more likely to use applications requiring performance guarantees.

[206] *See* Muris, FTC Statement, *supra*, at 23 ("As is often the case in two-sided industries, consumers and content providers have conflicting interests. As much as possible, content providers would like consumers to pay the full cost of building out last mile access through higher service fees. Consumers, on the other hand, want the Internet to shift toward the model more traditionally associated with advertising sponsored media such as the radio, television, and newspaper industries. That is, consumers would like content providers to invest some of their rapidly increasing advertising revenue for the infrastructure to allow consumers to receive next generation service over the same pipes and through the same basic interfaces that they use to send e-mail.").

bandwidth-intensive applications from the providers of those applications.[207] That policy would artificially depress broadband subscribership on the margins, particularly among consumers who would prefer to pay low rates simply for basic broadband connectivity and do not wish to use QoS-needy, bandwidth-intensive applications in the first place. Worse yet, a compelled consumer-pays-all rule would depress broadband subscribership most in those low-income communities where consumers are most sensitive to variations in price.[208] In this respect as well, the net neutrality agenda is at war with the Commission's objective of bridging the digital divide. As one NAACP official explains:

> Given the proven impact of broadband prices on its adoption, policies that increase the cost to users should be forbidden. Now, some well-intentioned online activists are pushing regulations called "net neutrality," which would keep costs low for the large Internet content companies but shift the costs of network expansion mostly to consumers. *The effects could be disastrous for low-income and minority communities, pricing them out of the broadband market[.]*[209]

Broadband providers could not avoid these regulatory obstacles to rational cost-recovery simply by supplementing traditional flat-rated subscriber fees with more QoS-sensitive rate

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[207] *See, e.g.*, Sidak, *Consumer-Welfare Approach*, *supra*, at 458 ("if network operators were free to contract for priority delivery with content providers, content providers would be forced to absorb some portion of the cost of prioritization"—with a corresponding increase in consumer surplus); Stephen B. Pociask, *Net Neutrality and Effects on Consumers*, American Consumer Institute, at 2 (2007) ("*Effects on Consumers*") (http://www.theamericanconsumer.org/ACI%20NN%20Final.pdf) ("[R]estrictions on multi-sided market pricing would mean that consumers lose $69 billion in potential benefits over the next 10 years. In effect, net neutrality regulations would require consumers to pay all of the upgrade costs of the next generation Internet and prohibit voluntary commercial agreements that would lower consumer broadband prices.").

[208] Pociask, *Effects on Consumers*, *supra*, at 2 ("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.").

[209] Greg Moore, *Extend Internet's Full Reach to Black Communities*, Asbury Park Press, May 11, 2007 (http://www.app.com/apps/pbcs.dll/article?AID=/20070511/OPINION/705110384/1030) (emphasis added).

structures that, in whole or in part, charge *subscribers* by application type or by specific QoS parameters. Consumers value simplicity in service plans, and to honor that preference, broadband providers can realistically offer and bill for only a limited range of service options. In contrast, the proliferation of latency-sensitive, high-bandwidth applications will require highly context-specific engineering judgments about (i) the precise QoS needs of each such application and (ii) which network techniques will provide the most efficient solution for those needs. Applications and content providers are uniquely positioned to address those highly technical questions about their own applications and content, and they alone can negotiate efficient, highly customized QoS arrangements with broadband network providers. Broadband network providers could not similarly negotiate efficient fee-based arrangements with millions of *end users* for the provision of customized QoS enhancements for the thousands of different types of applications and content that will need such enhancements.[210]

Thus, if broadband providers were precluded from dealing with applications providers and forced to recover all of their costs solely from end users, the likely result would be an unsatisfactory one-size-fits-all policy of "blended QoS" for all applications or, at best, a very limited range of options. That result would manage at once to "harm end-users of content providers that require enhanced QoS (by reducing the quality of QoS-needy applications)" and also "harm end-users . . . that do *not* value [QoS-needy applications] (by increasing the price of an unnecessary component [of their broadband service])."[211]

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[210] *See* Sidak, *Consumer Welfare Approach*, *supra*, at 452 ("If a network operator were free to contract with content providers for priority delivery, the transaction costs of reaching fee arrangements would be much lower than if the same network operator were constrained to negotiate only with individual end users.").

[211] Litan & Singer, *Unintended Consequences*, *supra*, at 30 (emphasis added).

In short, if policymakers want market forces to produce top-quality next-generation IP applications without pricing ordinary consumers out of the broadband market, they must give networks the flexibility they need to negotiate commercial agreements with content and applications providers. The biggest mistake the Commission could make at this stage in the Internet's development is to preempt the market from reaching that efficient, pro-consumer outcome by forcing broadband providers to recover all of their costs from consumers alone.

C. Common-Carrier Regulation of Business-to-Business Performance Enhancement Arrangements Would Be Anachronistic, Inefficient, and Legally Unjustifiable.

For the reasons stated, consumer harms would accompany any significant restriction on the ability of broadband providers to enter into business-to-business agreements for service quality enhancement with applications providers. Nonetheless, "[w]hen confronted with the pitfalls" of a flat ban on performance enhancement agreements between broadband networks and providers of applications and content, some "[p]roponents of network neutrality regulation" advance an alternative regulatory model under which "a network operator would be allowed to charge content providers for prioritization under the condition that the network operator did not price discriminate within a category of similar content providers."[212] This alternative version of net neutrality would subject broadband providers to a nondiscrimination regime similar to the one imposed on "common carriers" by Section 202 of the Communications Act.[213] As such, it

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212 Sidak, *Consumer-Welfare Approach*, *supra*, at 426-27.

213 Although net neutrality advocates sometimes suggest otherwise, "discrimination"—*i.e.*, offering the same service to different buyers on different terms for reasons unrelated to cost—is not inherently bad; indeed, it is often welfare-maximizing. *See, e.g.*, Baumol & Blinder, *Economics*, *supra*, at 239-42; *see also Sidak*, *Consumer-Welfare Approach*, *supra*, at 358 & n.9 (discussing "Ramsey pricing" scholarship). Thus, even regulatory schemes designed for *monopoly markets* typically forbid not "discrimination" as such, but only "unjust or unreasonable

would subject the Internet to the type of common-carrier nondiscrimination rule developed for the railroad monopolies of the nineteenth century and the static telephone industry of the 1930s.

Such regulation would be not only needless, for the reasons discussed in Section II above, but affirmatively harmful to consumer interests. Indeed, the Commission has already so found. In the *Wireline Broadband Order*, the Commission built on the free-market policies it had previously adopted in the cable modem context and concluded that continued application of common carrier regulation to *any* broadband access providers would serve no purpose beyond the destruction of healthy investment incentives.[214] The Commission thus categorically exempted those providers from the "nondiscrimination" rules that it had imposed, in the *Computer Inquiry* proceedings decades before, to govern the dealings of wireline carriers with unaffiliated providers of information services. Having reached those conclusions and taken those deregulatory steps, the Commission could not sensibly resurrect the same type of common carrier regulation here. Since (as the Commission rightly determined) it serves the public interest to allow a broadband access network provider to negotiate a network-access deal on an individualized basis with particular ISPs, it also serves the public interest to allow such a

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discrimination." *E.g.*, 47 U.S.C. § 202. Moreover, as competition has emerged, regulators have taken an ever-narrower view of what it means for discrimination to be "unjust or unreasonable." For example, wireless telephony providers are technically subject to the ban on "unjust or unreasonable discrimination" found in Section 202 of the Communications Act, but they may sell the same service package to different customers at different prices depending on the outcome of individualized negotiations. *See Orloff v. FCC*, 352 F.3d 415, 420 (D.C. Cir. 2003), *aff'g Orloff v. Vodafone AirTouch Licenses LLC d/b/a Verizon Wireless*, 17 FCC Rcd 8987 (2002); *see also* AT&T Comments, RM-11361 (Apr. 30, 2007); AT&T Reply Comments, RM-11361 (May 15, 2007). Here, given that Congress subjected telephone *monopolies* of the 1930s only to a restriction on "unjust or unreasonable" discrimination, it would be absurd to straitjacket today's competitive broadband networks with a rigid ban on all "discrimination" among their business partners, even when such discrimination is just, reasonable, and pro-consumer.

214 *See e.g.*, *Wireline Broadband Order*, ¶¶ 19, 44; *see generally* pp. 49-50, *supra*.

network to negotiate individualized commercial agreements with particular applications and content providers.

Indeed, the Commission would lack even the *legal authority* to adopt nondiscrimination rules for the Internet. Since the Commission has rightly concluded that broadband Internet access is an "information service" exempt from Title II regulation, the Commission would have to adopt any nondiscrimination rules under its "ancillary" Title I authority to regulate interstate communications.[215] But courts have consistently invalidated the Commission's invocation of Title I authority to adopt rules that are in significant tension with substantive principles embodied elsewhere in the Communications Act or in the Constitution.[216] Here, as the Commission itself has found, common carrier economic regulation of access networks would chill "deployment and innovation" and would thus contradict "Congress' clear and express policy goal [in Section 706] of ensuring broadband deployment, and its directive that we remove barriers to that deployment[.]"[217] It would also contradict Congress's stated intent in Section 230(b)(2) to keep the Internet "unfettered by Federal or State regulation."[218]

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215 *See generally Wireline Broadband Order*, ¶¶ 103-06.

216 *See, e.g., FCC v. Midwest Video Corp.*, 440 U.S. 689, 700-09 (1979) (invalidating FCC attempt to impose on cable companies under Title I the type of common carrier regulation that the Act would prohibit if the regulated parties had been broadcasters rather than cable companies); *Motion Picture Ass'n of Am. v. FCC*, 309 F.3d 796 (D.C. Cir. 2002) (invalidating FCC invocation of Title I to impose constitutionally problematic "video description" rules).

217 *Wireline Broadband Order*, ¶ 44; *see also id.* at ¶¶ 19, 65-73.

218 47 U.S.C. § 230(b)(2). It would further violate the First Amendment right of network owners to use the Internet as they see fit to promote content and applications to their subscribers. *See, e.g., Miami Herald Pub. Co. v. Tornillo*, 418 U.S. 241 (1974); *see generally Turner B'casting Sys. Inc. v. FCC*, 512 U.S. 622, 661-68 (1994).

Quite apart from these legal considerations, common carrier regulation simply has no place on the Internet. Such regulation might have made sense for static, highly regulated industries such as the railroad industry of 1887, for which Congress wrote the Interstate Commerce Act—the eventual model for the Communications Act of 1934. And it might have made sense for the highly static telephone business of 1934. In those days, the Bell System had a vertically integrated monopoly over local and long distance services and telephone equipment manufacturing. Even fifty years later, at the time of its break-up, the Bell System still owned the overwhelming majority of the nation's telephone lines, faced essentially no competition in its local exchange markets (often because it held de jure exclusive franchises), dominated the national long distance market, and ran almost the entire equipment manufacturing industry as well.

Since then, however, "the telecoms industry has changed out of all recognition, transformed by a cornucopia of new technologies beyond mere telephone calls, and a herd of robust new competitors."[219] In the Internet ecosystem, technological change is rapid and unpredictable; competitive entry is constant; and new alliances arise each day to satisfy evolving customer needs. It would make no more sense to apply "nondiscrimination" rules to this competitive free-for-all than to apply such rules to, say, the relationships between computer chip manufacturers and the developers of operating systems, or between those operating system developers and the developers of applications software; or between supermarket chains and their suppliers. In all of these contexts, regulatory intervention is inappropriate because market forces

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[219] *Telecoms mergers: Healthy network effects*, The Economist, May 7, 2005, at 53.

are the best guardians of consumer welfare, and the antitrust laws are available to correct any market failures if and when they arise.[220]

In *this* context, moreover, any "nondiscrimination" mandate would have especially pernicious effects. First, the genius of the Internet lies in its free-wheeling experimentation with new business ideas and one-off strategic alliances. Nondiscrimination rules are, by their nature, designed for more static regulatory environments in which business plans change less rapidly and fast-paced experimentation is less critical to the success of the industry. If applied to the Internet, they would deter such experimentation by magnifying the downside risk of business misjudgments. A firm would be less likely to try out new services or speculative business alliances if, upon discovering that they are unprofitable, it nonetheless remains bound to offer the same services to additional buyers or to enter into similar alliances with other companies on the same terms. In short, the "in for one, in for all" ethic of common carrier regulation is anathema to the creative dynamic of customization at the heart of the Internet's success.[221]

Second, any nondiscrimination mandate would usher in a new era of debilitating regulatory uncertainty in the Internet marketplace, as lawyers slog through years of litigation about how to construe that mandate in innumerable settings. No matter how promptly the Commission tried to address those disputes, it would always lag behind the industry's own evolution, because the regulatory process is inherently too slow to explicate a

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220 *See* note 142, *supra*.

221 *See, e.g., Wireline Broadband Order*, ¶ 19 ("[F]ast-paced technological changes and new consumer demands are causing a rapid evolution in the marketplace for [broadband Internet access] services. Wireline broadband carriers are constrained in their ability to respond to these changes in an efficient, effective, or timely manner as a result of the limitations imposed by [nondiscrimination] obligations.").

"nondiscrimination" principle for fast-evolving Internet technologies and business models. A nondiscrimination regime would likewise require the Commission to resolve conceptually intractable disputes about how to distinguish true "discrimination" from aggressive but pro-consumer behavior, mere incidents of poor service quality, or simple misunderstandings.[222] As one network scholar observes, "Net neutrality regulation, even if justified, will inevitably lead to some difficult line-drawing. . . . Anti-discrimination rules can be hard to write, and hard to enforce."[223]

If the Commission nonetheless ventured into these uncharted waters, its "difficult line-drawing" would inevitably produce "false positives"—an antitrust term for subtly erroneous decisions that hold firms liable for engaging in types of aggressive conduct that may seem anticompetitive at first blush but, on balance, actually improve consumer welfare.[224] The chief danger of false positives is that they will chill precisely the type of aggressively competitive

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[222] For example, net neutrality bloggers recently posted intemperate accusations that Comcast had blocked access to video service provider Joost—until Joost acknowledged that the service problem was its own. *See* Chloe Albanesius, "Joost Accepts Blame for Outages," PC Magazine, Apr. 19, 2007.

[223] Edward Felten, *Nuts and Bolts of Network Neutrality*, at 6 (July 6, 2006) (http://itpolicy.princeton.edu/pub/neutrality.pdf) (formatting altered); *see also id.* at 5 (suggesting that regulators would find it difficult to "distinguish [an anticompetitive] strategem from the case of fair and justified engineering decisions that happen to cause a little temporary jitter"); *Keep it simple*, The Economist, at 57, Mar. 11, 2006 ("Ensuring 'neutrality' could require regulators to interpose themselves in all kinds of agreements between network operators, content providers and consumers. If a network link is too slow to support a particular service, does that constitute a breach of neutrality?").

[224] Baumol & Blinder, *Economics*, *supra*, at 425-26 ("One problem that haunts most antitrust litigation . . . is that vigorous competition may look very similar to acts that *undermine* competition and support monopoly power. The resulting danger is that the courts will prohibit, or the antitrust authorities will prosecute, acts that *appear* to be anticompetitive but that really are the opposite. The difficulty is that effective competition by a firm is always tough on its rivals."); *see also Spectrum Sports, Inc. v. McQuillan*, 506 U.S. 447, 458-59 (1993).

behavior on which any healthy free-market economy is based. And that is a special concern for the Internet. If the Commission adopts preemptive regulation in the absence of a demonstrated problem, the result would be to cause IP networks, for the first time, to err on the side of caution and conservatism in designing competitive business plans, all to the detriment of their consumers. That should not be this Commission's legacy.

IV. IF THE COMMISSION WERE TO ADOPT A NONDISCRIMINATION PRINCIPLE FOR THE BROADBAND INDUSTRY (AND IT SHOULD NOT), THAT PRINCIPLE WOULD HAVE TO EXTEND TO *ALL* PROVIDERS OF IP-BASED SERVICES, APPLICATIONS, CONTENT, AND NETWORKS.

If, despite the foregoing considerations, the Commission were to pursue the net neutrality agenda by subjecting access or backbone networks to a nondiscrimination principle, it could not stop there. Logical consistency would require the Commission to extend that same nondiscrimination obligation to every other Internet company that exerts structural influence on whether the Internet will treat applications and content "neutrally." Indeed, the Commission's existing fourth broadband principle already entitles consumers "to competition *among network providers, application and service providers, and content providers.*"[225] Thus, there could be no rational basis to exclude any of these providers from a fifth principle of nondiscrimination.

First, the Commission would need to apply nondiscrimination obligations to CDNs like Akamai and Limelight and to vertically integrated CDN-equipped applications providers like Google and Amazon.com. CDNs are in the business of ensuring that, from the end user's perspective, the Internet does *not* treat all applications, services and content the same as any other. At that, CDNs are tremendously successful. The preference they confer on some packets over others can affect an end user's experience of the Internet as much as, if not more than, any

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225 *Broadband Policy Statement*, *supra*, at ¶ 4 (emphasis added).

performance-enhancing services offered by traditional access or backbone networks.[226] There could thus be no logical basis for subjecting such networks, but not CDNs, to common carrier nondiscrimination regulation. For similar reasons, the Commission would also need to start regulating P2P technologies like BitTorrent, which enable some applications and content to consume network capacity at the expense of other applications and content, and the use of transmission protocols like UDP that give some packets priority over those that use the more "polite" TCP protocol.[227]

Second, if the Commission decided to start regulating the Internet, it would likewise need to apply nondiscrimination obligations to Internet search engines and their associated advertising placement services. More than any other feature of the Internet, search engines—and specifically Google's—affect where end users go on-line and which Internet sites will succeed and which will fail.[228] If the government's role is to ensure neutral treatment for all applications, content, and services, the case for regulatory intervention is much stronger for the search market than for the more competitive broadband access market.

In fact, the search market is so concentrated that some have deemed it "a natural monopoly."[229] According to one survey, Google accounted for nearly two-thirds of Internet

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226 *See* pp. 14-20, *supra*.

227 *See* pp. 23-26, *supra*.

228 *See* John Batelle, *The Search: How Google and Its Rivals Rewrote the Rules of Business and Transformed Our Culture* (2005).

229 James B. Stewart, *Google Is Best-Positioned to Dominate Online Ads*, SmartMoney.com (May 22, 2007) (http://www.smartmoney.com/commonsense/index.cfm?story=20070522&hpadref=1) ("[S]urely the jury is now in on the fundamental question about Google's search business: It is a natural monopoly.").

searches in April 2007,[230] and its market share is *growing*, despite the best efforts of prodigiously funded rivals like Microsoft to compete:

> Google continues to grow at the expense of its competitors. . . . Microsoft, in particular, has to be shaking its head. The company has been aggressively pursuing the web search market, completely revamping what is now known simply as Live Search. No matter what Microsoft does when it comes to search, it seems that Google has an answer and *the bigger Google gets, the harder it will be for the competition to close the gap*.[231]

As a result, "eager advertisers shoveled some $10.6 billion into Google's coffers last year, up an astonishing 73% from 2005."[232] Google now hopes to consolidate that success still further by persuading antitrust authorities to approve its $3.1 billion merger with rival on-line advertising firm DoubleClick.[233]

Google's advantage is highly entrenched because few, if any, rivals could match its physical infrastructure. Google owns "a staggering collection of hardware, whose constituent servers number 450,000, according to the lowest estimate,"[234] combined with a fiber-optic transmission network "so massive that several service provider specialists believe it could end up with one of the world's largest core transport networks, effectively building its own private

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230 Hitwise US—Leading Search Engines (Apr. 2007) (http://www.hitwise.com/datacenter/searchengineanalysis.php).

231 Eric Bangeman, *Microsoft, others suffer as Google's web search share grows,* Ars Technica (Feb. 28, 2007) (http://arstechnica.com/news.ars/post/20070228-8946.html).

232 Rob Hof, *Is Google Too Powerful? As the Web giant tears through media, software, and telecom, rivals fear its growing influence*, BusinessWeek, Apr. 9, 2007 (http://www.businessweek.com/magazine/content/07_15/b4029001.htm).

233 *See* Catherine Holahan, *Google's DoubleClick Strategic Move: With its $3.1 billion acquisition, the Internet giant secures entry into the promising business of display advertising and thwarts Microsoft in online search*, BusinessWeek, Apr. 14, 2007 (http://www.businessweek.com/print/technology/content/apr2007/tc20070414_675511.htm).

234 Gilder, *The Information Factories*, *supra*.

Internet" and "controlling distribution of much of the world's Internet traffic."[235] "By building its own infrastructure rather than relying on commercial data centers, [Google CEO Eric] Schmidt told analysts in May, Google gets 'tremendous competitive advantage.'"[236] With a market capitalization of more than $150 billion and the most valuable brand in the world,[237] Google now uses that "tremendous competitive advantage" not just to dominate rivals in its core search business, but to "storm a wide range of markets"—including, with its recent purchase of YouTube, streaming video. Indeed, a growing number of industry analysts are now convinced that "the vast commercial landscape of the Net, like so many other tech markets in the past," may "condense to one dominant force for the foreseeable future"—Google.[238]

These concerns have led some advocates of net neutrality regulation to begin calling for "search neutrality" rules as well:

> Let's take a closer look at Google itself, and the potential for losing what I call search neutrality—which could happen if search-engine companies gain the ability to control results. If Google became a monopoly, what would prevent it from corrupting search results for its own benefit? I hear about how Google is "not evil," but that's today. Things change. . . . With an entire Web-universe structured to rely on a limited number of search engines, when does corruption sneak into the equation, and what do you do about it?[239]

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235 Raynovich, *Google's Own Private Internet*, *supra*.

236 Gilder, *The Information Factories*, *supra.*

237 *Google beats Microsoft, Coke in brand stakes*, CNET News.com (Apr. 23, 2007) ("Google has knocked Microsoft off the top spot and been named the most powerful global brand of 2007 in a recently published brand ranking.").

238 Hof, *Is Google Too Powerful?*, *supra.*

239 John C. Dvorak, *A Threat to Web Search*, PCMag.com (Jan. 1, 2007) (http://www.pcmag.com/print_article2/0,1217,a=198269,00.asp).

Leading net neutrality proponent Timothy Wu has likewise suggested a possible need for preemptive regulations to "block discrimination by powerful applications providers."[240] In short, if the Commission were to conclude that preemptive "nondiscrimination" regulation is needed to ensure "neutrality" on the Internet, it would need to start with Google, which influences what people see and do on the Internet far more than any access or backbone network does.

In fact, given the Commission's goal, expressed in its fourth broadband principle, to promote competition among providers of IP-based networks, applications, services and content, it would be entirely arbitrary for the Commission not to exercise its Title I authority to subject Google to any new fifth principle of nondiscrimination. The information services offered by Google—particularly its advertising-based or "paid" search services—play a key role in shaping not just competition among the myriad entities engaged in e-commerce over the Internet, but also competition among *ideas*. Google's auction-based approach to the placement of ads on a page of search results gives priority placement to advertisers (*i.e.*, relevant websites with commercial, political, religious, social or other purposes) who can afford to pay the highest price. If the Commission ultimately concludes that a principle of nondiscrimination is necessary to foster competition on the Internet, it could not rationally exempt Google's search services from that principle.

Moreover, the Commission would have at least as strong a jurisdictional argument for imposing such regulation on the information services offered by Google as on the information services (Internet access) offered by broadband networks. In the *Pulver Order*, the Commission explained that it has Title I authority to regulate information services—even when the provider

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[240] Timothy Wu, *Why Have a Telecommunications Law? Anti-Discrimination Norms in Communications*, 5 J. Telecomm. & High Tech. L. 15, 46 (2006).

of those services does *not* provide transmission capability to its end users.[241] Thus, the Commission declared that Pulver's Free World Dialup service is "subject to the Commission's jurisdiction" even though "Pulver does not offer transmission to its members."[242] That same jurisdictional conclusion applies with at least equal force to Google's search services—indeed, with more force, given Google's use of a massive proprietary CDN in the delivery of its services.

Of course, AT&T does not actually advocate that any Internet participant (including Google) be subject to nondiscrimination obligations in the first place. As we have explained, the Internet has succeeded precisely because the government has kept information services free from regulation since the beginning. Our central point is that the Commission could not responsibly consider imposing "nondiscrimination" obligations on access or backbone networks but not on companies like Google and many others that exert equivalent or greater structural influences on the capabilities and performance of the Internet.

Just as important, the Commission should resist the call to focus myopically on the narrow role that access or backbone networks play within the Internet ecosystem. The Internet is the product of a vast, interrelated set of agreements among many thousands of Internet-based companies about how best to produce consumer value. The question for policymakers is not whether any given agreement is "nondiscriminatory," but whether the Internet ecosystem as a whole—the composite result of those innumerable agreements—is functioning properly in the best interests of consumers.

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241 *See pulver.com Petition Order*, ¶ 14. ("The Commission has never required or even suggested that the information service provider must be the entity that provides or offers the telecommunications over which the information service is made available to its members."); *see also id.*, ¶ 11 n.37, ¶ 18 n.64, ¶ 19 n.69 (2004).

242 *Id.* at ¶¶ 14, 26.

More generally, there is no reason to believe that, as the Internet evolves, compensation will flow only in one direction, from applications and content providers to network providers. To the contrary, it will likely flow in both directions, as consumer preferences and rapidly changing business models dictate. In the television industry, for example, companies that own the rights to programming (such as broadcasters and ESPN) often obtain substantial consideration from multi-channel video programming distributors (such as Comcast and DirecTV) for the right to show that programming.[243] The Internet could well evolve to a similar model.

In fact, it has already started. The most prominent example to date is "ESPN 360," a "robust, multi-feature broadband service, free to fans that get high-speed broadband service *from an ESPN-affiliated provider*."[244] An access network can become "an ESPN-affiliated provider," however, only by paying a fee for the privilege; otherwise, ESPN blocks the content. Customers of access networks that choose not to pay that fee are greeted with a short streaming-video teaser of coming attractions, interrupted by the announcement: "We're sorry, but you don't have access to ESPN 360. Please contact your Internet service provider, and ask them to partner with ESPN 360." Disney (which owns ESPN) calculates that competition among access networks will force many of them to pay the fee, because consumers of access networks that Disney has

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[243] *See, e.g.*, *Retransmission Consent and Exclusivity Rules: Report to Congress Pursuant to Section 208 of the Satellite Home Viewer Extension and Reauthorization Act of 2004*, ¶ 10 (2005) (http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260936A1.pdf); Second Report and Order, *Implementation of Sections of the Cable Television Consumer Protection and Competition Act of 1992: Leased Commercial Access*, 12 FCC Rcd 5267, ¶ 13 (1997), *aff'd sub nom. ValueVision International, Inc. v. FCC*, 149 F.3d 1204 (D.C. Cir. 1998); *see also* Ted Hearn, *NAB Chief Forecasts Cash for Retrans*, Multichannel News, May 1, 2006 (http://www.multichannel.com/index.asp?layout=articlePrint&articleID=CA6329716).

[244] *See* http://broadband.espn.go.com/espn360/ (emphasis added).

blocked from viewing ESPN 360 will often switch to alternative access networks that Disney has not blocked.[245] Disney's approach may work—and other content providers may likewise conclude that their consumer appeal gives them comparable leverage in negotiations with providers of access networks. Net neutrality proposals, however, propose an asymmetrical regime in which the access networks subject to such blocking are heavily regulated in their dealings with content providers, but the content providers that do the blocking are altogether unregulated. That regime would be absurd and would patently violate the Commission's fourth broadband principle of fostering competition "among" providers of networks, applications, services and content.[246]

In summary: The Internet's business-to-business relationships are dynamic, creative, and unpredictable. They have created the modern Internet and, in the process, have generated unprecedented consumer value. They will continue to serve consumers well so long as the Commission adheres to Congress's mandate to keep the Internet "unfettered by Federal or State regulation."[247]

CONCLUSION

The Commission should reject proposals for "net neutrality" obligations and keep the Internet unregulated.

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[245] For example, Verizon has paid the fee and "carries [ESPN 360] because the company believes it helps them stand out from the competition. 'It is sort of like an arms race' right now in the video-online world, said Bill Heilig, Verizon's executive director for portal and content services." Eric Bangeman, *ESPN charging ISPs to carry ESPN360*, Ars Technica (Aug. 1, 2006) (http://arstechnica.com/news.ars/post/20060801-7397.html).

[246] *Broadband Policy Statement*, *supra*, at ¶ 4.

[247] 47 U.S.C. § 230(b)(2).

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