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Network Neutrality and the Economics of Congestion

CHRISTOPHER S. YOO*

ABSTRACT

The Supreme Court's Brand X *decision has reignited the debate over "network neutrality," which would limit broadband networks' authority to impose restrictions on end users' ability to access content, run applications, and attach devices and to charge content and application providers higher prices for higher levels of quality of service. In this Article, Professor Christopher Yoo draws on the economics of congestion to propose a new analytical framework for assessing such restrictions. He concludes that when transaction costs render metering network-usage uneconomical, imposing restrictions on bandwidth-intensive activities may well enhance economic welfare by preventing high-volume users from imposing uncompensated costs on low-volume users. Usage of bandwidth-intensive services can thus serve as a useful proxy for congestion externalities just as port usage served as a proxy for consumption of lighthouse services in Coase's classic critique of the economic parable of the lighthouse. In addition, content delivery networks and other commercial caching systems represent still another innovative way to manage the problems associated with congestion and latency that would be foreclosed by network neutrality. Furthermore, allowing network owners to differentiate their services can serve as a form of price discrimination that can mitigate the sources of market failure that require regulatory intervention in the first place. This framework suggests that broadband policy would be better served by embracing a* network diversity *principle that would eschew a one-size-fits-all approach and would allow network providers to experiment with different institutional forms until it can be shown that a particular practice is harming competition. At most, concerns that telephone companies may prevent end users from using their digital subscriber line (DSL) connections to access Voice over Internet Protocol (VoIP) provide support for targeted regulatory intervention. They do not justify a blanket prohibition of end user restrictions that network neutrality proponents envision.*

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* Visiting Professor of Law, University of Pennsylvania Law School; Professor of Law, Vanderbilt University. © 2006, Christopher S. Yoo. This Article benefited from workshops conducted at the 33rd Telecommunications Policy Research Conference; the Wharton Colloquium on Media and Communications Law; the Entertainment, Media, and Cultural Policy Colloquium at the UCLA School of Law; and an ad hoc workshop at the University of Pennsylvania Law School, as well as from comments from Gerry Faulhaber, Bob Rasmussen, and Mike Vandenbergh. After the research underlying this Article was substantially complete, I was retained by the National Cable and Telecommunications Association (NCTA) to consult on matters related to issues discussed in this Article. The views expressed herein are my own and should not be attributed to NCTA.

INTRODUCTION

During the Internet's initial, narrowband phase of development, Internet Service Providers (ISPs) pursued a variety of architectural approaches. Some ISPs, such as CompuServe, Prodigy, and America Online, initially adopted relatively restrictive policies, which only provided end users with access to proprietary applications and content and charged them for network usage on a per-minute basis.[1] Others followed a more permissive approach, opening up their networks to all content and applications providers on a nondiscriminatory basis and allowing end users to download any content, run any application, and attach any device for a flat monthly fee. The latter approach ultimately proved more attractive to consumers, and end users became accustomed to a world in which they faced few restrictions either on the ways they could use their network connections or on the amount of bandwidth they consumed.

This same debate has resurfaced as the Internet has begun to migrate from a narrowband to a broadband architecture, which in the residential and small-business markets is provided primarily by cable modem systems and a telephone-based technology known as digital subscriber lines (DSL).[2] Once again, network owners have begun to experiment with more restrictive approaches. With respect to end users, some network owners have begun to offer bandwidth tiers to end users, in which the amount that customers pay varies with the amount of bandwidth with which they are provided.[3] Others have placed restrictions on end users' latitude to run certain applications or attach certain devices.[4] Still others have considered alternative pricing relationships with respect to content

1. *See* Stuart Minor Benjamin, *Spectrum Abundance and the Choice Between Private and Public Control*, 78 N.Y.U. L. REV. 2007, 2087 (2003); James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms*, 17 YALE J. ON REG. 39, 86 (2000).

2. *See* Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, 18 F.C.C.R. 16978, 17015–17 ¶¶ 51–52 (2003). In contrast, large business customers tend to obtain broadband services through high-volume technologies that are quite distinct from those used by residential and small customers. *See id.* at 17013–15 ¶¶ 46–49, 17061–63 ¶¶ 123–129.

3. *See, e.g.*, AT&T Yahoo! High Speed Internet, https://swot.sbc.com/swot/dslMassMarketCatalog.do?do=view&serviceType=DYNAMICIP (offering DSL at various speeds at six different price points ranging from $12.99 per month to $69.99 per month).

4. The most systematic review of these types of restrictions is Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. ON TELECOMM. & HIGH TECH. L. 141, 158–62, 173–74 (2003). For less comprehensive surveys, see LAWRENCE LESSIG, THE FUTURE OF IDEAS 156–58 (2002); François Bar et al., *Access and Innovation Policy for the Third-Generation Internet*, 24 TELECOMM. POL'Y 489, 509–14

and applications providers, under which transmission speed would depend on the tier of service purchased.[5]

These developments touched off a paroxysm of criticism from content providers and device manufacturers,[6] academics,[7] and public interest groups.[8] Although the details of the various proposals vary, they all fit comfortably under the rubric of "network neutrality," in that they all call for regulatory limitations on network owners' ability to discriminate against particular content, applications, and devices.

This debate has begun to influence policymaking. A recent policy statement issued by the Federal Communications Commission (FCC) endorsed a version of network neutrality,[9] albeit subject to some caveats.[10] Network neutrality has also influenced the recent Verizon-MCI and SBC-AT&T mergers[11] and has played a key role in shaping congressional debates about telecommunications

(2000); Jerome H. Saltzer, "Open Access" is Just the Tip of the Iceberg (Oct. 22, 1999) (unpublished manuscript, *available at* http://web.mit.edu/Saltzer/www/publications/openaccess.html).

5. *See, e.g.*, David Ho, *Varying Fees for Access to the Net a Possibility: Issue May Be Forced as Traffic Jumps*, ATLANTA J.-CONST., Mar. 18, 2006, at F3.

6. *See Ex parte* Communication from the Coalition of Broadband Users and Innovators at 3–4 (Jan. 8, 2003), Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Declaratory Ruling and Notice of Proposed Rulemaking, 17 F.C.C.R. 4798 (2002) (CS Dkt. No. 02-52), *available at* http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513401671 [hereinafter CBUI *Ex parte*]; Comments of the High Tech Broadband Coalition at 6–13 (June 17, 2002), Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Declaratory Ruling and Notice of Proposed Rulemaking, 17 F.C.C.R. 4798 (2002) (CS Dkt. No. 02-52), *available at* http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513198026 [hereinafter HTBC Comments].

7. *See* LESSIG, *supra* note 4, at 26–48, 147–76, 246–49; Bar et al., *supra* note 4, at 510; Wu, *supra* note 4, at 165; *Ex parte* Letter of Timothy Wu and Lawrence Lessig at 12–15 (filed Aug. 22, 2003), Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Declaratory Ruling and Notice of Proposed Rulemaking, 17 F.C.C.R. 4798 (2002) (CS Dkt. No. 02–52), *available at* http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514683884 [hereinafter Wu & Lessig, *Ex parte*].

8. *See, e.g.*, John Windhausen, Jr., Good Fences Make Bad Broadband: Preserving an Open Internet Through Net Neutrality: A Public Knowledge White Paper (Feb. 6, 2006), *available* at http://static.publicknowledge.org/pdf/pk-net-neutrality-whitep-20060206.pdf; Letter from Jeannine Kenney (Consumers Union), Mark Cooper (Consumer Federation of America), Ben Scott (Free Press) & Harold Feld (Media Access Project) to Sen. Ron Wyden (Mar. 2, 2006), *available at* http://www.hearusnow.org/internet/24/; Center for Digital Democracy, Internet Under Attack: Act Now to Preserve the Public Internet, *available at* http://www.democraticmedia.org/getinvolved/NetNeutralityAction.html; Common Cause, Keep the Internet Free and Open: Take Action Now to Protect Network Neutrality, *available at* http://www.commoncause.org/site/pp.asp?c=dkLNK1MQIwG&b=1234951.

9. *See* Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Policy Statement, 20 F.C.C.R. 14986 (2005) [hereinafter Wireline Broadband Policy Statement].

10. *See infra* notes 51–52 and accompanying text.

11. *See* Verizon Communications, Inc. and MCI, Inc. Applications for Approval of Transfer of Control, Memorandum Opinion and Order, 20 F.C.C.R. 18433, 18437 ¶ 3, 18492 ¶ 109, 18509 ¶ 143, 18537 ¶ 221 (2005) [hereinafter Verizon-MCI Order]; SBC Communications, Inc. and AT&T Corp. Applications for Approval of Transfer of Control, Memorandum Opinion and Order, 20 F.C.C.R. 18290, 18293 ¶ 3, 18350–51 ¶ 108, 18368 ¶ 144, 18392 ¶ 211, app.F (2005) [hereinafter SBC-AT&T Order].

reform.[12] In the process, network neutrality has emerged as one of the hottest issues in communications policy. To date, the policy decision has been framed as a choice between universal interoperability, in which end users remain free to access content, run applications, and attach devices as they see fit, and a world of "walled gardens," in which the subscribers to any particular network will only be able to enjoy the benefits of a limited number of Internet-based services. Policymakers are urged to choose between these two options based on their prediction of which architectural approach would better promote social welfare.[13]

I believe that the current debate has framed the issues in too narrow a manner. The problem is that—as even network neutrality proponents concede—deviations from network neutrality may well be motivated by legitimate concerns about network management and that it can be difficult, if not impossible, for experts to predict which architectural approach will eventually prevail.[14] For example, as Lessig himself notes, the vast potential of the Internet was lost not only on incumbent network owners like AT&T, but also on almost every computer science expert presented with the concept of the World Wide Web.[15] The difficulty of predicting the future is demonstrated even more eloquently by the furor surrounding America Online's acquisition of Time Warner. Many experts warned that the merger would create an Internet juggernaut, in which the combination of America Online's Internet content with the transmission capabilities of Warner Cable would chill innovation and with which other providers would struggle to compete. Needless to say, these dire predictions failed to materialize, as the vertically integrated business model that America Online pursued with such confidence ultimately proved to be a colossal failure.[16] In the absence of some reason to believe that policymakers will be able to anticipate which architecture will ultimately emerge as optimal, mandating one architecture over another has the unfortunate effect of foreclosing exploration of the potential benefits of alternative approaches.

Fortunately, competition policy offers a middle ground that obviates the need for policymakers to make such judgments. If the choice between two architectural approaches is ambiguous, policymakers have the option of permitting both alternatives to go forward until a concrete harm to competition can be demonstrated. In other words, rather than mandating any particular architecture, policymakers can instead embrace a regime of *network diversity* that allows

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12. *See infra* notes 58–62 and accompanying text.

13. Since network neutrality proponents defend their proposals almost exclusively in terms of the economic benefits of innovation, this Article discusses the issues solely in economic terms. I therefore set aside for another day any discussion of noneconomic issues, such as network neutrality's implications for democratic deliberation or the First Amendment.

14. *See* LESSIG, *supra* note 4, at 46; Wu, *supra* note 4, at 143, 153–54; *cf.* Saltzer, *supra* note 4 (conceding that all such restrictions can be justified by a "technical excuse").

15. *See* LESSIG, *supra* note 4, at 31–33, 42–44.

16. *See* Susan P. Crawford, *Someone to Watch Over Me: Social Policies for the Internet* 15–18 (Cardozo Legal Studies Research Paper No. 129 2005), *available at* http://ssrn.com/abstract=796825.

network owners to pursue different strategies. Unless such experimentation poses potential harms that are catastrophic or irreversible, the emerging consensus argues against imposing proactive regulation on the basis of speculation about the likely impact on competition.[17]

This approach places regulators in a more restrained and humble position that is better suited to their institutional capabilities. Rather than asking them to determine which architectural design is likely to prove more socially beneficial, it asks them only to determine whether a plausible case can be made to justify each possible approach and whether allowing experimentation with each approach would pose potentially catastrophic or irreversible harms. This approach is more than just a question of which side bears the burden of proof.[18] Instead, it represents a true middle course that allows policymakers to avoid having to foreclose any particular alternative when confronted with a policy choice that is ambiguous.

Recast in this manner, the key regulatory question is whether the restrictions criticized by network neutrality proponents are so pernicious and unjustifiable that experimentation should not be permitted. An analysis of the economics of the Internet reveals the existence of a number of plausible arguments demonstrating that deviations from network neutrality might well enhance economic welfare.

The key to understanding why this might be the case is recognizing the fact that the Internet is subject to congestion. When networks are subject to congestion, one customer's usage of the network can degrade the quality of service that other customers receive. The primary finding of the literature on the economics of congestion is that competitive markets will reach an efficient equilibrium if each user is charged a usage-sensitive price set equal to their marginal contribution to congestion.[19] As a result, some commentators have argued in favor of shifting all Internet services to usage-sensitive pricing.[20] At the same time, flat-fee pricing has persisted for a wide range of other congestible resources, such as ski lifts and local telephone service. The persistence of these practices has led to the creation of a literature exploring the circumstances under which usage-sensitive pricing might prove uneconomic. The general thrust of this literature is that transaction costs associated with a usage-sensitive

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17. *See* CASS R. SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 58–61, 109–17 (2005); *see also* Benjamin, *supra* note 1.

18. *Cf.* Tim Wu, *The Broadband Debate, A User's Guide*, 3 J. ON TELECOMM. & HIGH TECH. L. 69, 91 (2004).

19. *See, e.g.*, Eitan Berglas, *On the Theory of Clubs*, 66 AM. ECON. REV. (PAPERS & PROC.) 116, 119 (1976).

20. *See* Jeffrey K. MacKie-Mason & Hal R. Varian, *Pricing Congestible Network Resources*, 13 IEEE J. ON SELECTED AREAS COMM. 1141 (1995), *available at* http://www-personal.umich.edu/jmm/papers/Pricing_Congestible_Resources.pdf; Wu, *supra* note 4, at 154; *cf.* J. Gregory Sidak & Daniel F. Spulber, *Cyberjam: The Law and Economics of Internet Congestion of the Telephone Network*, 21 HARV. J.L. & PUB. POL'Y 327 (1998) (arguing that the economics of congestion justified requiring Internet service providers to pay interstate access charges).

pricing system can consume all of the economic benefits associated with a shift to usage-based pricing. When that is the case, economic welfare would be better served if end users were charged flat rates instead of usage-sensitive prices.[21]

While the debate between flat-rate and usage-sensitive pricing is an important one, it is incomplete in that it frames the range of available pricing options too narrowly. Specifically, it overlooks the insight, derived from Ronald Coase's classic critique of the economic parable of the lighthouse,[22] that the high transaction costs associated with metered pricing can also be avoided by finding an alternative activity that can serve as a proxy for usage. If that alternative activity is easier to meter, it can provide a useful approximation of actual usage of the primary services.

Consideration of a broader range of institutional solutions to the pricing problem expands the policy space in important ways. It suggests that allowing broadband providers to impose restrictions on bandwidth-intensive end user activities could well represent a more cost-effective way to address the problems of congestion. In fact, the types of restrictions that cause network neutrality proponents the greatest concern are precisely the type of activities that tend to impose congestion costs on other users. Viewed from this perspective, bandwidth management and end user restrictions are just two points in a spectrum of alternative institutional approaches to solving the problems of network management.[23] I need not determine which of the many possible ways to manage congestion on the Internet will ultimately prove most economical. For our purposes, it suffices to acknowledge that the optimal solution might take on one of a range of institutional forms. The indeterminacy of the problem justifies adopting policies that do not foreclose network owners from experimenting with any particular institutional solution absent the demonstration of concrete competitive harm. Indeed, there is no reason to presume that the eventual solution will be uniform, and it is quite conceivable that different portions of the network might pursue different institutional solutions.

This analysis also suggests that prohibiting last-mile providers from deviating from network neutrality may actually harm consumers. Simply put, the current regime of flat-rate pricing and unrestricted access discourages innovation in

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21. *See* Robert J. Barro & Paul M. Romer, *Ski-Lift Pricing, with Applications to Labor and Other Markets*, 77 AM. ECON. REV. 875, 876–79 (1987); Robert W. Helsley & William C. Strange, *Exclusion and the Theory of Clubs*, 24 CANADIAN J. ECON. 888, 889, 895–96 (1991); Kangoh Lee, *Transaction Costs and Equilibrium Pricing of Congested Public Goods with Imperfect Information*, 45 J. PUB. ECON. 337, 340–43 (1991); *cf.* MacKie-Mason & Varian, *supra* note 20, at 1145 (exploring Internet pricing when transaction costs render usage-based pricing uneconomical). Barro and Romer did not initially frame their analysis in terms of congestion economics but later acknowledged the connection. *See* Robert J. Barro & Paul M. Romer, *Ski-Lift Pricing, with Applications to Labor and Other Markets: Reply*, 81 AM. ECON. REV. 378 (1991) (discussing congestion costs).

22. *See* R.H. Coase, *The Lighthouse in Economics*, 17 J.L. & ECON. 357 (1974), *reprinted in* FAMOUS FABLES IN ECONOMICS 32–48 (Daniel F. Spulber ed., 2002).

23. As a result, network neutrality does not represent a middle ground between structural regulation and deregulation, as some have suggested. *See* Wu, *supra* note 18, at 88–90. Instead, end user restrictions and network management are more properly regarded as two sides of the same coin.

network management. In the process, it allows high-volume users to impose costs on low-volume users, in effect requiring the latter to subsidize the former. Taking a broader vision of consumer welfare reveals that allowing network owners to place restrictions on high-bandwidth uses can benefit consumers by making possible new ways to manage network traffic and to force those who create the most congestion on the Internet to bear the costs they impose on others. Conversely, low-volume users may well benefit from such restrictions through increases in the quality of the service they receive and decreases in the prices they pay.[24] Indeed, the emergence of potentially beneficial practices, such as backbone peering, content delivery networks like Akamai, network-based spam filtering, and blocking websites known to be the source of viruses, attests to the extent to which the Internet is already far from "neutral."

On a more fundamental level, adoption of a more permissive approach to end user restrictions would parallel the shift in the vision of the ideal form of competition that has taken place under the antitrust laws. Prior to the mid-1970s, the Supreme Court took an extremely hostile view towards vertical integration that combined manufacturing and retail delivery under the same corporate umbrella, as well as vertical contractual arrangements (such as exclusive dealing contracts, long-term contracts, territorial exclusivity, and requirements contracts) that were tantamount to the same thing. Over time, the Court has become considerably more hospitable towards vertical integration, recognizing that vertical integration can represent an important means through which firms can minimize transaction costs. In the process, the Court rejected categorical prohibitions in favor of a more nuanced approach that evaluates the competitive impact of vertical integration and vertical contractual restraints on a case-by-case basis.[25]

The case for permitting last-mile networks to experiment with end user restrictions also draws on economic considerations separate from congestion. For example, by allowing network owners to differentiate the services they offer, exclusivity can play a key role in mitigating the sources of market failure that require regulatory intervention in the first place. Indeed, some degree of discrimination and differentiation is inevitable in any industry characterized by large fixed costs. Furthermore, close analysis reveals that access requirements like network neutrality are less justifiable and less likely to succeed in a world in which competition among last-mile providers is growing ever more robust, natural interfaces between companies are complex and constantly changing, and the avalanche of content available on the Internet has heightened end users' reliance on media filters exercising editorial discretion.

I do not claim that every deviation from network neutrality will necessarily enhance economic welfare. My point is a more limited one. For my purposes, it

24. *See* Jeffrey K. MacKie-Mason & Hal R. Varian, *Some FAQs About Usage-Based Pricing*, 28 COMPUTER NETWORKS & ISDN SYS. 257, 258 (1995).

25. *See* Continental T.V., Inc. v. GTE Sylvania, Inc., 433 U.S. 36, 52–59 & n.21 (1977).

is sufficient if some deviations from network neutrality may plausibly be motivated by legitimate concerns, and it is hard to distinguish procompetitive and anticompetitive uses of such restrictions, as network neutrality proponents have conceded is often the case.[26] When it is possible that intervention may do more harm than good, and particularly when consumers do not face any immediate harm, the more prudent course would be to forego locking the network into any particular architecture. Since the threatened harms are neither catastrophic nor irreversible, competition policy supports forbearing from forbidding particular practices until a specific harm to competition can be demonstrated. Any competitive problems that do emerge can be addressed through the type of targeted intervention imposed by the FCC in *Madison River*, limited to prohibiting the broadband provider from blocking access to those applications that compete directly with the broadband provider's core business.[27] They would not justify the broad prohibition of end user restrictions envisioned under network neutrality.

The balance of the Article is organized as follows: Part I provides a brief overview of the debate over network neutrality. Part II identifies the sources of congestion on the Internet. Part III lays out the basic economics of congestion, paying particular attention to the impact of transaction costs. Part IV applies the insights provided by the foregoing analysis to the broadband industry, concluding that the types of restrictions that have drawn criticism from network neutrality proponents may be economically justified. Indeed, if one adopts a broader notion of consumer welfare, such restrictions may well be a benefit to consumers by forcing heavy bandwidth users to bear the congestion costs they impose on other users and by effectively lowering the prices paid by light bandwidth users who previously were forced to cross-subsidize heavier users. It also engages the broader arguments about the economics of innovation and the dangers of imposing regulation in the face of prospective harms. Part V bolsters the basic congestion-based argument by examining the ways that exclusivity can mitigate the sources of market failure that justify regulation in the first place.

I. A BRIEF OVERVIEW OF THE DEBATE OVER NETWORK NEUTRALITY

Although related issues arose during earlier proceedings in which the FCC addressed calls for multiple ISP access to cable modem systems,[28] the debate over network neutrality began in earnest in February 2002 when the FCC issued

26. *See supra* note 14 and accompanying text.

27. *See* Madison River Commc'ns, LLC, Order, 20 F.C.C.R. 4295 (2005).

28. Many commentators asked the FCC to require cable operators to make their cable modem systems available to all ISPs on a nondiscriminatory basis as part of the process of clearing a series of major mergers in the cable television industry. The FCC vacillated, declining to impose such requirements in connection with AT&T's acquisitions of TCI and MediaOne, imposing a multiple ISP access requirement as a condition to clearing America Online's acquisition of Time Warner, and then returning to refusing to mandate multiple ISP access when evaluating Comcast's acquisition of AT&T's cable

a notice of proposed rulemaking tentatively concluding that DSL systems were "information services" and thus were not subject to the access requirements imposed on traditional telephone companies.[29] The following month, the FCC issued a declaratory ruling drawing a similar conclusion with respect to cable modem systems.[30] In both cases, the FCC sought comment on what regulations, if any, the FCC should impose under its general rulemaking authority.[31]

At the time, last-mile broadband providers had begun to experiment with a variety of restrictions on the ways end users could use their network connections.[32] Although there was no evidence that last-mile broadband providers were blocking end user access to any content,[33] some network owners began employing tiered pricing schemes that forced heavy bandwidth users to pay more for their connections[34] and implementing technologies that slow down the connections of users running bandwidth-intensive applications, such as file-sharing programs.[35] Other end user restrictions included prohibitions on end users reselling bandwidth, acting as an Internet service provider (ISP), engaging in home networking, attaching certain devices, operating file servers, and employing commercial applications such as virtual private networks (VPNs).[36]

The emergence of end user restrictions alarmed traditional entertainment

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properties. *See* Daniel F. Spulber & Christopher S. Yoo, *Access to Networks: Economic and Constitutional Connections*, 88 CORNELL L. REV. 885, 1015–18 (2003).

29. *See* Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Notice of Proposed Rulemaking, 17 F.C.C.R. 3019, 3029–35 ¶¶ 17–29 (2002) [hereinafter Wireline Broadband NPRM]. The FCC's action was antedated by some commentary expressing concerns about end user restrictions. *See* Bar et al., *supra* note 4, at 509–14; Saltzer, *supra* note 4.

30. *See* Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Declaratory Ruling and Notice of Proposed Rulemaking, 17 F.C.C.R. 4798, 4819–39 ¶¶ 33–71 (2002) [hereinafter Cable Modem Declaratory Ruling and NPRM]. This declaratory ruling was preceded by a notice of inquiry exploring these issues. *See* Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities, Notice of Inquiry, 15 F.C.C.R. 19287 (2000).

31. *See* Cable Modem Declaratory Ruling and NPRM, *supra* note 30, at 4839–54 ¶¶ 72–112; Wireline Broadband NPRM, *supra* note 29, at 3040–48 ¶¶ 43–64.

32. *See supra* note 4 and accompanying text; *infra* Part IV.A.

33. *See* Peter J. Howe, *News from the Chicago Cable and Telecom Show*, BOSTON GLOBE, June 16, 2003, at C2 (quoting FCC Commissioner Jonathan Adelstein acknowledging the lack of evidence that last-mile providers were limiting end users' ability to access content and calling network neutrality "'a solution awaiting a problem'"); Declan McCullagh, *FCC Chief Dubious About New Cable Rules*, CNET NEWS.COM, Aug. 18, 2003, http://news.com.com/FCC+chief+dubious+about+new+cable+rules/2100-1025_3-5065325.html?tag=nl (quoting FCC Chairman Michael Powell as stating, "I don't know yet that I see anything that says we need a rulemaking on [network neutrality]"); Amy Schatz & Anne Marie Squeo, *Neutral Ground: As Web Providers' Clout Grows, Fears Over Access Take Focus; FCC's Ruling Fuels Debate Between Broadband Firms and Producers of Content*, WALL ST. J., Aug. 8, 2005, at A1 (quoting FCC Chairman Kevin Martin as saying "'We haven't seen any evidence of this being a problem'"); *cf.* Paul Kapustka, *Former FCC Chairman Powell: Net Neutrality "Doing Great,"* NETWORKINGPIPELINE, Feb. 20, 2006, *available at* http://www.networkingpipeline.com/news/180204778 (quoting former FCC Chairman Michael Powell as saying that there were "no perceptible transgressions" against network neutrality).

34. *See supra* note 3 and accompanying text.

35. *See* Roger Cheng, *Online Services Move to Restrict Bandwidth Hogs*, WALL ST. J., Nov. 19, 2003, at B2.

36. *See* Wu, *supra* note 4, at 156–62.

companies (such as Disney), providers of Internet-based applications (such as Amazon.com, eBay, and Yahoo!), software companies (such as Microsoft), and device manufacturers (such as Apple Computer and Dell). Together they formed a number of industry consortia that proposed a series of "connectivity principles" that would limit last-mile broadband providers' ability to prevent end users from accessing any content, running any applications, and attaching any devices they desired, unless necessary to comply with a legal duty or to prevent harm to the network.[37] Legal scholars Lawrence Lessig and Timothy Wu filed comments supporting a similar regime. Their approach would forbid last-mile broadband providers from imposing restrictions on the way end users employ their Internet connections, except as necessary to comply with legal duties, prevent harm to the network or interference with other users, or ensure the quality of broadband service.[38] In 2004, then-FCC Chairman Michael Powell called upon the industry to voluntarily embrace a series of "Internet freedoms" that would ensure end users' ability to access content, use applications, and attach personal devices, subject only to restrictions needed to manage networks, ensure quality experiences, prevent disruption of the network, and prevent theft of service,[39] although subsequent comments have made clear that Powell would not support turning his Internet freedoms into a regulatory mandate.[40] Concerns about network neutrality were heightened still further when a small local telephone company known as Madison River Communications blocked its DSL customers from using the ports needed to access Internet telephony (also known as Voice over Internet protocol or VoIP).[41] Allegations of similar interruptions of VoIP service by minor telephone companies have continued to appear,[42] although network neutrality proponents concede that such reports remain "isolated."[43]

Further consideration of network neutrality was temporarily foreclosed by the Ninth Circuit's decision in *Brand X Internet Services v. FCC*, which held that the FCC's declaratory ruling that cable modems represented an "information

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37. *See* HTBC Comments, *supra* note 6, at 6–13. The HTBC's proposal was later endorsed by the CBUI. *See* CBUI *Ex parte*, *supra* note 6, at 3–4.

38. *See* Wu & Lessig, *Ex parte*, *supra* note 7, at 12–15. For statements of their views appearing in the scholarly literature, see LESSIG, *supra* note 4, at 46–48, 156–59, and Wu, *supra* note 4, at 165–72.

39. *See* Michael K. Powell, *Preserving Internet Freedom: Guiding Principles for the Industry*, 3 J. ON TELECOMM. & HIGH TECH L. 5, 11–12 (2004). Chairman Powell also called for the industry to provide consumers with clear and meaningful information regarding the terms of their broadband service plans. *Id.* at 12.

40. *See* B2Day, Powell Warns Net Neutrologists Not to Be Naïve, Apr. 3, 2006, http://business2.blogs.com/business2blog/2006/04/powell_warns_ne.html.

41. *See* Madison River Commc'ns, LLC, Order, 20 F.C.C.R. 4295 (2005).

42. *See* Tripp Blatz, *Three Carriers Have Now Blocked Access to Ports for VoIP, Vonage Chairman Alleges*, TELECOMM. MONITOR, Aug. 23, 2005, *available at* http://pubs.bna.com/ip/BNA/tcm.nsf/is/A0B1J0D3P1.

43. *Net Neutrality: Hearing Before the S. Comm. on Commerce, Science & Transportation*, 109th Cong. 5 (2006) (statement of Prof. Lawrence Lessig) [hereinafter Lessig Testimony], *available at* http://commerce.senate.gov/pdf/lessig-020706.pdf.

service" was foreclosed by a previous Ninth Circuit decision.[44] The Supreme Court ultimately reversed the Ninth Circuit's decision and upheld the FCC's conclusion that cable modems constituted an information service that was not subject to the regulatory regimes applied to telephony and cable television.[45] In the process, the Court indicated that the FCC possessed the authority to impose additional regulatory requirements as it saw fit.[46]

The prospect that the FCC would once again begin addressing the issues surrounding network neutrality touched off a paroxysm of lobbying at the FCC and on Capitol Hill.[47] Their efforts were partially successful. When adopting an order ruling that DSL was exempt from the statutory access requirements applied to traditional telephone companies, the FCC declined to invoke its general regulatory jurisdiction to impose alternative access or nondiscrimination requirements.[48] At the same time, the FCC explicitly reserved the right to impose access requirements should circumstances warrant doing so[49] and issued a policy statement recognizing the agency's intent to preserve consumers' rights to access the content, run the applications, and attach the devices of their choice.[50]

These steps were not sufficient to placate network neutrality proponents' concerns. The policy statement recognized an exception for "reasonable network management" and explicitly acknowledged that it has no legal effect until incorporated into formal rules.[51] In addition, the statement released by FCC Chairman Kevin Martin in conjunction with the policy statement expressed his confidence that competition would remain sufficiently robust that such regulation would prove unnecessary.[52] In subsequent statements, Chairman Martin indicated that while he would oppose any attempt to completely block access to particular content and applications, he would not oppose allowing networks to charge content and applications providers for different tiers of service.[53] The continuing controversy ultimately became front-page news in *The Wall Street*

44. 345 F.3d 1120, 1132 (9th Cir. 2003) (per curiam) (holding that the FCC's Cable Modem Declaratory Ruling was foreclosed by *AT&T Corp. v. City of Portland*, 216 F.3d 871 (9th Cir. 2000)).

45. *See* Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Servs., 125 S. Ct. 2688 (2005).

46. *Id.* at 2708 (noting that "the Commission remains free to impose special regulatory duties on facilities-based ISPs under its Title I ancillary jurisdiction").

47. *See* Cheryl Bolen, *Entertainers Looking to Influence Next Telecommunications Act Update*, TELECOMM. MONITOR, July 19, 2005; Amy Schatz, *FCC May Set Rules Allowing Bells Exclusive Access Over DSL Lines*, WALL ST. J., Aug. 3, 2005, at A4.

48. *See* Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Report and Order and Notice of Proposed Rulemaking, 20 F.C.C.R. 14853, 14862–98 ¶¶ 12–85, 14904–05 ¶¶ 96–97 (2005) [hereinafter Wireline Broadband Access Order].

49. *See id.* at 14904 ¶ 96.

50. Wireline Broadband Policy Statement, *supra* note 9, at 14988.

51. *Id.* at 14988 n.15.

52. FCC Chairman Kevin J. Martin, Comments on Commission Policy Statement 1 (Aug. 5, 2005), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260435A2.pdf.

53. *See* Drew Clark, *FCC Chief Opens Door to Tiered, High-Speed Internet*, NAT'L J.'S INSIDER UPDATE: THE TELECOM ACT, Jan. 6, 2006, http://www.njtelecomupdate.com/lenya/telco/live/tb-FBRB1136842420157.html.

Journal, which predicted that the issue will be of major concern when Congress begins its impending overhaul of the communications laws.[54] A number of national media outlets have published editorials and opinion pieces on both sides of the issue.[55] The debate over network neutrality eventually led SBC, AT&T, Verizon, and MCI to agree to adhere to principles of network neutrality for two years in order to obtain FCC clearance of their mergers.[56] In the process, the two Democratic Commissioners issued statements lauding the merging parties' willingness to adhere to network neutrality, even if only for two years, while the two Republican Commissioners filed statements questioning the need for additional restrictions.[57] Network neutrality has subsequently been the subject of extensive legislative negotiations. On the Senate side, the Commerce Committee conducted hearings on network neutrality,[58] although the Committee remains deeply divided over the issue.[59] On the House side, proposed legislation with strong bipartisan support that included a network neutrality provision unraveled, and House Republicans, with the support of a small group of House Democrats, began to push forward a bill that did not contain a network neutrality provision.[60] The Subcommittee on Telecommunications and the Internet, the House Energy and Commerce Committee, and the full House each rejected amendments that would have added a broad network neutrality mandate to the bill.[61] Just before this Article went to press, the Senate Com-

54. *See* Schatz & Squeo, *supra* note 33.

55. For editorials favoring network neutrality, see Editorial, *Congress Turns a Deaf Ear to Need for Internet Neutrality*, SAN JOSE MERCURY NEWS, Apr. 7, 2006, at A1; Editorial, *Don't Undercut Internet Access*, S.F. CHRON., Apr. 17, 2006, at B4; Editorial, *Tollbooths on the Internet Highway*, N.Y. TIMES, Feb. 20, 2006, at A14; Editorial, *Whose Internet Is It, Anyway?*, CHRISTIAN SCI. MTR., Mar. 24, 2006, at 8; Steven Levy, *When the Net Goes from Free to Fee*, NEWSWEEK, Feb. 27, 2006, at 14; Catherine Yang et al., *At Stake: The Net as We Know It*, BUS. WEEK, Dec. 26, 2005, at 38.

For editorials opposing network neutrality, see Editorial, *Stuck in Neutral*, WALL ST. J., Mar. 8, 2006, at A20; Editorial, *The Eden Illusion*, WASH. POST, Mar. 13, 2006, at A14; Leslie Ellis, *Network Neutrality: Battle Royale*, CED MAGAZINE, Apr. 2006, *available at* http://www.cedmagazine.com/article/CA6319829.html; Julian Sanchez, *A Neutral Panic: Why There's No Need for New Laws to Keep the Internet Open*, REASON ONLINE, Apr. 10, 2006, *available at* http://www.reason.com/links/links041006.shtml+-.

56. *See* Verizon-MCI Order, *supra* note 11, at 18437 ¶ 3, 18492 ¶ 109, 18509 ¶ 143, 18537 ¶ 221; SBC-AT&T Order, *supra* note 11, at 18293 ¶ 3, 18350–51 ¶ 108, 18368 ¶ 144, 18392 ¶ 211, app.F.

57. *See* Verizon-MCI Order, *supra* note 11, at 18570 (statement of Martin, Comm'r), 18572–73 (statement of Abernathy, Comm'r), 18575 (statement of Copps, Comm'r), 18579 (statement Adelstein, Comm'r); SBC-AT&T Order, *supra* note 11, at 18422 (statement of Martin, Comm'r), 18424–25 (statement of Abernathy, Comm'r), 18427 (statement of Copps, Comm'r), 18431 (statement of Adelstein, Comm'r).

58. *See supra* note 43 and accompanying text.

59. *See* David Hatch & Drew Clark, *Stevens Says Commerce Panel Deeply Divided Over "Net Neutrality,"* NAT'L J.'S INSIDER UPDATE: THE TELECOM ACT, Mar. 20, 2006, http://www.njtelecomupdate.com/lenya/telco/live/tb-PKMQ1142371107278.html.

60. *See* Drew Clark, *Bipartisan Telecom Deal Unravels; Barton To Push GOP-Backed Bill*, NAT'L J.'S INSIDER UPDATE: THE TELECOM ACT, Mar. 24, 2006, http://www.njtelecomupdate.com/lenya/telco/live/tb-ZMKJ1143232909756.html.

61. On April 5, 2006, the Subcommittee on Telecommunications and the Internet of the House Energy and Commerce Committee voted 8-23 to reject a network neutrality amendment before

merce Committee rejected a network neutrality amendment by a vote of eleven to eleven.[62] The amendment's sponsors expect to reintroduce it when the bill is debated on the floor of the full Senate.

II. SOURCES OF CONGESTION ON THE INTERNET

As is commonly known, the Internet is not a single network but rather a network of interconnected networks. The FCC has found it useful to divide the networks that comprise the Internet into three types.[63] *Backbone providers* provide high-speed, long-distance connections between a small number of interconnection points.[64] *Middle-mile providers* provide regional distribution functions, carrying the traffic from the limited number of interconnection points served by backbone providers to the local distribution facilities maintained by last-mile providers in individual cities (which in the case of DSL is usually called a "central office" and in the case of cable modem systems is usually

approving the bill by a vote of 27-4. *See* Tom Abate, *Telecom Reform Moves Forward: House Panel OKs Measure Favored by Phone Companies*, S.F. CHRON., Apr. 6, 2006, at C1. Three weeks later, the full Committee also rejected a network neutrality amendment (by a vote of 22-34) before voting 42-12 to approve the entire bill. *See* Jim Puzzanghera, *Panel Vote Shows Rift over "Net Neutrality*,*"* L.A. TIMES, Apr. 27, 2006, at C1. The House Judiciary Committee voted 20-13 to approve a different bill that would have incorporated network neutrality into the federal antitrust laws. *See* Marilyn Geewax, *House Panel OKs "Network Neutrality*,*"* ATLANTA J.-CONST., May, 26, 2006, at G1. When the full House debated the version of the legislation reported by the House Commerce Committee on June 8, it rejected a network neutrality amendment offered by Rep. Edward Markey by a vote of 152-269 and approving the entire bill by a vote of 321-101. *See* Stephen Labaton, *House Backs Telecom Bill Favoring Phone Companies*, N.Y. TIMES, June 9, 2006, at C3.

62. *See* Tom Abate, *Net Neutrality Amendment Dies: Telecommunications Bill Goes to Senate Without Provision Sought by Web Firms*, S.F. CHRON., June 29, 2006, at C1.

63. *See* Inquiry Considering the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Second Report, 15 F.C.C.R. 20913, 20922–28 ¶¶ 18–28 (2000) [hereinafter Second Section 706 Report].

64. Originally, backbones only interconnected at the four public Network Access Points (NAPs) created by the National Science Foundation (located in San Francisco, Chicago, New York, and Washington, D.C.), as well as the Commercial Internet Exchange maintained in Santa Clara, California. *See* Michael Kende, *The Digital Handshake: Connecting Internet Backbones* 5–6 (FCC Office of Plans & Pol'y Working Paper No. 32, Sept. 2000), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp32.pdf. The NAPs have since been privatized, and backbone providers have also created a number of other public interconnection points, where any carrier can exchange traffic. In addition, backbone providers have begun to exchange traffic directly through private interconnection points. *See* Christopher S. Yoo, *Would Mandating Network Neutrality Help or Hurt Broadband Competition?: A Comment on the End-to-End Debate*, 3 J. ON TELECOMM. & HIGH TECH. L. 23, 31 (2004).

Depending on the context, the FCC sometimes replaces the term "backbone provider" with the term *long haul communications transport facilities* to make clear that it is referring to high-speed fiber transport used for voice as well as data communications. *See* Inquiry Considering the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Third Report, 17 F.C.C.R. 2844, 2853 n.33 (2002).

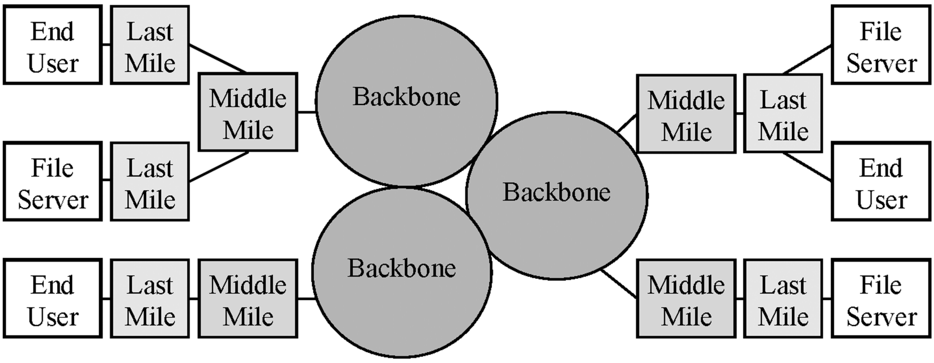

Figure 1: The Basic Architecture of the Internet

called a "headend").[65] *Last-mile providers* convey the traffic from these local distribution facilities to the premises of end users.[66] The FCC has analogized this to a road system. Backbones represent interstate highways, which convey traffic at high speeds and allow entry and exit only through limited access points. Middle-mile networks are the divided highways that connect interstate exits to local roads. Last-mile networks are the local roads, responsible for delivering traffic to the driveways leading into individual residences.[67]

Until recently, the protocols that govern the Internet have required that all of these providers be organized into a series of parallel hierarchies, in which each last-mile provider exchanged traffic with a dedicated middle-mile provider, which in turn exchanged traffic with a dedicated backbone.[68] Each type of Internet provider in this chain must maintain some infrastructure for conveying the stream of data packets, consisting of wires, fiber optic cable, or some other medium of transmission. Each network must also have a number of computers called *routers*, which operate in the core of the network to direct packets to their destination. Computers that store files at the edge of the network and fulfill requests for those files from other users are called *servers*.

The process can be illustrated by tracing the path of a typical Internet transaction, such as downloading a webpage over a cable modem system. The process begins when an end user employs its computer to submit a request for a webpage. The end user's computer divides the address of the requested webpage into packets and forwards the packets to the cable modem provider serving that end user. The packets travel through the coaxial cables connecting the end user's premises to a fiber node located in its neighborhood, which aggregates

65. Under broadband, middle-mile and last-mile provision is often vertically integrated. This is because there are often real efficiencies that result from such integration. *See* Yoo, *supra* note 64, at 31–34.

66. *See* Second Section 706 Report, *supra* note 63, at 20923 ¶ 18, 20938–39 ¶ 60.

67. *See id.* at 20922–23 ¶ 18.

68. *See* Stanley M. Besen et al., *Advances in Routing Technologies and Internet Peering Agreements*, 91 AM. ECON. REV. (PAPERS & PROC.) 292, 292 (2001).

those packets with other traffic and transmits them to the headend. A cable modem termination system separates the data packets from the video stream and directs them onto the data network maintained in the headend.[69] The router on the data network located in the headend transmits the packets to a middle-mile provider, which in turn transmits the packets to one of the interconnection points served by backbone providers. The backbone directs the packets to other backbone providers until they reach the backbone connected to the middle-mile provider that serves the destination.[70] The middle-mile provider then directs the packets to the terminating last-mile provider, which passes them on to the server hosting the webpage content. The web server fulfills the request, and the packets comprising the webpage returns through a similar set of steps.

Congestion results from the fact that the capacity of almost every step in this process is constrained. For example, the bandwidth of each component of the physical transmission media (e.g., the wires and fiber nodes comprising the network) is limited.[71] The number of packets and requests that routers and content servers can fulfill at any time is similarly constrained. When data packets arrive at a rate that exceeds the capacity of any particular element, they form a queue. The resulting delay in the speed with which the requests are fulfilled causes degradation in the quality of service provided by the network.

Changes in the ways people are using the Internet are making these problems all the more acute. The Internet was once dominated by e-mail and other applications that placed fairly modest demands on the network, and the restrictions imposed by the National Science Foundation on backbone services limited the Internet to noncommercial uses. The subsequent privatization of the Internet has greatly increased the number of network users as well as the heterogeneity of network usage.[72] These changes have increased the variability of demand in

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69. *See* Spulber & Yoo, *supra* note 28, at 1014–15 (offering a more detailed depiction of cable modem systems).

70. The number of backbones involved depends on whether service is being provided under a *peering* or a *transit* arrangement. Under peering arrangements, backbones only exchange traffic that originates from the customer of one backbone and terminates with the customers of the other peered backbone. In that case, the maximum number of backbones involved is two. Under transit arrangements, backbones serve as intermediaries for traffic that neither originates from nor terminates with their customers or the customers of their peering partners. In this case, the number of backbones involved may exceed two. *See* Kende, *supra* note 64, at 5, 7.

71. In addition to congestion in backbone and middle-mile services, cable modem customers share bandwidth both between the end users' premises and the fiber node as well as between the fiber node and the cable headend. As a result, both segments are subject to congestion. *See* Spulber & Yoo, *supra* note 28, at 1014–15. DSL systems have historically used dedicated circuits that were less subject to congestion. Telephone companies are increasingly deploying remote terminals that aggregate traffic and convey them via fiber to their central office facility in a manner quite similar to the hybrid fiber-coaxial architecture of most cable modem systems. *See id.* at 1004–05. To the extent that they employ remote terminals, telephone networks may be subject to congestion effects between the remote terminal and the central office that are similar to those suffered by cable modem systems between the fiber node and the headend. The connection between the end users' premises and the remote terminal continues to be through dedicated wires that are not subject to congestion.

72. *See* Yoo, *supra* note 64, at 34–37.

ways that have made problems of network management considerably more complex.[73] For example, the emergence of webpage downloading, which requires the transfer of images and multimedia features, has increased the intensity of bandwidth usage, as has the emergence of music filesharing and other applications involving the transfer of increasingly large files. In addition, end users are more frequently using applications that are sensitive to delay, such as streaming media, online gaming, and VoIP. Thus, guaranteed throughput rates have become increasingly important at the precise time that increases in the volume of traffic are making quality of service harder to maintain. Indeed, some technologists have increasingly come to regard the thirty-year old suite of protocols around which Internet is currently designed (known as TCP/IP), which routes packets on a first-come, first-served basis in precisely the manner favored by network neutrality proponents, as an increasingly obsolete technology that is ill-suited to increasingly varied and intense demands that end users are placing on the network.[74]

III. THE ECONOMICS OF CONGESTION

The fact that the Internet is subject to congestion gives rise to a number of important policy implications. Perhaps the most sophisticated insights into congestion are provided by the branch of economics known as *club goods*, which was largely inspired by the pioneering work of Nobel laureate James Buchanan.[75]

Club goods are goods that can be shared by more than one person. At the same time, they differ from infinitely shareable goods (known in the literature as *pure public goods*) in that consumption by an additional person creates

73. *See* Daniel F. Spulber & Christopher S. Yoo, *On the Regulation of Networks as Complex Systems: A Graph Theory Approach*, 99 NW. U. L. REV. 1687, 1688 (2005).

74. *See, e.g.*, Carol Wilson, *Point of No Return*, TELEPHONY, Apr. 3, 2006, *available at* http://voip-blog.tmcnet.com/blog/rich-tehrani/voip/point-of-no-return.html (quoting former FCC Chief Technologist and Carnegie Mellon Professor David Farber as stating that the current Internet architecture is "getting old" and is increasingly unable to satisfy the demand for new functionality for new services such as streaming video).

75. *See* James Buchanan, *An Economic Theory of Clubs*, 32 ECONOMICA 1 (1965). *See generally* RICHARD CORNES & TODD SANDLER, THE THEORY OF EXTERNALITIES, PUBLIC GOODS AND CLUB GOODS 351–53 (2d ed. 1996) (reviewing the origins of the study of club goods). Buchanan's work is related to Charles Tiebout's earlier work on local public goods, which analyzed shared resources provided by local governments. Tiebout's model assumed that cities attempt to achieve an optimal community size, which is achieved when a city produces the bundle of services desired by residents at the lowest average cost. The posited "U"-shape of the cost curve in turn presupposed the existence of some local resource that was in fixed supply, such as a beach or the total amount of land available; otherwise, there would be no logical reason to limit community size. *See* Charles M. Tiebout, *A Pure Theory of Local Expenditures*, 64 J. POL. ECON. 416, 419 (1956). Although Tiebout does not specify what causes marginal cost to increase, it is analogous to the congestion costs assumed by the club goods literature. The primary difference between club goods and local public goods is the feasibility of entry. The former assumes that entry by new clubs is possible. The latter assumes that the total number of municipalities is fixed. *See* Suzanne Scotchmer, *Public Goods and the Invisible Hand*, *in* MODERN PUBLIC FINANCE 93, 95, 107 (John M. Quigley & Eugene Smolensky eds., 1994).

congestion costs that cause the quality of the services provided to others to deteriorate. Buchanan's paradigmatic example of a club good is a swimming pool.[76] Others have suggested that the theory also applies to a wide range of facilities, including golf courses, theaters, laundromats, restaurants,[77] and roads.[78]

A. CONGESTION AND THE CHOICE BETWEEN FLAT-RATE AND USAGE-SENSITIVE PRICING

One of the primary issues that has emerged in the literature is whether a club should charge a single flat-rate price for membership or whether it should charge a price that varies with the intensity of each member's usage of the club facilities. The standard result is that reliance solely on flat-rate pricing will result in inefficiently high levels of congestion and in overconsumption of the club facilities.[79]

The intuitions underlying this result are quite straightforward. Economic welfare is maximized if the market reaches equilibrium at the point where the social benefits equal the social costs. In the case of club goods, this would occur where the benefits each club member derives from the last unit consumed equals the costs of congestion created by the last unit consumed. The problem is that if club members are charged rates that are not sensitive to usage, the private cost of consuming an additional unit is zero. That means that utility-maximizing club members will increase their consumption of club resources until the marginal utility from any further increases in usage is zero, at which point the social costs associated with the last unit consumed will exceed the benefits, and welfare is reduced.

In short, flat-rate pricing results in excessive consumption of club resources, which arises because the congestion costs represent a negative externality that individual club members responsible for causing the congestion are not forced to bear. The classic solution is to impose a usage-sensitive price that is equal to the congestion costs imposed by the last unit consumed. In this way, usage-sensitive pricing aligns incentives by bringing private costs into line with the true social costs of consuming an additional unit.[80] As a theoretical matter,

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76. *See* Buchanan, *supra* note 75, at 1.

77. *See, e.g.*, Robin Boadway, *A Note on the Market Provision of Club Goods*, 13 J. PUB. ECON. 131, 131 (1980).

78. *See* Tracey E. George & Chris Guthrie, *Induced Litigation*, 98 NW. U. L. REV. 545, 555–57 (2004).

79. *See, e.g.*, Berglas, *supra* note 19, at 119; Eitan Berglas, *The Market Provision of Club Goods Once Again*, 15 J. PUB. ECON. 389, 393 (1981); Suzanne Scotchmer, *Two-Tier Pricing of Shared Facilities in a Free-Entry Equilibrium*, 16 RAND J. ECON. 456, 457 (1985).

80. Within each club, each member will calibrate their consumption until the utility they derive is equal. There may initially be some variation in per capita utility across clubs, with some clubs being more crowded than others. Assuming that mobility across clubs is possible, people in high-congestion clubs will seek to shift to low-congestion clubs until utility is equalized across all clubs. Furthermore, club goods theory posits the existence of an optimal club size. On the one hand, increasing club size benefits members by allowing them to amortize the overhead costs needed to establish the club and to enforce exclusion over a larger membership base. On the other hand, any increase in membership causes congestion costs to rise. Clubs thus add members until the benefits of spreading costs over an

usage-sensitive pricing has thus been regarded as a critical mechanism for promoting the efficient allocation of resources.

B. THE IMPACT OF TRANSACTION COSTS ON THE CHOICE BETWEEN FLAT-RATE AND USAGE-SENSITIVE PRICING

The preference for usage-sensitive pricing suggested by the theoretical literature on club goods is subject to a number of limiting assumptions and conditions. Many of these caveats are not relevant to the network neutrality debate.[81] One caveat that is applicable, however, is that the standard result depends on the assumption that exclusion and metering is costless.[82] A literature has emerged relaxing this assumption and exploring the results that obtain when metering and exclusion require the incurrence of transaction costs. It draws on the insight that someone buying ten units of a good is indifferent between a price of $1 per unit and a $10 entry fee with a ten-unit limit per customer. In other words, the equilibrium under usage-sensitive pricing can be replicated by charging a

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additional member no longer exceed the marginal increase in congestion costs, at which point they will stop adding new members. Assuming free entry, any remaining individuals refused membership in existing clubs remain free to form new clubs. The result is an equilibrium in which the optimal number of clubs exists and in which each club member consumes the optimal amount of club services. *See* Buchanan, *supra* note 75, at 3–5, 8–9. Subsequent work has confirmed this result regardless of whether the market structure is monopolistic, oligopolistic, or competitive. *See* MacKie-Mason & Varian, *supra* note 20, at 1143, 1147 (competitive and monopolistic); P.S. Calem & Daniel F. Spulber, *Multiproduct Two-Part Tariffs*, 2 INT'L J. INDUS. ORG. 105 (1984) (oligopolistic).

81. For example, as a purely formal matter, a club good equilibrium is only stable if dividing the overall population by the optimal club size results in an integer. When that occurs, the solution is said to be in the *core*, which in turn implies that the equilibrium is Pareto optimal, in that no individual or set of individuals can improve their situation by forming a different club. A noninteger result destabilizes the equilibrium, however, since anyone excluded from club membership will have the incentive to attempt to bid their way into a club by offering to accept a lower payoff than a current club member. The result is a constant shuffling of club composition. *See, e.g.*, Mark V. Pauly, *Clubs, Commonality and the Core: An Integration of Game Theory and the Theory of Public Goods*, 34 ECONOMICA 314 (1967). Fortunately, introduction of a concept known as the *approximate core* renders the nonexistence of an equilibrium less problematic than initially appears. If the number of club members is large relative to the number of nonmembers, club members can make side payments to nonmembers in order to induce them not to destabilize the existing coalitions. The resulting utilities lie fairly close to core utilities. *See, e.g.*, Myrna H. Wooders, *The Tiebout Hypothesis: Near Optimality in Local Public Goods Economies*, 48 ECONOMETRICA 1467 (1980).

Another limiting factor is that the classic analysis of club goods assumes that consumer preferences are homogeneous. *See, e.g.*, Buchanan, *supra* note 75, at 6, 8. If preferences are heterogeneous, each homogeneous subset of the population should partition itself into homogeneous clubs. *See* Eitan Berglas & David Pines, *Clubs, Local Public Goods, and Transportation Models: A Synthesis*, 15 J. PUB. ECON. 141, 150–52 (1981); Martin McGuire, *Group Segregation and Optimal Jurisdictions*, 82 J. POL. ECON. 112 (1974); Mark V. Pauly, *Cores and Clubs*, 9 PUB. CHOICE 53 (1970). If integer problems prevent the total population from segregating itself into homogeneous clubs, individuals with different preferences may have to form a *mixed club*. The resulting intraclub heterogeneity can lead to suboptimal provision. *See* Berglas & Pines, *supra*, at 150–52. Later work has shown that mixed clubs may be optimal so long as crowding is anonymous and members' demands for facility size and congestion coincide at a feasible division of total economy-wide endowments. *See* Suzanne Scotchmer & Myrna Holtz Wooders, *Competitive Equilibrium and the Core in Club Economies with Anonymous Crowding*, 34 J. PUB. ECON. 159 (1987).

82. *See* Helsley & Strange, *supra* note 21, at 889, 895–96.

flat-rate price set equal to the unit price under usage-sensitive pricing times the optimal number of units consumed.[83] Given the identity of these two pricing mechanisms, providers are free to choose the pricing regime that imposes the fewest transaction costs. Thus, if the transaction costs of metering and exclusion are sufficiently high, charging a flat-rate pricing based on the contribution to congestion by the average club member may well prove economically superior to usage-sensitive pricing.[84]

The FCC's initial order implementing the Telecommunications Act of 1996 recognized that transaction costs can render flat-fee pricing of congestible resources efficient. One of the primary purposes of the 1996 Act was to foster the development of competition in local telephone services. As competition for local services emerged, some calls would inevitably originate on one company's local telephone network and terminate on the local telephone facilities of another company. In the process, both the originating and terminating carrier would incur costs. Because local telephone service in the United States has traditionally operated on a "caller pays" basis, only the originating carrier would generate revenue from the call. As a result, the 1996 Act mandates that the FCC establish a system of "reciprocal compensation" through which originating carriers could compensate other carriers for the costs they incurred terminating their calls.[85] The statute provides for reciprocal compensation based on a reasonable approximation of the costs incurred by each carrier.[86] The statute specifically provides that it should not be construed to preclude bill-and-keep arrangements, in which each carrier recovers its costs from its own customers without receiving any additional payment from the other carrier.[87]

In implementing these provisions, the FCC expressed skepticism about bill-and-keep, based largely on the concern that failing to compensate terminating carriers for their costs might give originating carriers both the ability and the incentive to impose costs onto terminating carriers. As with club goods, the concern is that the resulting externalization of costs can lead to overutilization

83. *See* Barro & Romer, *supra* note 21, at 875–79.

84. *See id.* at 879; Helsley & Strange, *supra* note 21, at 895–96. It is worth noting that the analyses that found flat-rate pricing preferable to usage-sensitive pricing assumed perfect information. *See* Helsley & Strange, *supra* note 21, at 893. When information is imperfect, the presence of transaction costs can lead to an adverse selection problem in which high demanders patronize facilities designed for low demanders. In such cases, no equilibrium may exist, and any equilibrium that does exist is inefficient. *See* Lee, *supra* note 21, at 338, 359.

In addition, existing analyses take capacity as given. Although per capita usage will be higher under flat-rate pricing, models that take capacity as endogenous also point out that capacity will be higher as well. As a result, the net impact on congestion is ultimately ambiguous and depends on which of these effects dominates. The problem becomes even more complex if one acknowledges that flat-rate pricing can cause the number of users to change as well. If users can shift to alternative providers of network services, adopting a flat-rate price will cause the customer base to consist solely of a small group of intensive users with a high tolerance for congestion. *See* MacKie-Mason & Varian, *supra* note 20, at 1145–47.

85. *See* 47 U.S.C. § 251(b)(5) (2000).

86. *See id.* § 252(d(2)(A).

87. *See id.* § 252(d)(2)(B).

of the terminating carrier's resources. As a general matter, the FCC thus regarded bill-and-keep regimes as "not economically efficient."[88]

At the same time, the FCC acknowledged that circumstances may exist under which bill-and-keep may make economic sense. If the traffic exchanged between carriers is roughly symmetrical, the compensation that each carrier would pay the other for terminating its calls would simply offset one another. When that is the case, eliminating usage-sensitive pricing would not have any significant adverse impact on the carriers. At the same time, it might yield economic benefits by allowing both carriers to avoid the administrative burdens and transaction costs needed to create and implement metering regimes.[89] In other words, the presence of transaction costs may well make flat-rate pricing the preferred institutional arrangement.

Indeed, historical patterns suggest that bill-and-keep may make economic sense even when the traffic exchanged between carriers is not symmetrical. Similar compensation issues were posed long prior to the enactment of the 1996 Act by the existence of independent (i.e., non-Bell) local telephone companies operating in the same local calling areas as AT&T. Perhaps the most prominent example of this situation is the simultaneous provision of local telephone service by GTE and Pacific Bell to adjacent neighborhoods in Los Angeles. Just as was the case with local telephone providers under the 1996 Act, these carriers needed some mechanism for compensating each other for the costs of terminating calls that originated on the other's network. Interestingly, these carriers generally relied on bill-and-keep as the mechanism for settling interconnection costs despite the fact that the size of their customer bases was far from symmetrical.[90] The implication is that the transaction cost economies associated

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88. *See* Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, First Report and Order, 11 F.C.C.R. 15499, 16055 ¶ 1112 (1996) [hereinafter Local Competition Order].

89. *See id.*

90. *See* PETER W. HUBER ET AL., FEDERAL TELECOMMUNICATIONS LAW § 2.4.1, at 174–75 (2d ed. 1999). The economics of bill-and-keep do not appear to require symmetry in total traffic. Instead it is sufficient if the number of calls each carrier originates roughly equals the number of calls it terminates. When each carrier's originations and terminations are balanced and the pattern of calls is evenly distributed across the customer base, bill-and-keep is efficient even if the total traffic generated by one carrier is much larger than the total traffic generated by the other.

The point is most easily understood through the following example. Suppose that two local networks operate in the same area, with the incumbent carrier serving 900 customers and the new entrant serving 100 customers. Each customer makes ten calls randomly distributed throughout the entire customer base. One would expect the customers of the dominant carrier to initiate 9000 calls. Ninety percent (or 8100) of those calls would terminate on the incumbent's network, while ten percent (900) would terminate on the new entrant's network. At the same time, one would expect the new entrant's customers to place 1000 calls, ten percent (100) of which would terminate on the new entrant's network and ninety percent (900) of which would terminate on the dominant carrier's network. Thus, if originations and termination are symmetric and randomly distributed, 900 calls would pass from the incumbent's network to the new entrant's network, and the same number of calls would pass in the other direction. Under these circumstances, metering actual usage would provide no economic benefits even though the total traffic handled by each network would be far from balanced. Note that a far different situation holds if the distribution of calls is not random. In addition, the symmetry of with avoiding metering costs outweighed what little benefit that would have resulted from a more accurate accounting of the actual traffic flows.

Indeed, transaction costs can help explain another one of the persistent puzzles of telecommunications pricing, which is the persistence of flat-rate pricing for local telephone service. Local telephone service in the U.S. has not historically been priced on a usage-sensitive basis. Instead, subscribers can place unlimited local calls for a flat monthly fee.[91] Economists have long theorized that the fact that local calling was unmetered at the margin was inducing customers to make excessive calls and that usage-sensitive pricing would lead to "modest" welfare gains.[92] It is for this reason that some local telephone companies began experimenting with usage-sensitive pricing regimes generally known as "local measured service" (LMS).

The economics of congestion arguably suggest that LMS would eventually emerge as the dominant pricing regime, and yet network providers, regulators, and consumers all failed to embrace LMS. Acceptance of LMS was deterred in part because of the magnitude of the transaction costs needed to meter local telephone service.[93] The available data suggest that the transaction costs associated with metering and billing for local telephone service may well be substantial. Studies conducted several years ago indicate that the costs of metering and billing represent more than 50% of the costs associated with an incremental call and roughly 100% of the incremental cost of a nonpeak call,[94] with the total cost to the industry exceeding $10 billion.[95]

The problem is further complicated by the nature of congestion on communications networks. When total network usage is relatively low and network resources are slack, the costs associated with incremental usage approach zero. It is only when demand peaks that congestion costs become significant.[96] As a

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terminations and originations does not hold if one carrier only terminates calls, such as would occur for carriers providing service to paging service providers, call centers, or Internet service providers. In that case, the resulting asymmetry on a caller-pays system would lead to substantial distortions. *See* Local Competition Order, *supra* note 88, at 16043 ¶ 1092.

91. *See* Local Competition Order, *supra* note 88, at 16055 ¶ 1112. This situation contrasts with the rate practice of much of the rest of the world, which generally employs usage-based pricing for local telephone service.

92. *See* Bridger M. Mitchell, *Optimal Pricing of Local Telephone Service*, 68 AM. ECON. REV. 517, 533 (1978).

93. *See* Michael A. Crew & Robert D. Dansby, *Cost-Benefit Analysis of Local Measured Service*, *in* REGULATORY REFORM AND PUBLIC UTILITIES 35, 41, 45 (Michael A. Crew ed., 1982); James Griffin & Thomas Mayor, *The Welfare Gain from Efficient Pricing of Local Telephone Service*, 30 J.L. & ECON. 465, 471 (1987); Alfred E. Kahn & William B. Shew, *Current Issues in Telecommunications Regulation: Pricing*, 4 YALE J. ON REG. 191, 232–34, 235–36 (1987); G. Franklin Mathewson & G. David Quirin, *Metering Costs and Marginal Cost Pricing in Public Utilities*, 3 BELL J. ECON. & MGMT. SCI. 335 (1972); Mitchell, *supra* note 92, at 517; Lee W. Selwyn, *Perspectives on Usage-Sensitive Pricing*, PUB. UTILS. FORTNIGHTLY, May 7, 1981, at 15.

94. *See* MacKie-Mason & Varian, *supra* note 24, at 263.

95. *See* Tim Wilson, *Billing Systems Market Reaps Huge Growth: How Telecom Carriers Handle Phone Bills Can Make or Break Their Customer Base*, TELEPATH, Jan. 5, 1998, at T15.

96. *See* Spulber & Yoo, *supra* note 73, at 1712.

result, a first-best solution would require imposing a form of peak-load pricing in which the usage charge at any particular moment varies with network elements being used and the level of demand being placed on those elements.[97] Thus, as a theoretical matter, economic efficiency would require that prices vary with each local exchange and would vary from one moment to the next depending on the particular level of network demand.[98] As a practical matter, however, the inability to make such minute adjustments prevents networks from charging prices that are precisely calibrated toward actual usage. Instead, network owners typically divide the day into peak and off-peak periods and charge uniform prices during those periods that exceed the true congestion costs of the lower-volume segments of the period and that fall short of the true congestion costs of the higher-volume segments of the period. Variations in demand within those periods inevitably lead to some degree of economic inefficiency, since the uniformity of prices during the period will deter efficient calls during the low-volume segments of the period and will not deter inefficient calls during the high-volume segments of the period. The welfare losses created by these imperfections in the pricing regime become another source of inefficiency that offsets the welfare benefits of usage-sensitive pricing.[99] The combination of transaction costs and the inefficiency caused by the inability to precisely tailor prices to current demand may be sufficient to render usage-based pricing uneconomical.

In addition, networks are complex systems that can adapt in ways that are hard to predict. For example, increasing a particular flow through a saturated network element by ten percent will not necessarily reduce the carrying capacity of the network by ten percent, since the network may be able to compensate by rerouting traffic through other paths. Networks' ability to compensate for changes in network flows can cause the elements that are saturated to shift in discontinuous ways that greatly complicate determining the precise impact of increasing a network flow at any particular time.[100] Customers' aversion to complex pricing regimes further limits networks' ability to implement usage-sensitive prices.[101] Furthermore, the fact that capacity expansion typically takes time and is subject to indivisibilities dictates that capacity will generally be

97. For leading analyses of peak-load pricing, see generally, for example, Marcel Boiteux, *La Tarification des demande en pointe: application de la théorie de la Vente au coût marginal* [Peak-Load Pricing: An Application of the Theory of Sale at Marginal Cost], 58 REVUE GÉNÉRALE DE L'ELECTRICITÉ 321 (1949), *translated as* M. Boiteux, *Peak-Load Pricing*, 33 J. BUS. 157 (H.W. Izzard trans., 1960); Peter O. Steiner, *Peak Loads and Efficient Pricing*, 71 Q.J. ECON. 585 (1957); Oliver E. Williamson, *Peak-Load Pricing and Optimality Constraints under Indivisibility Constraints*, 56 AM. ECON. REV. 810 (1966).

98. *See* Kahn & Shew, *supra* note 93, at 237–38.

99. *See* ROLLA EDWARD PARK & BRIDGER M. MITCHELL, OPTIMAL PEAK-LOAD PRICING FOR LOCAL TELEPHONE CALL 6, 32 (Rand Paper No. R-3404-1-RC March 1987); Kahn & Shew, *supra* note 93, at 232–34, 235–36.

100. *See* Spulber & Yoo, *supra* note 73, at 1703–06.

101. *See* Larry Garfinkle, *Usage Sensitive Pricing: Studies of a New Trend*, TELEPHONY, Feb. 10, 1975, at 24, 28.

added before it is needed. In addition, networks always maintain a certain level of excess capacity to insure against unexpected surges in demand. As a result, the network will always appear slack even when the excess capacity is simply a reflection of proper network management.[102]

The impracticality of designing a pricing regime that was precisely calibrated to the actual congestion costs associated with an incremental call led carriers implementing LMS to adopt pricing regimes that broke the day into three discrete periods: peak, near peak (called "shoulder rates"), and off peak.[103] Empirical studies of these experiments have split on the economic impact of LMS.[104] Some have concluded that the combination of metering costs and the misincentives created by the inability to set prices precisely equal to congestion costs were sufficient to render LMS uneconomical.[105] Others have concluded that adoption of LMS would enhance economic welfare,[106] although even those favoring LMS concede that any such gains were modest.[107] The failure of LMS to yield clear welfare benefits demonstrates how transaction costs can render deviating from usage-based pricing uneconomical.

Interestingly, wireless telephone pricing has moved in the opposite direction. When cellular telephones first appeared, carriers tended to charge subscribers on a strict, per-minute basis. Thus, as a theoretical matter, the wireless industry began with a pricing regime that was a model of usage sensitivity. Over time, wireless carriers began to relax their initial approach to pricing in two ways. First, they tended to sell peak minutes in bundles, so that incremental usage was not fully metered. Second, carriers began to allow subscribers to use off-peak minutes for free. The wireless industry's abandonment of an established usage-based pricing regime in favor of one with flat-rate characteristics again attests to the complexity created by the presence of significant transaction costs.

These conclusions are not unassailable by any means. For example, it is quite possible that the replacement of mechanical switches with first electrical and later digital switches has dramatically lowered the transaction costs of metering usage.[108] In addition, the persistence of usage-based pricing of local telephone service in other countries[109] raises questions of the universality of the benefits of flat-rate pricing. My argument does not, however, depend on any definitive

102. *See* Spulber & Yoo, *supra* note 73, at 1712–13, 1720.

103. *See* PARK & MITCHELL, *supra* note 99, at 1–2, 26–27, 29; Griffin & Mayor, *supra* note 93, at 472–73. Near-peak rates are necessary to avoid creating new demand peaks adjacent to the peak-load period as consumers redistribute the timing of their purchases to avoid peak-load prices. *See* Boiteux, *supra* note 97, at 173–74.

104. *See* Kahn & Shew, *supra* note 93, at 235, 237–38 (collecting sources); Steve G. Parsons, *The Economic Necessity of an Increased Subscriber Line Charge (SLC) in Telecommunications*, 48 ADMIN. L. REV. 227, 238 n.38 (1996) (same).

105. *See* PARK & MITCHELL, *supra* note 99, at 32–34.

106. *See* Griffin & Mayor, *supra* note 93, at 482.

107. *See* Kahn & Shew, *supra* note 93, at 237.

108. *See id.* at 236; David L. Kaserman & John W. Mayo, *Cross-Subsidies in Telecommunications: Roadblocks on the Road to More Intelligent Telephone Pricing*, 11 YALE J. ON REG. 119, 125 (1994).

109. *See supra* note 91.

resolution of these debates. The sheer variety of approaches to pricing local telephone service underscores the difficulty in determining whether the transaction costs are of sufficient magnitude to render usage-sensitive pricing uneconomical and demonstrates the potential benefits from allowing network owners to experiment with different institutional arrangements. Nor is local telephone service the only prominent instance in which communications networks have relied on flat-rate pricing. Consider the terms under which the Internet backbones exchange traffic. Backbones that are able to meet minimum traffic volumes exchange traffic through a system known as *peering*, under which the backbones do not charge each other for terminating traffic. In other words, top-tier backbones employ a pricing system that is equivalent to bill-and-keep systems for reciprocal compensation for terminating local telephone calls. Backbones unable to meet these minimum volume requirements enter into *transit arrangements*, under which they pay other backbones to terminate their traffic.[110] Backbones too small to peer with top-tier backbones have begun to avoid paying transit costs by entering into *secondary peering arrangements* with one another, which has helped to create a richer, less hierarchical set of interconnection arrangements that has weakened the dominant position of the top-tier backbones.[111]

This brief analysis reveals how transaction cost considerations have caused backbone providers to enter into a wide diversity of pricing arrangements, including many that do not depend on usage. The FCC has taken the existence of peering as an indication that flat-rate pricing regimes may at times prove economical.[112] At the same time, the fact that backbones limit peering to other backbones of similar size does suggest the existence of circumstances under which the preferred pricing regime will be more usage sensitive.[113]

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110. *See* Kende, *supra* note 64, at 5–7, 16–17; Jay P. Kesan & Rajiv C. Shah, *Fool Us Once Shame on You—Fool Us Twice Shame on Us: What We Can Learn from the Privatizations of the Internet Backbone Network and the Domain Name System*, 79 WASH. U. L.Q. 89, 148 (2001); James B. Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. COMM. L.J. 225, 232 (2002).

111. *See* Besen et al., *supra* note 68, at 292, 295. In addition, the development of a practice known as *multihoming*, in which middle-mile providers interconnect with more than one backbone has reduced the market power of core backbone providers still further. *See id.*

112. *See* Developing a Unified Intercarrier Compensation Regime, Notice of Proposed Rulemaking, 16 F.C.C.R. 9610, 9627 ¶ 43 (2001) [hereinafter Intercarrier Compensation NPRM].

113. Symmetry in traffic exchanged costs may not provide the only explanation for backbone peering. The Internet depends on some ISPs generating complete routing tables for the Internet, in order to avoid circularity problems in which links simply direct traffic along paths that feed back into themselves. The transaction costs of coordinating routing tables goes up as the number of core backbones increases. This suggests the existence of an optimal number of core backbones exchanging traffic on a settlement-free basis. This also suggests that other networks must be charged for terminating traffic in order to prevent them from free riding on the core backbones' efforts to maintain complete routing tables. *See* Paul Milgrom et al., *Competitive Effects of Internet Peering Policies*, *in* THE INTERNET UPHEAVAL 175, 179–85 (Ingo Vogelsang & Benjamin M. Compaine eds., 2000).

Limiting peering to large backbones may also be designed to minimize another type of free riding. For example, backbones that interconnect on a settlement-free basis would prefer coast-to-coast traffic to travel on their peering partners' network to the greatest extent possible. This would mean that they

These examples have prompted the FCC to soften its traditional hostility toward flat-rate pricing and to initiate a number of proceedings exploring broader use of pricing regimes that are not usage sensitive. For example, the FCC had tentatively concluded in 1996 that wireless providers should interconnect with wireline providers on a bill-and-keep basis.[114] In drawing this conclusion, it noted studies indicating that the transaction costs of metering the termination of traffic were sufficiently high to make bill-and-keep the more economically efficient pricing regime.[115] This effort ended when the FCC opted to fold wireless-to-wireline interconnection into the proceeding to implement the interconnection provisions of the Telecommunications Act of 1996.[116]

The FCC's interest in non-usage-sensitive pricing has continued to grow. Prompted by a pair of in-house studies supporting broader use of bill-and-keep regimes[117] and by the prevalence of peering regimes for backbone interconnection and flat-rate pricing for residential local telephone service,[118] the FCC has begun exploring whether bill-and-keep can serve as the basis for reforming the entire regime of intercarrier compensation.[119] In the process, the FCC specifically sought and received comments on whether transaction costs might justify flat-rate pricing.[120]

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would hand off traffic that they originate at the earliest possible interconnection point and would accept traffic that they terminate at the latest possible interconnection point. In other words, a backbone carrying traffic from New York to Silicon Valley would like to hand it off as early as possible and have the traffic travel across the country on its partner's backbone. Conversely, the same backbone handling traffic heading in the other direction would like the traffic to be handed off as late as possible so that again the burden of carrying the traffic falls upon its peering partner. In order to avoid this type of free riding, backbones have adopted a practice known as "hot potato routing," in which each backbone delivers packets bound for another backbone at the nearest possible interconnection point. A backbone could defeat the benefits of hot potato routing simply by maintaining a relatively small number of interconnection points located close to its customers. This possibility makes it logical for backbones to limit peering arrangements to those backbones large enough to maintain a presence at each of the major backbone interconnection points. *See id.* at 186; Kende, *supra* note 64, at 18–19.

114. *See* Interconnection Between Local Exchange Carriers and Commercial Mobile Radio Service Providers, Notice of Proposed Rulemaking, 11 F.C.C.R. 5020 (1996).

115. *Id.* at 5038 ¶ 36.

116. *See* Local Competition Order, *supra* note 88, at 16005–07 ¶¶ 1023–1026.

117. *See* Jay M. Atkinson & Christopher C. Barkenov, *A Competitively Neutral Approach to Network Interconnection* (FCC Office of Plans & Pol'y Working Paper No. 34, Dec. 2000), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp34.pdf; Patrick DeGraba, *Bill and Keep at the Central Office as an Efficient Interconnection Regime* (FCC Office of Plans & Pol'y Working Paper No. 33, Dec. 2000), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp33.pdf.

118. *See* Intercarrier Compensation NPRM, *supra* note 112, at 9615 ¶¶ 9–10.

119. *See id.* at 9624–45 ¶¶ 37–97 (seeking comment on replacing all aspects of intercarrier compensation with bill-and-keep); Developing a Unified Intercarrier Compensation Regime, Further Notice of Proposed Rulemaking, 20 F.C.C.R. 4685 (2005) [hereinafter Intercarrier Compensation Further NPRM] (seeking comment on specific industry proposals submitted in response to the FCC's request for comments on imposing bill-and-keep).

120. *See* Intercarrier Compensation NPRM, *supra* note 112, at 9628 ¶ 51; Intercarrier Compensation Further NPRM, *supra* note 119, at 4700 ¶ 30.

C. COASEAN PROXIES AS AN OVERLOOKED SOLUTION TO CONGESTION

Although incorporating transaction cost considerations has yielded important insights into the choice between flat-rate and usage-sensitive pricing, the analysis remains incomplete. The problem is that framing the issue as a choice between flat-rate and usage-sensitive pricing fails to take into account the full range of possible institutional forms. In particular, it overlooks the possibility that transaction costs can also be avoided by identifying and charging for another good that can be metered more cheaply and that can serve as a reasonable proxy for usage of the good that needs to be metered.

This solution is suggested by Ronald Coase's classic critique of lighthouses as pure public goods.[121] Lighthouses have long been regarded as posing a paradigmatic example of a market failure in need of governmental redress.[122] The standard account posits that the fact that the difficulties that lighthouse owners face in securing payment from ships that benefit from the services they provide prevents lighthouse owners from generating sufficient revenue to cover their costs. Restated in terms relevant for our purposes, the difficulties in metering the usage of lighthouse services introduce an externality that creates a wedge between private and social net product. The resulting distortion in the market for lighthouse services caused by the presence of metering costs is generally regarded as providing a classic case for governmental intervention.

Coase rebutted this account by pointing out that throughout most of the 17th and 18th centuries British lighthouses were operated by private, profit-making enterprises. Lighthouse owners were able to finance their lighthouses through tolls collected at nearby ports, since presumably only those ships that were preparing to enter port would come close enough to shore to have need of the lighthouse's services. Port usage thus represented an easily metered proxy for determining which ships had benefited from the services of the nearby lighthouse. The historical record suggests that this system was quite successful. As of 1820, thirty-four of the forty-six lighthouses in existence had been built by private individuals. Over time, these private lighthouses began to be taken over by a quasi-governmental organization known as Trinity House. Even after being acquired by Trinity House, they continued to be privately financed through user fees rather than through tax revenues.[123]

Coase's analysis of lighthouse financing suggests that framing the debate over congestion pricing as a choice between flat-rate and usage-sensitive pricing overlooks the full range of possible pricing arrangements. Although later schol-

121. *See* Coase, *supra* note 22.

122. For classic references to this proposition, see 1 JOHN STUART MILL, PRINCIPLES OF POLITICAL ECONOMY (1847), *reprinted in* 3 THE COLLECTED WORKS OF JOHN STUART MILL 968 (J.M. Robson ed., 1965); A.C. PIGOU, THE ECONOMICS OF WELFARE 183–84 (4th ed. 1948); HENRY SIDGWICK, THE PRINCIPLES OF POLITICAL ECONOMY 406 (3d ed. 1901). For more modern references, see PAUL A. SAMUELSON, ECONOMICS 159 n.1 (6th ed. 1964); JOSEPH E. STIGLITZ, ECONOMICS OF THE PUBLIC SECTOR 102 (1986).

123. *See* Coase, *supra* note 22, at 363–68.

ars have disputed the specifics of his analysis,[124] it still serves as a useful illustration of the benefits of thinking more broadly about alternative institutional solutions to the problems of exclusion. In the process, it demonstrates how public policy might be better served if providers of club goods were given the latitude to explore the use of proxies that minimize transaction costs while incorporating some of the positive features benefits associated with usage-sensitive pricing.

IV. IMPLICATIONS OF CONGESTION ECONOMICS FOR NETWORK NEUTRALITY

In this section, I apply the analytical framework developed above to the network neutrality debate. It reveals that economic justifications may exist for many of the practices criticized by network neutrality proponents. Although these restrictions would place some limits on end users' ability to run applications, access content, and attach devices as they see fit, they can also provide a new way to internalize the congestion costs that high-volume users impose on others. They can also create consumer benefits by reducing the congestion costs and by lowering the access prices that low-volume end users must pay. Although network neutrality proponents have suggested that mandating network neutrality is essential to preserving the environment for innovation on the Internet, a close examination of the economic literature reveals that such arguments are misplaced in the context of physical networks like the Internet, because the network owner has both the ability and the incentive to internalize any spillover benefits associated with innovative activity.

Shifting to a view that end user restrictions can actually promote consumer welfare would parallel the historical development of antitrust doctrine with respect to vertical integration, which transformed antitrust doctrine from a vision of competition that favored the independence of purchasers and traders to buy and sell in an open market into one considerably more hospitable towards vertical integration. Given the similarities between these two situations, the lessons of vertical integration would seem to apply with equal force to network neutrality.

A. THE ROLE OF USE RESTRICTIONS AND ACCESS TIERING IN MANAGING CONGESTION

The economic attractiveness of employing usage-sensitive pricing on the Internet turns on the nature of congestion and the magnitude of the transaction costs needed to implement such a scheme. The standard result is that in the absence of transaction costs, economic welfare would be maximized if the price of incremental usage of network services were set equal to the contribution of

124. *See* Richard A. Epstein, *The Libertarian Quartet*, REASON, Jan. 1999, at 64, *available at* http://reason.com/9901/bk.re.thelibertarian.shtml; Andrew Odlyzko, *The Evolution of Price Discrimination in Transportation and Its Implications for the Internet*, 3 REV. NETWORK ECON. 323, 325–27 (2004); David E. Van Zandt, *The Lessons of the Lighthouse: "Government" or "Private" Provision of Goods*, 22 J. LEGAL STUD. 47 (1993).

that incremental usage to network congestion. If transaction costs are sufficiently high, it may well prove more economical to allow network providers to pursue alternative pricing regimes.

Because Internet-based communications operate on fundamentally different principles, the transaction costs associated with metering Internet traffic are likely to be even more significant than those associated with local telephone service. The protocol that comprises the Internet breaks every piece of communication into smaller packets that are transmitted individually and reassembled at their destination. In addition, the Internet is connectionless, in that it does not establish a closed, dedicated circuit between the originating and the terminating computers. Instead, each packet is allowed to move independently. Because routing tables are updated dynamically, it is possible for different packets from the same communications to pass through different routes on the way to their destination. As a result, multiple records are required to account for every Internet-based communication. Indeed, the number of records needed to account for the packets associated with a ten-minute telephone call over the Internet could number in the tens of thousands.[125] Consequently, the industry has struggled to develop workable methods for metering Internet usage.[126]

At the same time, the increasingly varied and intense demands that end users are placing on the network and the rise of applications that are more sensitive to variations in throughput rates have made the need for managing congestion all the more acute.[127] Furthermore, since any impact of the congestion costs imposed by a particular user depends upon the volume and pattern of other traffic being carried by the network, congestion only begins to degrade service when the aggregate traffic levels cause individual network elements to approach saturation. A properly calibrated usage-based pricing regime might therefore need to employ a complex version of peak-load pricing.[128] In addition, usage-based pricing is further complicated by the fact that modern applications often access network resources autonomously, which limits end users' ability to exercise control over their total bandwidth usage.

It is thus quite plausible that the transaction costs needed to establish and run a properly calibrated usage-based pricing regime would be sufficiently large enough to make alternative pricing arrangements economically desirable. Furthermore, even if metering is economical in the long run, the inevitable lag in creating such a metering system may lead Internet providers to rely on alternative institutional arrangements on a transitional basis.

The significance of these transaction costs reveals why Internet providers might be interested in experimenting with alternative ways to manage the costs of congestion by forcing those who consume large amounts of bandwidth to

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125. *See* MacKie-Mason & Varian, *supra* note 24, at 263.
126. *See* Wilson, *supra* note 95.
127. *See* Christopher S. Yoo, *Beyond Network Neutrality*, 19 HARV. J.L. & TECH. 1, 21–22 (2005).
128. *See* Spulber & Yoo, *supra* note 73, at 1703–07, 1712–13.

bear the costs created by their actions. From this perspective, it would be quite sensible for providers to charge higher prices to those who engage in bandwidth-intensive activities. If enforcement of these bandwidth limits proves too costly, it may prove more efficient to prohibit certain bandwidth-intensive applications altogether. Indeed, a close analysis of the specific provisions criticized by network neutrality proponents suggest that last-mile providers have experimented with tiered pricing and use restrictions in precisely the way that theory would suggest.

In advancing this argument, I do not purport to draw any firm conclusions about the optimality of any particular form of tiered access or use restrictions. A determination of the most efficient institutional form would require detailed analysis of the relevant cost data and network flows and would likely vary from network to network. Indeed, one might well expect different networks to pursue different pricing strategies. In addition, the data would need to be updated constantly in response to technological changes. The difficulties in determining the relative merits of various forms of access tiering and end user restrictions provide one of the most powerful arguments against mandating or foreclosing any particular institutional arrangement. The plausibility of economic benefits provides sufficient justification for permitting network owners to experiment with different pricing arrangements until actual harm to competition can be demonstrated.

1. Prohibitions on Reselling Bandwidth or Acting as an Internet Service Provider

Consider first restrictions on reselling bandwidth, acting as an ISP, or attaching equipment that makes network service available to users residing outside the subscriber's premises.[129] When analyzed under the framework laid out above, such restrictions make perfect sense. A last-mile provider who finds that transaction costs render deploying usage-based pricing uneconomical may find it beneficial to turn to a flat-rate price set equal to average congestion costs imposed by an average user. Even though such usage would be unmetered at the margin, the flat-rate price could be calibrated to lead an equilibrium that approaches efficient pricing.[130] Reselling bandwidth or acting as an ISP would upset this balance by having a single connection serve multiple end users despite the fact that the cost of service was calibrated to reflect the network demands imposed by a single user. This would in turn create economic inefficiency by allowing those end users to impose congestion costs that far exceed the amount that they pay for the service. Prohibiting end users from reselling bandwidth or acting as an ISP would thus appear to represent a necessary concomitant way to facilitate flat-rate pricing.

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129. *See* Wu, *supra* note 4, at 158 tbl. 1, 160, 162.
130. *See supra* notes 83–84 and accompanying text.

2. Restrictions on Home Networking

Another practice that has drawn the ire of network neutrality proponents are restrictions on home networking, either prohibiting home networking or charging those who connect more than one computer to the network more for their service.[131] Restrictions on home networking may make sense for reasons similar to those justifying restrictions on the resale of bandwidth. Home networking technologies permit multiple computers to access the Internet through a single connection. This would be unproblematic under usage-sensitive pricing, since each subscriber would be forced to compensate the network owner and other users for the additional contribution to network congestion.

The situation is quite different if transaction costs make it more economical for network owners to rely on flat-rate pricing. In that case, the network owner sets the flat-rate price so that it equals the congestion costs imposed by the average subscriber. Calibrating this price becomes significantly more difficult if the number of computers attached to any link varies, because bandwidth usage will vary from customer to customer depending on the number of computers attached. Furthermore, the absence of any restrictions on the number of computers attached to a single connection can give rise to an adverse selection problem, as high-volume end users take advantage of information asymmetries to consume greater network resources without paying any additional compensation.[132]

The result will be to increase the flat rate charged, which simultaneously excludes some users from access and forces low-volume users to cross subsidize those who place more intensive demands on the Internet. It should thus come as no surprise that network owners have experimented with prohibiting home networking or charging those attaching multiple computers more for their service. Such an approach is perfectly sensible when viewed through the lens of congestion economics.

3. Restrictions on Attaching Devices

Another area of controversy centers on restrictions on end users' right to attach devices, such as gaming consoles, Internet phones, and WiFi routers. On some occasions, network providers have prohibited the attachment of certain equipment altogether.[133] On other occasions, providers have required customers wishing to attach such equipment to pay an additional charge.[134] The economics of congestion reveals why such measures may be quite sensible when transaction costs render usage-sensitive pricing infeasible. To the extent that online gaming consoles, Internet telephones, and home networking equipment are associated with bandwidth-intensive applications, prohibiting them or requiring

131. *See* LESSIG, *supra* note 4, at 157–58; Wu, *supra* note 4, at 161–62; Saltzer, *supra* note 4.
132. *See* Lee, *supra* note 21, at 338, 359.
133. *See* Wu, *supra* note 4, at 162.
134. *See* Schatz & Squeo, *supra* note 33.

end users employing them to pay more for their use may represent a sensible use of proxies for high-volume uses. The absence of such limits will increase the cost of access, thereby reducing the number of people able to connect to the Internet. It will also effectively allow high-volume users to free ride on the contributions made by low-volume users.

The restrictions on attaching devices to the Internet are in some tension with the FCC's historical approach toward the attachment of handsets and other customer premises equipment (CPE) to the public telephone network. With respect to telephony, both the D.C. Circuit's *Hush-a-Phone* and the FCC's *Carterfone* decisions recognized the customer's right to interconnect any device that would improve the utility of the telephone system "so long as the interconnection does not adversely affect the telephone company's operations or the telephone system's utility for others."[135] The FCC later promulgated rules (commonly known as the "Part 68" rules after their location in the Code of Federal Regulations) that allow the interconnection of any device that complies with certain designated standards.[136] As part of the second *Computer Inquiry*, the FCC also prohibited common carriers from bundling CPE with telecommunications services.[137]

The context surrounding these decisions was quite different than that surrounding the Internet. For example, telephone service in the 1950s and 1960s was provided over lines dedicated to individual residences and businesses. Placing a local telephone call thus did not place much pressure on transmission facilities shared with other users, and thus the impact that one person's usage had on the quality of service provided to other users was minimal.[138] Long distance calling did place additional pressure on shared transmission facilities, but those effects were internalized through usage-sensitive prices.

In addition, at the time these rules were promulgated, there were no viable alternatives to the local telephone network. Since there was little point in promoting innovation and competition in transmission technologies, promoting innovation and competition in complementary services represented a sensible policy goal at that time.

The FCC and the Supreme Court have both acknowledged that the underlying technological environment has changed in ways that have undercut the basis

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135. Use of the Carterfone Device in Message Toll Telephone Service, 13 F.C.C.2d 420, 424 (1968); *see also* Hush-a-Phone Corp. v. United States, 238 F.2d 266, 269 (D.C. Cir. 1956) (recognizing every subscriber's right "to use his telephone in ways which are privately beneficial without being publicly detrimental").

136. *See* 47 C.F.R. §§ 68.1–.614 (2004).

137. *See* Amendment of Section 64.702 of the Commission's Rules and Regulations, Final Decision, 77 F.C.C.2d 384, 442–45 ¶¶ 149–155 (1980) [hereinafter *Computer II* Final Decision], *aff'd sub nom.* Computer & Commc'ns Indus. Ass'n v. FCC, 693 F.2d 198 (D.C. Cir. 1982).

138. Local telephone calls do require the use of a local switch, which is a shared resource. The scalability of switching capacity makes the collective impact of call usage easier to manage than transmission capacity.

for its previous policies.[139] As an initial matter, the Internet is subject to congestion in a way that was not true with respect to conventional telephone service. The impact of congestion on other users is further exacerbated by the fact that the devices end users attach to the network have an increasingly heterogeneous impact on demand. As a result, the attachment of devices used to run bandwidth-intensive applications to the network can adversely affect the quality of service enjoyed by other end users, and these devices arguably represent situations in which restrictions on attaching devices would be permissible under both *Carterfone* and *Hush-a-Phone*. Lastly, as I will subsequently discuss in greater detail, the emergence of alternative transmission technologies is in the process of eliminating network owners' ability to use end user restrictions in an anticompetitive manner.[140]

4. Restrictions on Operating File Servers

Similar reasoning justifies restrictions on end users' ability to operate servers holding files for retrieval by other users. Prominent examples include webpage hosting, game servers, and file sharing.[141] These practices represent quintessential bandwidth-intensive uses of network services and are particularly problematic once one acknowledges that network owners will inevitably take the usual network usage patterns of typical users into account when designing their networks. Because most end users download a larger volume of traffic than they upload, network owners typically allocate bandwidth asymmetrically by devoting more bandwidth to downloading.[142] As a result, allowing end users to operate servers places particular pressure on a system designed for different usage patterns, which will degrade the quality of service for other users.

5. Discrimination Against Particular Applications

Another type of restriction that has drawn criticism from network neutrality proponents are restrictions on particular applications. Some of these restrictions are imposed against end users. For example, some acceptable use policies prohibit commercial uses outright.[143] Others simply require end users who wish to use their connections for commercial purposes to subscribe to a higher-priced service.[144] Still others have responded to reports that file-sharing programs are consuming an overwhelming share of the Internet's capacity[145] by requiring

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139. *See* Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Servs., 125 S. Ct. 2688, 2708, 2710–11 (2005); Cable Modem Declaratory Ruling and NPRM, *supra* note 30, at 4825 ¶ 44; Wireline Broadband NPRM, *supra* note 29, at 3040–42 ¶¶ 43–48.

140. *See infra* Part IV.C.3.c.

141. *See* LESSIG, *supra* note 4, at 156; Bar et al., *supra* note 4, at 510; Wu, *supra* note 4, at 153–54, 159–60; Saltzer, *supra* note 4.

142. *See* LESSIG, *supra* note 4, at 159; Wu, *supra* note 4, at 162–63.

143. *See* Wu, *supra* note 4, at 160–61.

144. *See id.* at 152; Bar et al., *supra* note 4, at 510.

145. *See Protecting Copyright and Innovation in a Post-Grokster World: Hearings Before the Judiciary Comm.*, 109th Cong. (Sept. 28, 2005) (statement of Sam Yagan, President of Meta Machine,

those who wish to file share to pay a higher charge or by barring the use of file-sharing programs altogether.[146] On other occasions, network owners discriminate against particular applications on the server side, rather than the end user side, of the network. Specifically, some networks are considering deploying devices known as "policy-based routers" that will give a higher priority to traffic based on the application with which it is associated.

The defensibility of end user restrictions on certain applications again turns on whether the applications being restricted are correlated with more intensive consumption of network resources. If so, it is reasonable to ask those who make greater use of network resources and who impose greater congestion costs on other users either to forego such behavior or to internalize the costs they impose on others.

The problems of network management can also justify the use of policy-based routers on the server side as well. As I have discussed elsewhere, one natural response to capacity constraints is to give traffic associated with time-sensitive applications, such as streaming media or VoIP, a higher priority than traffic associated with less time-sensitive applications, such as e-mail and web browsing, in which delays of a third of a second are essentially unnoticeable.[147] Discriminating among applications may thus represent nothing more than the natural response of network owners attempting to manage congestion and latency in a world in which capacity is constrained and in which end user demands are increasingly heterogeneous and intense.

6. Discrimination Against Particular Content

The development that concerns network neutrality proponents the most is the possibility that network owners will discriminate against particular content. The original concern was that network owners would completely block access to dispreferred websites,[148] although FCC commissioners have repeatedly noted

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Inc., the company that developed and distributes the market leading file-sharing program known as eDonkey) (reporting a study indicating that in North America and the United Kingdom file sharing represents 76% of total upstream and 48% of total downstream traffic, while in Europe it represents 85% of total upstream and 60% of all downstream traffic), *available at* http://judiciary.senate.gov/testimony.cfm?id=1624&wit_id=4689; *Adams Picks Sandvine*, XDSL NEWS, Aug. 1, 2005, at 13 (reporting that file sharing consumes 60% of Internet traffic); *Executive Q&A: Can BitTorrent (Yes, BitTorrent) Supercharge Mobile?*, WIRELESS BUS. FORECAST, Aug. 25, 2005, at 1 (reporting that as much as 50% of Internet traffic is file-sharing); Kathy Tracy, *New Technologies Rock the L.A. Screenings*, VIDEO AGE INT'L, May 1, 2005, at 1 (reporting that 50% of all Internet traffic is file sharing); Ryan Underwood, *VU Moves to Unload Download Burden: 3 Barred Programs Hog Internet Capacity*, NASHVILLE TENNESSEAN, Oct. 1, 2005, at 1A (estimating that file sharing consumes 37% of the available bandwidth capacity); Stephen Lawson, *London is Global Internet Bandwidth Capital*, INFOWORLD DAILY, Sept. 8, 2005 (estimating that file sharing makes up 60% of Internet traffic), *available at* http://www.infoworld.com/article/05/09/08/HNlondonbandwidth_1.html.

146. *See* Underwood, *supra* note 145, at 1A.

147. *See* Yoo, *supra* note 127, at 21–23.

148. *See supra* note 41 and accompanying text.

the lack of evidence that network owners have widely adopted such practices[149] and even network neutrality proponents acknowledge that port blocking does not represent a serious problem.[150] More recently, the focus has shifted away from the outright blocking of access and toward the danger that network owners will give traffic bound for or received from preferred content and applications providers a higher priority or will inject latency into traffic associated with dispreferred content and applications providers.[151] Although the FCC has yet to uncover any allegations that any network provider has pursued such practices,[152] network neutrality proponents remain concerned that such discrimination might harm the competitiveness and innovativeness of markets for content and applications.[153] Similarly, network neutrality proponents have expressed misgivings about what Professor Lessig has called "access tiering," in which content and applications pay different access charges depending on the levels of service they would like to receive. The concern is that allowing large content and applications to obtain guaranteed levels of bandwidth will restrict the opportunities of other innovators who wish to offer Internet-based services.[154]

These arguments overlook the fact that the type of discrimination they decry represents one of the most innovative ways found to date to mitigate the problems of congestion and latency on the Internet. The following example provides an apt illustration of my point: Suppose that an end user located in Los Angeles attempts to download a webpage from a leading content provider, such as CNN.com. If CNN hosted the content itself, all such queries would be transmitted to CNN's server (presumably located in CNN's headquarters in Atlanta). The distance that the packets comprising both the query and the response would have to travel guarantees that this transaction would suffer from at least some degree of latency. In addition, the network access points where backbones exchange traffic may well be congested,[155] as might CNN's file server.

A new technological solution known as "content delivery networks" has emerged that has the potential to mitigate these problems.[156] Content delivery

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149. *See supra* note 33 and accompanying text.

150. *See, e.g.*, Lessig Testimony, *supra* note 43, at 5 (calling port blocking problems "isolated"); Anne Broache & Declan McCullagh, *Playing Favorites on the Net?*, CNET NEWS.COM, Dec. 21, 2005, *available at* http://news.com.com/Playing+favorites+on+the+Net/2100-1028_3-6003281.html (noting that network neutrality proponent Amazon.com acknowledged that outright blocking of sites was not a current problem and was unlikely to become one in the future).

151. *See* Verizon-MCI Order, *supra* note 11, at 18507–08 ¶ 140; SBC-AT&T Order, *supra* note 11, at 18366 ¶ 141; LESSIG, *supra* note 4, at 160.

152. *See* Verizon-MCI Order, *supra* note 11, at 18508–09 ¶ 141; SBC-AT&T Order, *supra* note 11, at 18367 ¶ 142.

153. *See* LESSIG, *supra* note 4, at 160.

154. *See* Lessig Testimony, *supra* note 43, at 2, 8–10.

155. *See* Kende, *supra* note 64, at 6.

156. For an excellent overview of content delivery networks, see Dave Clark et al., The Growth of Internet Overlay Networks: Implications for Architecture, Industry Structure and Policy 15–28 (Sept. 8, 2005) (unpublished manuscript, presented at the 33rd Research Conference on Communication,

networks dynamically store content and applications at multiple locations throughout the Internet. When a last-mile network receives a query for content stored on a content delivery network, instead of blindly directing that request to the designated URL, the content delivery network may redirect the request to a particular cache that is more closely located or less congested. In the process, it can minimize delay and congestion costs by taking into account the topological proximity of each server, the load on each server, and the relative congestion of different portions of the network. In this manner, content delivery networks can dynamically manage network traffic in a way that can minimize transmission costs, congestion costs, and latency. Distributing multiple copies of the content throughout the Internet also enhances network performance in other ways, by allowing content and applications providers to aggregate server capacity and by giving them added protection against denial of service attacks.[157] Using distributed caching to bypass the backbones also weakens whatever market power is enjoyed by backbones and regional ISPs.[158] Content delivery networks have proven tremendously successful. The leading content delivery network, known as Akamai, reportedly maintains more than fourteen thousand servers and handles more than fifteen percent of the world's web content.[159] Indeed, it is conceivable that content delivery networks might displace the current architecture and become *the* network, in much the same way that the Internet began as an overlay on top of a voice network and is now in the process of displacing the voice network.[160]

Content delivery networks thus appear to be an important alternative solution to reducing network costs, managing congestion, and minimizing latency. The problem is that content delivery networks violate network neutrality. Not only does URL redirection violate the end-to-end argument by introducing intelligence into the core of the network;[161] the fact that content delivery networks are commercial entities means that their benefits are available only to those entities willing to pay for their services. In other words, MSNBC.com would suffer greater latency and congestion than CNN.com unless it is also willing to pay a content delivery network to assist in delivering its content.[162]

Information and Internet Policy), *available at* http://web.si.umich.edu/tprc/papers/2005/466/TPRC_Overlays_9_8_05.pdf.

157. *See id.* at 23.

158. *See* Besen et al., *supra* note 68, at 292.

159. *See* Wilson P. Dizard III, *Sliming from 170 to One: DHS Wants to Consolidate Portals and Web Sites, Now It's Looking for the Right Tools*, WASH. TECH., June 6, 2005.

160. *See* Clark et al., *supra* note 156, at 5, 9–10, 43.

161. *See id.* at 18. For my critique of the way the end-to-end argument has been applied to the network neutrality debate, see Yoo, *supra* note 64, at 41–46.

162. Network neutrality proponents also oppose access tiering because end users will not be able to determine whether problems with latency are the responsibility of the network owner or the content and applications provider. *See* LESSIG, *supra* note 4, at 160. Interestingly, the Supreme Court has upheld a district court decision condoning the bundling of complementary services (in this case installation and service of a cable television system) with a monopoly product (in this case cable television equipment) in part on the grounds that, should problems with the system develop, consumers would be unable to

To the extent that it would prohibit networks from charging content and applications providers for higher levels of service, network neutrality would thus threaten to foreclose one of the most innovative solutions to the problems of congestion and delay. Indeed, preventing network owners from pricing bandwidth would foreclose them from employing the most widely used mechanism for allocating scarce resources in our society. In the process, prohibiting access tiering would have the unintended effect of favoring current industry players whose offerings are not particularly bandwidth-intensive or time-sensitive, while impeding the development of new applications whose creators would gladly pay for higher guaranteed throughput rates if given the chance.[163]

7. The Insufficiency of Capacity Expansion and Tiered Pricing as Alternatives

Despite acknowledging that deviations from network neutrality may be justified by the needs of network management,[164] network neutrality proponents still argue against such restrictions. These arguments bear close scrutiny because it is the persuasiveness of these justifications for overriding the needs of network management that will determine the overall convincingness of network neutrality proposals.

For example, Lessig acknowledges that the need to preserve quality of service may justify some discrimination among applications,[165] but suggests that this problem can be solved simply by increasing capacity. Although Lessig recognizes that the prospect of unlimited bandwidth is a classic example of the impossible economic free lunch, he nonetheless states, "I'm willing to believe in the potential of essentially infinite bandwidth. And I am happy to imagine the scarcity-centric economist proven wrong."[166]

Relying on capacity expansion to solve the problems related to congestion implicitly presumes that capacity will grow faster than network demand.[167] Over the longer term, there is no compelling reason to believe *a priori* that that will be the case,[168] especially given the number of would-be providers of bandwidth-intensive applications that are waiting in the wings and in light of the fact that the number of potential connections increases quadratically as the

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determine whether the problems resulted from the equipment or the manner in which the equipment had been installed and maintained. Under those circumstances, it was reasonable to allow the provider bundle them together during the initial growth phase of its business. *See* United States v. Jerrold Elecs. Corp., 187 F. Supp. 545, 557–58, 560 (E.D. Pa. 1960), *aff'd mem.*, 365 U.S. 567 (1961).

163. In the words of one industry consultant, "'If I have an expanding business or I create a [high-bandwidth] application, I'd gladly pay for better service.'" *See* Ben Worthen, *The Net Neutrality Debate: You Pay, You Play?*, CIO MAG., Apr. 15, 2006, *available at* http://www.cio.com/archive/041506/net.html?page=3.

164. *See supra* note 14 and accompanying text.

165. *See* LESSIG, *supra* note 4, at 46, 174.

166. *Id.* at 47.

167. *See* Yoo, *supra* note 127, at 22, 70–71.

168. *See* MacKie-Mason & Varian, *supra* note 24, at 260.

number of end users connected to the system increases.[169] Indeed, many observers take for granted the existence of a cadre of would-be providers of bandwidth-intensive applications waiting in the wings to soak up any increases in capacity.

Relying on capacity expansion to solve problems related to congestion also ignores the problems associated with the inherent impossibility of perfect forecasting of demand and the inability to expand capacity instantaneously. Unless network owners are able to anticipate changes in demographic patterns, improvements in networking technology, and the development of complementary products that drive demand for network services, situations will exist in which network owners underestimate the growth in network demand. When that occurs, some form of network management may prove to be the only viable short-run solution. Stated more generally, capacity expansion and network management represent alternative approaches to dealing with the problems of congestion. Because the relative costs of each solution are likely to be different and likely to vary over time, there appears to be no reason to erect what would amount to a systematic preference for one solution over the other.[170]

To cite one salient example, the widescale deployment of personal computers (PCs) during the mid-1980s allowed end users to connect to the precursor to the Internet maintained by the National Science Foundation (known as NSFNET) through PCs rather than dumb terminals. The increased functionality provided by the PC enabled users to run increasingly bandwidth-intensive applications on the network, most notably file transfer programs. As a result, terminal-based NSFNET sessions began to run unacceptably slowly. Because capacity cannot be added instantaneously, NSFNET adopted the interim solution of reprogramming its routers to give terminal sessions priority over file transfer sessions.[171] This emergence of the PC represents an exogenous shock caused by a technological development in a related technology that is inevitable in the broadband industry and which makes anticipating the future demand for capacity difficult. This example also shows how discrimination on the basis of the application can be the preferred (and perhaps the only feasible) solution to problems of managing a network in an environment characterized by rapid changes in technology and consumer demand. Given that the costs of discrimination and capacity expansion are likely to vary from case to case, and amidst the uncertainty that the cost of adding capacity will decline faster than demand for network capacity will grow, it would seem imprudent to precommit to one solution over the other.

Other commentators urge network owners to solve congestion problems through tiered pricing.[172] Although tiered pricing would solve some of the problems associated with congestion costs, it would also require the establish-

169. *See* Spulber & Yoo, *supra* note 73, at 1696 (noting that for *n* users, the number of total possible connections is $(1/2)n(n-1)$).

170. *See* Yoo, *supra* note 127, at 21–23, 71.

171. *See id.* at 22–23; Mackie-Mason & Varian, *supra* note 24, at 259.

172. *See* Wu, *supra* note 4, at 154.

ment of mechanisms for monitoring bandwidth usage and for bringing enforcement actions against those who exceed the bandwidth limits. As a result, it would require the incurrence of transaction costs quite similar to those required to implement a regime of usage-sensitive pricing. To the extent that the transactions costs are likely to render usage-sensitive pricing uneconomical, they will probably also preclude the use of tiered pricing as a solution.

B. A BROADER PERSPECTIVE ON CONSUMER WELFARE

The foregoing analysis demonstrates that, contrary to the suggestions of network neutrality proponents, allowing some end user restrictions may in fact be welfare enhancing. In so doing, it underscores the often overlooked downside to the image of competition advanced by network neutrality proponents, in which end users and providers of content and applications are able to contract with each other freely in a constantly shifting spot market. Use of the alternative institutional forms can in fact benefit consumers by effectively lowering the prices paid by low-volume end users. In addition, increasing the economic efficiency of the overall pricing system should lower the price of basic access, which in turn should increase the number of people able to benefit from the network's services.[173]

In this sense, the debate over network neutrality bears a number of striking parallels to the debate over vertical integration under the antitrust laws.[174] Until the mid-1970s, the Supreme Court clearly embraced a vision of competition quite similar to that espoused by network neutrality proponents. Fueled by a scholarly literature that was largely distrustful of vertically integrated enterprises,[175] the Supreme Court invalidated a wide range of exclusivity arrangements on the grounds that they infringed on consumers' freedom of choice.[176] The Court invalidated other exclusivity arrangements as an impermissible restriction on manufacturers' ability to access all channels of distribution.[177]

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173. *See supra* note 24 and accompanying text.

174. *See generally* Alan J. Meese, *Farewell to the Quick Look: Redefining the Scope and Content of the Rule of Reason*, 68 ANTITRUST L.J. 461, 466–77 (2000) (providing an overview of the shift in antitrust policy).

175. *See, e.g.*, JOE S. BAIN, INDUSTRIAL ORGANIZATION 381 (2d ed. 1968); ADOLPH A. BERLE, JR., & GARDINER C. MEANS, THE MODERN CORPORATION AND PRIVATE PROPERTY 350–51 (1932); ARTHUR ROBERT BURNS, THE DECLINE OF COMPETITION: A STUDY OF THE EVOLUTION OF AMERICAN INDUSTRY 462–521 (1936); EDWARD CHAMBERLIN, THE THEORY OF MONOPOLISTIC COMPETITION 122–23 (3d ed. 1938). *See generally* Herbert Hovenkamp, *The Antitrust Movement and the Rise of Industrial Organization*, 68 TEX. L. REV. 105, 153–66 (1989) (surveying the intellectual history of the hostility towards vertical integration).

176. *See* FTC v. Brown Shoe Co., 384 U.S. 316, 321 (1966) (holding that exclusive dealing contracts "conflict[ ] with the central policy of [the antitrust laws] against contracts which take away freedom of purchasers to buy in an open market"); Times-Picayune Publ'g Co. v. United States, 345 U.S. 594, 605 (1953) (concluding that tying arrangements represent an improper interference with "buyers' independent judgment" about the merits of the product).

177. *See* United States v. Topco Assocs., Inc., 405 U.S. 596, 610–11 (1972) (invaliding exclusive sales territories as an unlawful restriction on an individual seller's right not to be foreclosed from any

Over time, however, the Court began to realize that this atomistic vision of competition often exacted a steep price.[178] Economic theorists began to identify circumstances under which vertical integration and vertical contractual restraints could promote efficiency, either by eliminating downstream monopoly pricing[179] or by rationalizing the proportions of variable inputs.[180] Even more important was the realization that vertical integration could also yield transaction cost efficiencies that could not be realized in the world of unfettered buyer and trader freedom.[181] In particular, economists began to recognize how vertical integration and vertical contractual restraints that simulate vertical integration (such as exclusive dealing contracts, tying, and territorial exclusivity) can reduce the transaction costs needed to protect against opportunism.[182]

The Supreme Court eventually embraced this emerging vision in its landmark decision in *Continental T.V., Inc. v. GTE Sylvania*, in which it accepted the reduction of the transaction costs needed to guard against opportunism as a pro-competitive business justification sufficient to support holding exclusivity agreements.[183] In the process, the Court rejected buyer and trader freedom as independent values that justify regulatory intervention even in the absence of any showing of harm to competition.[184] In so doing, the Court implicitly reaffirmed the principle that the antitrust laws were enacted for "the protection of *competition*, not *competitors*."[185] If competition is sufficiently robust, the

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one sector of the economy); Albrecht v. Herald Co., 390 U.S. 145, 152–53 (1968) (holding that price fixing agreements "'cripple the freedom of traders and thereby restrain their ability to sell in accordance with their judgment'" (quoting Kiefer-Stewart Co. v. Joseph E. Seagram & Sons, Inc., 340 U.S. 211, 213 (1951))), *overruled by* State Oil Co. v. Khan, 522 U.S. 3 (1997); Klor's, Inc. v. Broadway-Hale Stores, Inc., 359 U.S. 207, 212–13 (1959) (concluding that group boycotts "cripple the freedom of traders and thereby restrain their ability to sell in accordance with their own judgment" and "takes from Klor's its freedom to buy appliances in an open competitive market," and "deprives . . . manufacturers and distributors of their freedom to sell to Klor's").

178. *See generally* Christopher S. Yoo, *Vertical Integration and Media Regulation in the New Economy*, 19 YALE J. ON REG. 171, 189–90, 192–200, 260–64 (2002) (reviewing the potential efficiencies from vertical integration).

179. *See, e.g.*, Fritz Machlup & Martha Taber, *Bilateral Monopoly, Successive Monopoly, and Vertical Integration*, 27 ECONOMICA 101 (1960); Joseph J. Spengler, *Vertical Integration and Antitrust Policy*, 58 J. POL. ECON. 347 (1950).

180. *See, e.g.*, Lionel W. McKenzie, *Ideal Output and the Interdependence of Firms*, 61 ECON. J. 785 (1951); John M. Vernon & Daniel A. Graham, *Profitability of Monopolization by Vertical Integration*, 79 J. POL. ECON. 924 (1971).

181. *See, e.g.*, R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

182. *See* Yoo, *supra* note 178, at 192–200, 260–64. For some of the leading authorities in this literature, see OLIVER E. WILLIAMSON, MARKETS AND HIERARCHIES: ANALYSIS AND ANTITRUST IMPLICATIONS 20–40, 82–131 (1975); Benjamin Klein et al., *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 J.L. & ECON. 297 (1978); and Lester G. Telser, *Why Should Manufacturers Want Fair Trade?*, 3 J.L. & ECON. 86 (1960).

183. 433 U.S. 36, 54–55 (1977).

184. *Id.* at 53 n.21 (rejecting the proposition that "the Sherman Act was intended to prohibit restriction on the autonomy of independent businessmen" even in the absence of harm to competition).

185. Brown Shoe Co. v. United States, 370 U.S. 294, 320 (1962) (offering the classic statement of this proposition). For more recent statements, see *NYNEX Corp. v. Discon, Inc.*, 525 U.S. 128, 135 (1998); *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 224 (1993); *Atlantic*

reduction in freedom of some consumers or manufacturers does not rise to the level of antitrust concern, as any consumer who wishes to avoid the strictures of the exclusivity arrangement can do so simply by shifting their purchases to another provider.[186]

Sylvania marked a sea change in competition policy with respect to vertical integration. Following *Sylvania*, the debate shifted away from the impact on individual buyers and traders and instead focused on increasingly sophisticated analyses of whether or not particular exclusivity arrangements promote economic welfare.[187] Thereafter, antitrust law has become increasingly hospitable to vertical integration and vertical contractual restraints.[188]

The image of end user and application/content provider freedom that lies at the center of network neutrality is quite reminiscent of the vision of an atomized market composed of small manufacturers that dominated pre-*Sylvania* antitrust law. Indeed, network neutrality proponents often wax rhapsodic about the early days of the Internet when small innovators were important sources of new Internet content and applications.[189] That the Court has since rejected this vision and has acknowledged that vertical integration and exclusivity arrangements can often promote competition is quite striking and suggests a dramatically different model of industrial organization. This history of vertical integration thus cautions against taking too narrow a vision of competition and taking too skeptical a position with respect to exclusivity.

C. THE IMPACT OF EXCLUSIVITY ON INNOVATION

Network neutrality proponents do not simply justify their arguments on the need to preserve the autonomy of end users and providers of applications, content, and devices for its own sake. They also argue that network neutrality is essential to promoting and preserving innovation on the Internet. The concern is that without guaranteed access to markets, content and applications providers will be deterred from innovating and that network owners will make decisions

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Richfield Co. v. USA Petroleum Co., 495 U.S. 328, 338 (1990); *Cargill, Inc. v. Monfort of Colorado, Inc.*, 479 U.S. 104, 110 (1986); and *Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc.*, 429 U.S. 477, 488 (1977).

186. *See* Jefferson Parish Hosp. Dist. No. 2 v. Hyde, 466 U.S. 2, 11–12 (1984); N. Pac. Ry. Co. v. United States, 356 U.S. 1, 6–7 (1958).

187. *See, e.g.*, Jonathan B. Baker, *Recent Developments in Economics That Challenge Chicago School Views*, 58 ANTITRUST L.J. 645 (1989); Herbert Hovenkamp, *Antitrust Policy After Chicago*, 84 MICH. L. REV. 213, 255–83 (1985); Michael S. Jacobs, *An Essay on the Normative Foundations of Antitrust Economics*, 74 N.C. L. REV. 219, 240–50 (1995).

188. *See, e.g.*, State Oil Co. v. Khan, 522 U.S. 3 (1997); Spectrum Sports, Inc. v. McQuillan, 506 U.S. 447, 459 (1993); Bus. Elecs. Corp. v. Sharp Elecs. Corp., 485 U.S. 717 (1988); Barry Wright Corp. v. ITT Grinnell Corp., 724 F.2d 227, 236–37 (1st Cir. 1983) (Breyer, J.). *See generally* Yoo, *supra* note 178, at 187–205 (tracing this shift in the vertical integration doctrine).

189. *See, e.g.*, Lessig Testimony, *supra* note 43, at 4.

that hurt the interests of the public as a whole.[190]

Both the FCC and network neutrality proponents recognize that it is typically in the best interests of network owners to maximize the value that end users derive from their network connections.[191] Indeed, competition policy has long rejected the notion that the owners of bottleneck facilities have systematic incentives to expand into vertically related markets for the simple reason that there is only one monopoly rent generated by any vertical chain of production and a monopolist can extract the entirety of that rent without vertically integrating simply by charging the monopoly price for the bottleneck facility.[192] Although later theorists identified limited circumstances under which the one monopoly rent theorem does not hold, those models explicitly or implicitly assume that the relevant markets are both concentrated and protected by barriers to entry.[193] For reasons described more completely below,[194] those structural preconditions are not satisfied in the context of broadband, which makes it far more likely that vertical integration is motivated by a desire to achieve efficiencies than it is by a desire to harm competition in the adjacent market.

One would thus expect a network owner's natural instinct would be to open up its network to all content and applications providers, because doing so would maximize the value of its network and thus maximize the amount that it could charge for network access. Because innovation in applications and content only serves to increase a network's value, network owners should have every incentive to encourage such innovation. To the extent that innovation is best promoted by an open architecture, network owners can generally be expected to embrace it in the absence of some element that leads to market failure.[195] The failure of early proprietary services provided by America Online, CompuServe, and Prodigy[196] attests to the market's ability to discipline network owners who attempt to impose closed architectures on consumers who prefer open ones.

This underscores the extent to which the interests of network owners on the one hand and the interests of content and application providers on the other hand are aligned. Both have a strong interest in maximizing total sales, since

190. *See* Wu and Lessig *Ex parte*, *supra* note 7, at 3–9; LESSIG, *supra* note 4, at 156, 168, 175; Mark A. Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. REV. 925, 932, 945–46 (2001); Wu, *supra* note 4, at 145, 155.

191. *See* Wireline Broadband Access Order, *supra* note 48, at 14892–94 ¶¶ 74–76; LESSIG, *supra* note 4, at 161; Wu, *supra* note 4, at 142; Wu and Lessig, *Ex parte*, *supra* note 7, at 7.

192. *See* Yoo, *supra* note 178, at 188–89. For the seminal statement of this proposition, see Ward S. Bowman, Jr., *Tying Arrangements and the Leverage Problem*, 67 YALE L.J. 19, 20–21 (1957).

193. *See* Yoo, *supra* note 178, at 202–05, 265–67.

194. *See infra* Part IV.C.2–3.

195. *See* 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) (noting that "the platform monopolist has an incentive to be a good steward of the applications sector for its platform"); Speta, *supra* note 1, at 76 (noting that network owners have the incentive to maximize the value of complementary services); *cf.* Benjamin, *supra* note 1, at 2086–89 (making a similar point in the context of spectrum-based networks).

196. *See supra* note 1 and accompanying text.

doing so will maximize their joint profits. Indeed, this is the same conclusion that the FCC's Network Inquiry Special Staff drew more than twenty years ago with respect to the relationship between the broadcast television networks (the analog to modern applications and content providers) and their local affiliates (the analog modern last-mile providers). Simply put, both players have a strong interest in maximizing joint profits. They will inevitably vie with one another over how those profits should be divided.[197] Although the division of profits will be of intense interest to the parties, it raises few, if any, policy implications.

From this perspective, absent market failure, mandating network neutrality is unnecessary at best and counterproductive at worst. If innovation is better promoted by open architectures, network owners can be expected to embrace network neutrality voluntarily, in which case regulatory intervention would be unnecessary. If innovation is better promoted by closed architectures, mandating network neutrality would only serve to frustrate the very goals that network neutrality would purport to promote. It is for this reason that network neutrality arguments necessarily depend on the presence of some externality that creates market failure by driving a wedge between the private benefits network owners capture and the benefits that accrue to society as a whole.[198] To supply this critical element, network neutrality proponents turn to the branch of economics concerning *network economic effects*.[199]

1. The Inapplicability of Network Economic Effects

Network economic effects arise when the value of the network is determined by the number of other users connected to the same network.[200] The value of a network to an innovator depends on the number of customers it can reach through the network. The larger the number, the more valuable the network.[201] The problem is that end users who join a network are typically unable to capture the benefits created by their adoption decision. Some scholars regard the presence of these unappropriable benefits as a positive *network externality* that will cause overall utilization of the network to drop below efficient levels.[202] The result is a collective action problem that leads individuals to make decisions that deviate from the outcomes that would prevail if coordination were

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197. *See* STANLEY M. BESEN ET AL., MISREGULATING TELEVISION 55–57, 65 (1984).

198. *See* LESSIG, *supra* note 4, at 162, 168, 175.

199. *See generally* Mark A. Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 CAL. L. REV. 479 (1998) (surveying the literature on network economic effects).

200. A classic example is the choice between VHS and Beta formats for video cassette recorders (VCRs). Network economics would suggest that in choosing which type of VCR to buy, a consumer cared less about the technical capabilities of each format and more about which format was adopted by other consumers. *See* W. Brian Arthur, *Positive Feedbacks in the Economy*, 262 SCI. AM. 92, 92 (1990). For a cogent argument against regarding VHS's victory over Beta as the result of network economic effects, see S.J. Liebowitz & Stephen E. Margolis, *Should Technology Choice Be a Concern for Antitrust Policy?*, 9 HARV. J.L. & TECH. 283, 314–16 (1996).

201. *See* LESSIG, *supra* note 4, at 171.

202. *See, e.g.*, Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985).

possible. Similarly, when different providers own and operate portions of the network, the decisions of owners of particular portions of the network can create costs and benefits that they do not fully internalize. Individual providers may find it individually profitable to engage in behavior that harms the network as a whole. These theorists also suggest that the presence of network externalities can turn exclusivity into a competitive weapon. By providing exclusive access to certain content, the owners of the largest networks can leave end users who wish to access that content no choice but to join their network. Network neutrality proponents also contend that network economic effects can adversely affect innovation. Exclusivity arrangements can prevent content and applications providers from reaching the critical mass of potential customers needed to support their products. The inability to reach these customers lowers the incentive to invest in innovative content and applications.[203]

The problem with these arguments is that they ignore the fact that network externality theory is subject to a number of caveats and limiting conditions.[204] For example, network neutrality advocates overlook the fact that network economics gives rise to two effects that push in opposite directions.[205] On the one hand, a decision by a network to leave an existing standard in favor of a new standard provides value to those who have already adopted the new standard. The inability to capture this benefit can create a positive externality which will make network owners too reluctant to switch standards, which leads to a situation sometimes called *excess friction*. At the same time, a decision to switch to a new standard necessarily reduces the value of the network running on the existing standard. The fact that network owners who switch standards do not bear these costs gives rise to a negative externality that makes them too eager to switch standards and can lead to a situation known as *excess momentum*.

Whether networks switch standards too frequently or not frequently enough from the standpoint of social welfare depends upon which of these two effects dominates. This creates an empirical question that cannot be answered *a priori* and does not necessarily favor complete interoperability on open standards. Indeed, a formal model developed by Michael Katz and Carl Shapiro suggests competition between proprietary standards is more likely to lead to the adoption of the socially optimal technology than is competition in which one or both of the competing standards are nonproprietary.[206] The ambiguity of this balance is demonstrated dramatically by comparing the positions taken by network neutral-

203. *See* LESSIG, *supra* note 4, at 171; Wu, *supra* note 4, at 151.

204. The discussion that follows is based on Yoo, *supra* note 178, at 278–85, and Spulber & Yoo, *supra* note 28, at 925–30.

205. *See* Yoo, *supra* note 178, at 278–79 (citing Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 AM. ECON. REV. 940, 941–42 (1986)).

206. Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822 (1986).

ity proponents with the concern traditionally associated with network economics. The traditional concern is that network economic effects will cause a network to become locked into an obsolete standard.[207] Network neutrality is concerned that network owners will be *too eager* to deviate from the current regime of universal interoperability.[208]

Furthermore, the arguments advanced by network neutrality proponents overlook the fundamental difference between networks in which end users are physically interconnected (called *direct network externalities*) and networks in which the relationship between end users are mediated by a market (called *indirect network externalities*).[209] Direct network externalities do not represent an economic problem. Because they arise within a physical network that can be owned, the network owner is in an ideal position to solve the collective action problem by capturing the benefits created by increases in network size. Thus, even if end users are unable to appropriate all of the benefits associated with their adoption decisions, the network owner is in a position to internalize these benefits by charging prices that reflect the benefits new users confer on incumbents. Indeed, the owner of a physically interconnected network has every incentive to maximize the value of the network in this manner.[210] The fact that the benefits resulting from any increase in the network's value would accrue directly to the network owner effectively aligns social benefits with private benefits.[211]

Finally, concerns about network economic effects are ameliorated further by the fact that the broadband industry is undergoing rapid growth. Both cable modem and DSL providers have continued to add subscribers at a brisk pace.[212] A host of new technologies, including third-generation mobile communications

207. *See, e.g.*, W. Brian Arthur, *Competing Technologies, Increasing Returns, and Lock-In by Historical Events*, 99 ECON. J. 116 (1989); Farrell & Saloner, *supra* note 205, at 942–43; Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, J. ECON. PERSP., Spring 1994, at 93, 108; *cf.* Mark A. Lemley, *Antitrust and the Internet Standardization Problem*, 28 CONN. L. REV. 1041, 1045–54 (1996) (arguing that Internet standards are subject to lock-in).

208. *See* LESSIG, *supra* note 4, at 48, 168, 171, 176.

209. *See* Katz & Shapiro, *supra* note 202, at 424; Joseph Farrell & Garth Saloner, *Standardization, Compatibility, and Innovation*, 16 RAND J. ECON. 70, 70–71 (1985).

210. *See* S.J. Liebowitz & Stephen E. Margolis, *Are Network Externalities a New Source of Market Failure?*, 17 RES. LAW & ECON. 1, 11–13 (1995); S.J. Liebowitz & Stephen E. Margolis, *Network Externality: An Uncommon Tragedy*, 8 J. ECON. PERSP. 133, 137 (1994).

211. Network neutrality proponents more plausibly argue that negotiating exclusivity arrangements can result in transaction and coordination costs. *See* LESSIG, *supra* note 4, at 162, 171. At the same time, the FCC has recognized that imposing nondiscrimination requirements creates transaction costs of their own. *See* Wireline Broadband Access Order, *supra* note 48, 14887–92 ¶¶ 65–73, 14904–05 ¶ 97. The fact that transaction cost considerations push in both directions effectively undercuts any attempt to derive simple policy inferences with respect to network neutrality. Moreover, the reduction in transaction costs made possible by the Internet and the proliferation of institutional solutions, such as centralized transaction clearinghouses, makes it likely that over time the balance will shift in favor of permitting greater exclusivity.

212. *See* FED. COMMC'NS COMM'N, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2005, at 2–3, tbls.2–4 (Apr. 2006), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-264744A1.pdf.

devices (3G), broadband over powerline (BPL), and wireless hotspots employing WiFi technology, are waiting in the wings.[213] When that is the case, application and content providers will be less concerned about current market shares of broadband providers and more about the relative market positions they will obtain in the future and should find it relatively easy to vie for new customers. In short, it is the market of tomorrow, not the market of today, that will determine the behavior of applications and content providers.[214]

2. The Lack of Concentration in a Properly Defined Market

Furthermore, a close examination of the leading models of network economic effects reveals that anticompetitive outcomes necessarily depend on the existence of a dominant network owner with market power.[215] It is a common misperception that the broadband markets are sufficiently concentrated to justify regulatory intervention.[216] On the contrary, once the relevant markets that network neutrality is designed to protect have been properly identified, it becomes clear that the concentration levels fall short of those traditionally associated with anticompetitive concern.[217]

The key to understanding this important insight is recognizing that application and content providers care about the total number of users they can reach. So long as their total potential customer base is sufficiently large, it does not really matter whether they are able to reach users in any particular city. This point is well illustrated by a series of recent decisions regarding the market for cable television programming. As the FCC and the D.C. Circuit recognized, a television programmer's viability does not depend on its ability to reach viewers in any particular localities, but rather on the total number of viewers it is able to reach nationwide. So long as a cable network can reach a sufficient number of viewers to ensure viability, the fact that a particular network owner may refuse carriage in any particular locality is of no consequence.[218] The FCC has similarly rejected the notion that the local market power enjoyed by early cellular telephone providers posed any threat to the cellular telephone equip-

213. Availability of Advanced Telecommunications Capability in the United States, FCC, Fourth Report to Congress, 19 F.C.C.R. 20540, 20553–62 (2004) [hereinafter Fourth § 706 Report].

214. *See* Michael L. Katz & Carl Shapiro, *Product Introduction with Network Externalities*, 40 J. INDUS. ECON. 55, 67, 73 (1992); Liebowitz & Margolis, *supra* note 200, at 292.

215. *See* Spulber & Yoo, *supra* note 28, at 923, 926; *cf.* Yoo, *supra* note 178, at 202–05, 265–67 (noting that the post-Chicago theories supporting the monopoly leverage theory of vertical integration depend on the assumption that the markets are highly concentrated and protected by entry barriers).

216. *See* LESSIG, *supra* note 4, at 159; Jerry A. Hausman et al., *Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers*, 18 YALE J. ON REG. 129, 155 (2001); Lemley & Lessig, *supra* note 190, at 952; Daniel L. Rubinfeld & Hal J. Singer, *Open Access to Broadband Networks: A Case Study of the AOL/Time Warner Merger*, 16 BERKELEY TECH. L.J. 631, 649 (2001).

217. *See* Yoo, *supra* note 64, at 50–53; Yoo, *supra* note 178, at 253–58.

218. *See* Time Warner Entm't Co. v. FCC, 240 F.3d 1126, 1131–32 (D.C. Cir. 2001) (citing Implementation of Section 11(c) of the Cable Television Consumer Protection and Competition Act of 1992, Third Report and Order, 14 F.C.C.R. 19098, 19114–18 ¶¶ 40–50 (1999)).

ment market, since any one cellular provider represented a tiny fraction of the national equipment market.[219] Simply put, it is national reach, not local reach, that matters. This in turn implies that the relevant geographic market is a national one, not a local one. What matters is not the percentage of broadband subscribers that any particular provider controls in any geographic area, but rather the percentage of a nationwide pool of subscribers that that provider controls.

Once the relevant market is properly defined in this manner, it becomes clear that the broadband market is too unconcentrated for vertical integration to pose a threat to competition. The standard measure of market concentration is the Hershman-Hirfindahl Index (HHI), which is calculated by summing the squares the market shares of each individual firm.[220] The guidelines employed by the Justice Department and the Federal Trade Commission establish 1800 as the HHI threshold for determining when vertical integration would be a cause for anticompetitive concern.[221] The FCC has applied an HHI threshold of 2600 in its recent review of mergers in the wireless industry.[222] The concentration levels for the broadband industry as of September 2005 yields an HHI of only 1110, well below the thresholds identified above.[223] The imminent arrival of 3G, WiFi, WiMax, BPL, and other new broadband technologies promises to deconcentrate this market still further in the near future.

The inability of competitors in a deconcentrated market to harm competition is well illustrated by the following thought experiment: Suppose that Verizon decided to enter into exclusivity arrangements with a number of applications and content providers and to prohibit its subscribers from accessing competing websites. Would that type of move be regarded as such a significant threat to competition that regulators should prohibit Verizon from experimenting with such a business model? The standard economic answer is "no." At nine percent of the market, Verizon lacks the market position to harm competition through unilateral action. When that is the case, the standard economic response is to let

219. *See* Bundling of Cellular Customer Premises Equipment and Cellular Service, FCC, Report and Order, 7 F.C.C.R. 4028, 4029–30 ¶ 13 (1992).

220. *See generally* Yoo, *supra* note 64, at 52–53. For example, a four-firm market with market shares of 40%, 30%, 20%, and 10% would yield an HHI of $40^2 + 30^2 + 20^2 + 10^2 = 1600 + 900 + 400 + 100 = 3000$.

221. *See* U.S. Department of Justice & Federal Trade Commission, Non-Horizontal Merger Guidelines §§ 4.131, 4.213, 57 Fed. Reg. 41,552 (1992), *available at* http://www.usdoj.gov/atr/public/guidelines/2614.htm (applying an HHI threshold of 1800). *See generally* Yoo, *supra* note 64, at 52–53 (discussing HHI and the relevant guideline thresholds).

222. *See* Applications of Nextel Communications, Inc. and Sprint Corp. for Consent to Transfer Control of Licenses and Authorizations, Memorandum Opinion and Order, 20 F.C.C.R. 13967, 13993 ¶ 63 (2005) (applying an HHI threshold of 2800); Applications of Western Wireless Corp. and Alltel Corp. for Consent to Transfer Control of Licenses and Authorizations, Memorandum Opinion and Order, 20 F.C.C.R. 13053, 13073 ¶¶ 46–47 (2005) (same); Applications of AT&T Wireless Services, Inc. and Cingular Wireless Corp. for Consent to Transfer Control of Licenses and Authorizations, Memorandum Opinion and Order, 19 F.C.C.R. 21522, 21568 ¶¶ 106–107 (2004) (same).

223. The HHI calculation is based on subscriber data reported in Broache & McCullagh, *supra* note 150. For earlier data, see Yoo, *supra* note 64, at 53 fig. 4, and Yoo, *supra* note 178, at 256 tbl. VII.

the experiment go forward. As the previous discussion makes clear, it is quite conceivable that the efficiency benefits from exclusivity will justify deviating from interoperability, in which case permitting the experiment to go forward will represent a social benefit. If not, the experiment will fail and Verizon will be under substantial economic pressure to reopen its network. Although Verizon subscribers may be somewhat chagrined while the experiment runs its course, those harms represent more of a harm to a competitor than the type of harm to competition needed to justify intervention under the traditional competition policy.

3. The Emergence of Competition

One of the most important developments distinguishing the current technological environment from the one prevailing at the time the rules prohibiting local telephone companies from discriminating against so-called foreign attachments were adopted is the emergence of alternative last-mile technologies.[224] At the time the aforementioned prohibitions were adopted, local telephone companies faced little competition from other network providers.[225] The absence of competing options strengthened the arguments for compelling access to what was then the only available means of providing service.

As the Supreme Court and the FCC have recognized, the emergence of alternative network providers has rendered this justification considerably less compelling.[226] The presence of competition drastically reduces the ability of network owners to use exclusivity arrangements to harm competition because disgruntled consumers can simply transfer their subscriptions to another network. As I have discussed in some detail elsewhere, compelling access can also dampen the incentives for those device manufacturers shut out by exclusivity arrangements to help finance the buildout of alternative network capacity. Rescuing these manufacturers from having to undertake these investments can thus have the perverse effect of entrenching whatever market concentration that exists by depriving would-be builders of alternative or competing networks of their natural strategic partners.[227] Empirical studies have indicated that the access requirements imposed by the Telecommunications Act of 1996 have dampened investment incentives in precisely this manner.[228] The conduct of the leading content providers and device manufacturers in the immediate aftermath of the Supreme Court's *Brand X* decision is similarly telling. When faced with

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224. *See* Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, 20 F.C.C.R. 15908 (2005) (increased penetration of mobile phones); Fourth § 706 Report, *supra* note 213, at 20553–62.

225. *See supra* note 138 and accompanying text (discussing the lack of alternatives to the local telephone network during the time of the Computer Inquiries).

226. *See supra* note 139 and accompanying text.

227. *See* Yoo, *supra* note 127, at 48–53; Yoo, *supra* note 178, at 246–47, 268–69.

228. *See* Yoo, *supra* note 127, at 51 & nn.198–199 (collecting sources).

the impending loss of guaranteed access to cable modem and DSL systems, Google, IBM, and Intel have each undertaken major investments in BPL,[229] while other content providers, such as Disney, EarthLink, and ESPN, entered into strategic partnerships with existing wireless broadband technologies.[230] Most striking of all is Google's plan to build a wireless Internet network for the city of San Francisco for free.[231] Google's willingness to make such a large investment eloquently demonstrates how the prospect of losing guaranteed access to last-mile networks can provide powerful incentives to invest in alternative transmission technologies.

Indeed, these insights underscore the extent to which network neutrality proponents are focusing on the wrong policy problem.[232] Economic theory has demonstrated that every vertical chain of production will only be efficient if every link is competitive. This suggests that the central goal of competition policy should be to identify the link in the chain of production that is the most concentrated and protected by entry barriers and to increase competition within that link. In the case of the Internet, the markets for applications and content are already the ones that are the most competitive and, given the low barriers to entry, the most likely to remain that way. The central policy focus should be on how to encourage greater entry by new last-mile providers. When competition is emerging and entry by alternative network providers is feasible, there are strong arguments that this goal can best be accomplished by permitting network owners to enter into exclusivity arrangements.

The history of the regulatory precedents invoked by network neutrality proponents largely confirms these insights, as the increase in competition has led the FCC to steadily roll back its role in regulating CPE. For example, in 2000 the FCC relinquished its role in establishing the technical criteria for CPE and turned those functions over to private standard-setting bodies.[233] The FCC subsequently abolished the prohibition on bundling CPE with telecommunications services.[234] Given the overall logic and direction of these regulations, they would appear to serve as only a weak precedent for regulating the Internet in the future.

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229. *See* Ed Gubbins, *Intel Gets Behind BPL*, TELEPHONY, Sept. 5, 2005 at 16; Ken Kerschbaumer, *Plug-and-Play Internet: Wall-Outlet Broadband Attracts Heavy Hitters*, BROAD. & CABLE, July 18, 2005, at 20.

230. *See* Jesse Drucker & Merissa Marr, *Disney to Enter Cellphone Market, with Kids in Mind*, WALL ST. J., July 6, 2005, at D5; Bob Keefe, *Battered EarthLink Shifts Gears: Phone Services Play Role in Makeover*, ATLANTA J.-CONST., July 24, 2005, at C1.

231. *See* Laurie J. Flynn, *Some Worries as San Francisco Goes Wireless*, N.Y. TIMES, Apr. 10, 2006, at C5.

232. *See* Yoo, *supra* note 127, at 15–19; Yoo, *supra* note 64, at 59–60.

233. *See* 2000 Biennial Regulatory Review of Part 68 of the Commission's Rules and Regulations, Report and Order, 15 F.C.C.R. 24944 (2000).

234. *See* Policy and Rules Concerning the Interstate, Interexchange Marketplace, Report and Order, 16 F.C.C.R. 7418 (2001).

D. PRACTICAL PROBLEMS IMPLEMENTING NETWORK NEUTRALITY

Any regulatory regime that attempts to mandate nondiscrimination would confront significant practical difficulties as well. Specifically, past efforts to impose nondiscrimination requirements have all too often proven unworkable. In addition, a literature has emerged warning of the dangers of prophylactic regulation, which has underscored the risks of adhering to the status quo in the face of uncertainty.

1. The Difficulty in Supervising Nondiscrimination Mandates

Like all access regimes, network neutrality would necessarily require the imposition of four different types of regulatory requirements. First, network neutrality requires mandating *interconnection* by requiring network owners to provide content and application providers access to their facilities. Second, interconnection must occur across a defined interface, which inevitably requires *standardization*.[235] Third, network neutrality would require mandating *nondiscrimination*, in order to prevent network owners from defeating the interconnection requirement simply by favoring preferred providers. Fourth, a network owner could attempt to evade network neutrality simply by charging both affiliated and unaffiliated content and applications providers nondiscriminatory, but exorbitant fees. Such fees would simply redistribute profit from the content affiliate to the network affiliate, while simultaneously subjecting unaffiliated content and applications providers to a price squeeze.[236] At the same time, the Supreme Court has recognized that mandating access becomes much less tractable when the network services vary in terms of quality, the industry is technologically dynamic, and the complexity of the interface allows for a myriad of ways that network owners can provide discriminatory or substandard interconnection.[237] The implication is that regulators who wish to mandate network neutrality will have to police quality of service and other nonprice terms of service. In short, when the interface is complex, network neutrality poses regulatory authorities with the nearly insuperable task of regulating almost all aspects of the business relationship.[238] Nondiscrimination mandates

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235. *See* Yoo, *supra* note 127, at 3, 5–6.

236. *See id.* at 37–39.

237. *See* Verizon Commc'ns, Inc. v. Law Offices of Curtis V. Trinko, L.L.P., 540 U.S. 398, 414 (2004) (recognizing that interconnection disputes are "highly technical" and multifaceted "given the incessant, complex, and costly changing interaction of competitive and incumbent LECs implementing the sharing and interconnection obligations"); AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 429 (1999) (Breyer, J., concurring in part and dissenting in part) ("The more complex the facilities, the more central their relation to the firm's managerial responsibilities, the more extensive the sharing demanded, the more likely these [the administrative and social costs of compulsory sharing] will become serious.").

238. *See* Yoo, *supra* note 178, at 244–46, 268–69 (noting that variability in quality of cable programming frustrates meaningful regulation and regulators mediating disputes over terms and conditions of access); Gerald R. Faulhaber, *Policy-Induced Competition: The Telecommunications Experiments*, 15 INFO. ECON. & POL'Y 73, 81 (2003).

are likely to succeed only when the interface between products is relatively simple, easy to monitor, and requires little information from the network.[239] The FCC's experience in attempting to implement nondiscrimination regimes with respect to long distance, cable television, and local telephone service attests to these difficulties.[240] I find it particularly telling that two distinguished scholars of network industries not particularly noted for deregulatory views (including one who was directly involved in imposing access requirements on the Baby Bells in the aftermath of the breakup of AT&T) have suggested that access regimes have proven so unworkable that they should be abandoned.[241]

The FCC's history with nondiscrimination regimes thus provides ample reason to be skeptical about the likely success of attempts to mandate broadband nondiscrimination. The complexity of the interface, the increasing heterogeneity of end users' demands, and the pace of technological change severely challenge policymakers' ability to implement network neutrality with respect to broadband.[242]

2. The Danger of Prophylactic Intervention in the Face of Uncertainty

Network neutrality proponents argue in the alternative that regulatory intervention is needed because broadband network owners often fail to appreciate the benefits to innovation provided by open network architectures.[243] Lessig has argued that the incumbents' inability to perceive their long-term business interests justifies mandating network neutrality.[244] Wu, while reluctant to argue that network owners are incapable of apprehending their true long-term interests,[245] nonetheless contends that regulators should use the threat of regulation to educate network owners about their true long-term interests.[246]

Even if true, this observation fails to serve as a justification for imposing network neutrality. Network owners' misperception of their long-term business interests is generally not considered to be a valid justification for regulatory intervention, since such an error typically involves a harm to a competitor rather

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239. *See id.* at 77–86.

240. *See* Yoo, *supra* note 127, at 40–42.

241. *See* Paul L. Joskow & Roger G. Noll, *The Bell Doctrine: Applications in Telecommunications, Electricity, and Other Network Industries*, 51 STAN. L. REV. 1249, 1252 (1999).

242. *See* Yoo, *supra* note 127, at 39–45.

243. *See* LESSIG, *supra* note 4, at 30–38, 176; Farrell & Weiser, *supra* note 195, at 115–16; Lemley & Lessig, *supra* note 190, at 937–38; Wu, *supra* note 4, at 143, 145, 154–55.

244. In Lessig's words:

> Dinosaurs should die . . . . And innovators should resist efforts by dinosaurs to keep control. Not because dinosaurs are evil; not because they can't change; but because the greatest innovation will come from those outside these old institutions. Whatever the scientists at Bell Labs understood, AT&T didn't get it. Some may offer a theory to explain why AT&T wouldn't get it. But this is a point most understand without needing to invoke a fancy theory.

LESSIG, *supra* note 4, at 176.

245. *See* Wu, *supra* note 4, at 143.

246. *See id.* at 154–55, 156.

than a harm to competition.[247] The irony is that although network neutrality proponents invoke the rhetoric of a Darwinian, survival-of-the-fittest competition among applications and content,[248] they fail to follow the reasoning to its logical conclusion. Taking the evolutionary analogy seriously would imply that companies that adopt flawed business plans should not be saved from those mistakes by regulation or guided away from them by education. The collapse of a broadband network should not reduce competition over the long term because the physical network assets will continue to exist, awaiting redeployment by another entity. It would create some short-run transition costs, but such costs are inevitable in any market-based system and must be tolerated if society is to enjoy the benefits that markets provide.

Furthermore, any proposed regulatory solution must take care to avoid the classic nirvana fallacy: Just because a market-based outcome is suboptimal does not mean that a government-imposed outcome will necessarily fare any better. Indeed, a burgeoning literature exists analyzing how transaction costs, imperfect information, and collective action problems can cause regulatory intervention to fail to maximize social welfare.[249] Determining the best course of action thus requires an exercise in the comparative second best. In other words, arguments in favor of regulatory correction of suboptimal business decisions are coherent only if one presumes that regulatory authorities would be better at perceiving and furthering what would be in network owners' best interests than would the network owners themselves.

Such an assertion is difficult to maintain once one recognizes the inherent difficulties in determining which business strategies will ultimately prove successful when confronted with sound economic reasons that can plausibly justify the restrictions in question. The same foresight difficulties that have allegedly led network owners astray are likely to plague regulators as well. If the experts in the academy and in the industry are unable to make correct assessments of what would best foster innovation, there is little reason to presume that the experts in the government will do any better.

Finally, regulatory intervention is especially problematic when, as here, it is meant to forestall a perceived danger that has not yet materialized. Commentators have cautioned about the dangers of regulating on the basis of predictive harms[250] and have argued that preserving the status quo becomes untenable as a

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247. *See, e.g.*, William F. Baxter, *Legal Restrictions on Exploitation of the Patent Monopoly: An Economic Analysis*, 76 YALE L.J. 267, 318 (1966); Louis Kaplow, *Extension of Monopoly Power Through Leverage*, 85 COLUM. L. REV. 515, 549–50 (1985).

248. *See* Wu & Lessig, *Ex parte*, *supra* note 7, at 5–6; Wu, *supra* note 4, at 145, 146.

249. The seminal works include MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION (1965) and George J. Stigler, *The Theory of Economic Regulation*, 2 BELL J. ECON. & MGMT. SCI. 3 (1971). For surveys of this literature, see W. KIP VISCUSI ET AL., ECONOMICS OF REGULATION AND ANTITRUST 375–99 (4th ed. 2005); and Roger G. Noll, *Economic Perspectives on the Politics of Regulation*, *in* 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1253, 1262–81 (Richard Schmalensee & Robert D. Willig eds., 1989).

250. *See* 5 PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 1120a, at 51 (2d ed. 2003); Benjamin, *supra* note 1, at 312–13.

default position once one acknowledges that there is no reason to privilege *a priori* the risks posed by action over the risks posed by inaction.[251] As a result, these commentators have attempted to cabin the problem by reserving such regulation for circumstances in which the consequences from the failure to act are potentially catastrophic or irreversible.[252] Neither precondition would appear to be satisfied in the case of network neutrality. As important as innovation on the Internet is, reduced innovation does not constitute the type of catastrophic harm that would justify regulatory intervention in the absence of a concrete showing of competitive harm. Allowing networks to become noninteroperable should not be irreversible. As the experience in reconfiguring local telephone switches for independent long distance providers demonstrates, courts and policymakers have been able to retrofit network interfaces to accommodate neutrality, albeit at substantial immediate cost.[253]

E. THE AVAILABILITY OF MORE LIMITED RESPONSES TO ANTICOMPETITIVE ACTIVITY

This is not to say that all deviations from network neutrality will invariably be innocent. Indeed, under my approach such restrictions would not be justified when the transaction costs of metering bandwidth usage are relatively low. The adoption of an exclusivity arrangement can also harm existing subscribers by upsetting their expectations about the complementary services they would be able to obtain on the open market.[254] Another anticompetitive problem that can arise in a convergent world is when a broadband provider bars access to an Internet application that competes directly with its core business. One example is Madison River Communication's attempt to protect its local telephone business by blocking its DSL customers from using VoIP.[255] Similar concerns would be raised if a cable modem provider was to attempt to protect its core cable television business by prohibiting its cable modem customers from accessing streaming video. [256]

If a sufficient number of competitive options exist, any attempt to use exclusivity in an anticompetitive manner should be disciplined by the market over the long run, as end users who dislike the exclusivity arrangement will simply transfer their subscriptions to a different network. This is why courts and leading commentators have consistently condemned compelling access to communications networks where alternative network platforms exist.[257] As noted

251. *See* SUNSTEIN, *supra* note 17, at 26–34.

252. *See id.* at 58–61, 109–17.

253. *See* Faulhaber, *supra* note 238, at 81–83.

254. *See* Eastman Kodak Co. v. Image Technical Servs., Inc., 504 U.S. 451 (1992) (holding that switching and information costs can cause adoption of an exclusivity arrangement with respect to complementary services to harm existing customers who are locked-in).

255. *See supra* notes 27, 41, and accompanying text.

256. *See, e.g.*, LESSIG, *supra* note 4, at 156–58; Saltzer, *supra* note 4, at 1. *But see* Wu, *supra* note 4, at 164 (finding no evidence that cable operators have barred streaming video).

257. *See* AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366, 388–89 (1999) (rejecting the imposition of UNE access when the network elements are available from alternative sources); U.S. Telecom Ass'n v.

earlier, the broadband industry is already sufficiently competitive to undercut the justification for depriving last-mile providers of any control over the content and applications that can be accessed over their networks. The imminent arrival of new technologies, such as 3G, BPL, WiFi, and WiMax, suggests that the competition will only intensify in the years to come. And even if intermodal competition is slow to arrive, the "one monopoly rent theorem" indicates that last-mile providers will have powerful incentives to maximize the value of their networks to consumers.[258] Although adoption of an exclusivity arrangement with respect to a complementary service may disadvantage alternative providers of the complementary service and existing customers who are locked-in, mere harm to individual competitors or customers does not rise to the level of a concern under established principles of competition policy unless and until it has an adverse effect on the competitiveness of the market. The presence of a sufficient number of competitive alternatives renders such a consequence unlikely.

In any event, even assuming that these preconditions were met, such considerations would not justify imposing a categorical requirement that all broadband networks make their networks available to all content and applications. At most, such considerations would justify a targeted response that either bars DSL providers from preventing their customers from accessing VoIP, like the consent decree imposed by the FCC in *Madison River*, or prohibits cable modem providers from stopping their customers from accessing streaming video. Under no circumstances would they provide support for the kind of blanket condemnation of restrictions on the applications end users can run through their broadband connections envisioned under network neutrality.

V. ADDITIONAL ECONOMIC JUSTIFICATIONS FOR NETWORK DIVERSITY

The strong justifications for network diversity provided by the economics of congestion are reinforced by two other economic considerations. First, some form of discrimination and differentiation is almost certainly inevitable in industries like telecommunications, which are characterized by large fixed costs. Second, the emergence of the Internet as an important source of media content heightens the importance of permitting conduits for that content to exercise editorial discretion.

FCC, 290 F.3d 415, 429 (D.C. Cir. 2002) (rejecting decision subjecting DSL-compatible portion of telephone lines for its failure to take into account competition from cable modem systems); 3A PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 773b2, at 200–03 (2d ed. 2002) (limiting compelled access to essential facilities to situations in which the facility cannot be obtained from another source); *cf.* Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Servs., 125 S. Ct. 2688, 2711 (2005) (upholding the FCC's decision that the availability of broadband services from other sources justified refusing to impose access requirements on cable modem systems).

258. *See supra* notes 191–94 and accompanying text.

A. THE INEVITABILITY OF DISCRIMINATION AND DIFFERENTIATION

Economic analyses of the telecommunications industry strongly suggest that price discrimination is essentially inevitable and most likely beneficial. The reason that discrimination is so pervasive in telecommunications is best understood in terms of the classic model of natural monopoly, which posits that the presence of large, up-front capital investments[259] creates economies of scale that are not exhausted even when a single firm produces the entire market output (which means that the demand curve crosses the average cost curve at a point where the average cost curve is declining and lies above the marginal cost curve).[260] This gives the largest firm a decisive cost advantage that eventually allows it to drive its competitors out of business. Although the issue is not free from dispute,[261] the high up-front investments needed to establish a telecommunications network have historically been regarded as turning telecommunications carriers into natural monopolies.[262]

Any profit-maximizing monopolist will produce at the level where its marginal revenue curve and its marginal cost curve intersect (represented in Figure 2 by P_{mon} and Q_{mon}). Because monopolists are not price takers, they set prices that are inefficiently high, in that they exceed marginal cost. The classic policy response is to impose some form of rate regulation to lower the price charged by the monopolist. At the same time, the price must allow the monopolist to recoup its costs of production, which implies that the prices charged must equal or exceed average cost. If the monopolist must charge the same price to all customers, the lowest sustainable price is where the demand curve crosses the average cost curve (represented in Figure 2 by P_{sus}). The problem is that P_{sus} still exceeds efficient levels (represented in Figure 2 by P_{eff} and Q_{eff}) in that it still exceeds marginal cost, with the inefficient shortfall in production represented by the difference between Q_{sus} and Q_{eff}. The only way that the monopolist can satisfy the consumers between Q_{sus} and Q_{eff} is by offering them service at a price below average cost and by making up the difference by charging other customers a price that exceeds average cost. In other words, the only way to

259. The theory of contestable markets has added the refinement that large, up-front investments are not economically problematic unless they are "sunk," i.e., unrecoverable upon exit. *See* WILLIAM J. BAUMOL ET AL., CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE 288–93 (rev. ed. 1988).

260. Although it is a sufficient condition for natural monopoly that the available economies of scale are unexhausted over the quantity of industry demand, that condition is not a necessary one. Natural monopoly results whenever a market is *subadditive*, i.e., whenever a single firm will be able to serve the entire market at a lower cost than could two producers. If the total industry demand lies just beyond the lowest point of the average cost curve (which is also called *minimum efficient scale*), it is possible for a market to be subadditive even though the monopolist is producing on the increasing portion of the average cost curve. *See id.* at 17–19.

261. *See* Wesley W. Wilson & Yimin Zhou, *Telecommunications Deregulation and Subadditive Costs: Are Local Telephone Monopolies Unnatural?*, 19 INT'L J. INDUS. ORG. 909, 910 (2001) (reviewing the empirical dispute over whether local telephone service has historically been and currently remains a natural monopoly).

262. *See, e.g.*, HUBER ET AL., *supra* note 90, at 2; JEAN-JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS 3 (2000).

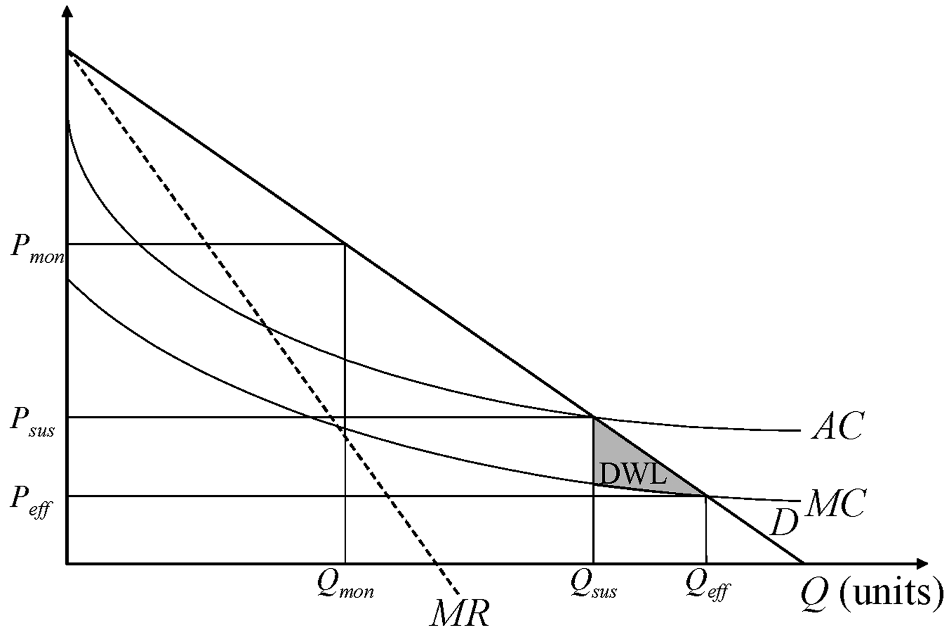

Figure 2: Natural Monopoly Pricing, Rate Regulation, and Price Discrimination

maximize economic welfare without driving the monopolist into bankruptcy is price discrimination.

Indeed, this is the insight underlying Ramsey pricing.[263] In infrastructure industries, the prices charged must allow the network owner to recover a portion of the up-front, fixed-cost investment in addition to marginal cost. Thus, any price charged must necessarily exceed marginal cost. The problem is that pricing above marginal cost is a classic source of inefficiency. Ramsey pricing relies upon differences in consumers' elasticities of demand to mitigate this effect. For those consumers who have relatively elastic demands, increasing price above marginal cost causes a severe dropoff in consumption. As a result, these consumers are asked to bear a smaller proportion of the fixed costs. Conversely, consumers with relatively inelastic demands are more likely to keep purchasing despite an increase in price. Thus, the best way to recover fixed costs in an efficient manner is to allocate fixed cost in inverse proportion to the elasticities of demand and to fund fixed costs by transferring the surplus that would otherwise be captured by inframarginal consumers to the producer. Failing to discriminate in this manner results in inefficiency and foregone welfare gains.

It is for this reason that economic commentators from a wide variety of

263. *See* F.P. Ramsey, *A Contribution to the Theory of Taxation*, 37 ECON. J. 47 (1927).

perspectives support price discrimination as economically beneficial in industries like telecommunications that require substantial fixed-cost investments,[264] and it has long been recognized that usage-sensitive pricing can represent one form of price discrimination.[265] Indeed, there is no reason to expect that network owners will only attempt to engage in price discriminate vis-à-vis end users. In a two-sided market, network owners are just as likely to try to price discriminate with respect to content and applications providers as well. Their ability to do so will depend largely on the relative bargaining power of each party.

On a more general level, it is not entirely clear that last-mile providers will always hold the upper hand in such a bargain. For example, in the cable television industry, money typically flows in the other direction, with last-mile providers typically paying cable networks for the right to access their content. Conversely, with respect to broadcast television, it was the television networks that historically paid compensation to the local affiliate responsible for distributing the content to individual homes. In recent years, however, the direction of the cash flow has sometimes reversed, as the network is able to extract payments from weaker broadcast affiliates.[266] There is thus no reason to assume a priori that the payments will necessarily flow from the content providers to the last-mile providers instead of the other way around.

Enshrining the current regime into law, as network neutrality proponents advocate, would have the unfortunate effect of prohibiting cash from flowing in either direction. This is because backbones exchange traffic through peering relationships on a settlement-free basis. In other words, it is impossible for money to change hands when it crosses a peering point, which in turn forecloses all business models that depend upon cash payments flowing from last-mile providers to content providers or vice versa. Institutions that violate network neutrality, such as content delivery networks like Akamai, make it possible for money to flow from an entity on one side of a peering point to another.[267]

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264. *See, e.g.*, LAFFONT & TIROLE, *supra* note 262, at xv; F.M. SCHERER & DAVID ROSS, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 496–502 (3d ed. 1990); William J. Baumol & Daniel G. Swanson, *The New Economy and Ubiquitous* Competitive *Price Discrimination: Identifying Defensible Criteria of Market Power*, 70 ANTITRUST L.J. 661, 669–70 (2003); Harold Demsetz, *The Private Production of Public Goods*, 13 J.L. & ECON. 293, 301–02 (1970); Benjamin Klein & John Shepard Wiley, Jr., *Competitive Price Discrimination as an Antitrust Justification for Intellectual Property Refusals to Deal*, 70 ANTITRUST L.J. 599, 611–15 (2003); Michael E. Levine, *Price Discrimination Without Market Power*, 19 YALE J. ON REG. 1, 25–26 (2002).

265. *See, e.g.*, Bowman, *supra* note 192, at 23–24, 28; M.L. Burstein, *A Theory of Full-Line Forcing*, 55 NW. U. L. REV. 62, 64–73 (1960); Aaron Director & Edward H. Levi, *Law and the Future: Trade Regulation*, 51 NW. U. L. REV. 281, 293 (1956). For a review of the modern literature on how bundling products together can effectuate price discrimination, see Christopher S. Yoo, *Rethinking the Commitment to Free, Local Television*, 52 EMORY L.J. 1579, 1706–12 (2003).

266. *See, e.g.*, *Broadcaster to Pay NBC in Turnabout: Precedent-Setting Deal Points Up Shift in Power Between Networks and Their Affiliates*, L.A. TIMES, Feb. 15, 2000, at C14; Matthew Rose & Joe Flint, *Station Break: Behind the Media-Ownership Fight, An Old Power Struggle Is Raging*, WALL ST. J., Oct. 15, 2003, at A1.

267. *See* Clark et al., *supra* note 156, at 20–22.

Commentators have also recognized that product differentiation can represent a particularly effective form of price discrimination because product differentiation can identify customers with particularly intense demands for certain product features and can price those features to extract a greater proportion of the requisite surplus.[268] Because product differentiation segments the market in a particular way, it may well prove more efficient than usage-sensitive or tiered pricing. This suggests that giving last-mile providers the latitude to employ product differentiation as well as nonlinear pricing regimes may well result in an increase in economic welfare. As DirecTV's successful use of an exclusive programming package known as "NFL Sunday Ticket" illustrates, entering into exclusivity arrangements with respect to content represents an important means for differentiating one's network.[269]

As I have argued at length elsewhere,[270] allowing networks to differentiate themselves can ameliorate the economic features of telecommunications markets long thought to lead to market failure. For example, network differentiation can allow smaller players to survive, despite the presence of unexhausted economies of scale created by large, up-front sunk costs, by offering products designed to have greater appeal to smaller subsegments of the overall market—in much the same manner that specialty stores survive in a world increasingly dominated by low-cost, mass-market retailers. Network differentiation can also mitigate the impact of network economic effects. Simply put, a network valued particularly highly by a subsegment of users can overcome the impact of network economic effects so long as the increase in utility provided by the differentiated network exceeds the reduction in utility associated with joining a smaller network. At the same time, network differentiation can make it possible for the telecommunications network to serve users who would not otherwise receive service.

This suggests that broadband policy would be better served if Congress and the FCC embraced a *network diversity* principle. More importantly for our purposes, it also provides yet another economic reason to question the prudence of imposing network neutrality as a matter of regulation.

268. *See, e.g.*, Severin Borenstein, *Price Discrimination in Free-Entry Markets*, 16 RAND J. ECON. 380 (1985); Klein & Wiley, *supra* note 264, at 617 n.34; Levine, *supra* note 264, at 21; Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, 72 (2001).

269. *See* Yoo, *supra* note 127, at 32; *cf.* Carl Shapiro, *Exclusivity in Network Industries*, 7 GEO. MASON L. REV. 673, 678 (1999) (noting how exclusivity "can serve to differentiate products and networks"). Some have argued that the fact that end users are unable to determine whether poor network performance is caused by the network owner or the content provider is an argument in favor of network neutrality. *See* Schatz & Squeo, *supra* note 33. Ironically, difficulty in distinguishing which of two companies is responsible for performance inadequacies has traditionally been regarded as a justification for vertical integration and exclusivity arrangements, not for imposing access requirements. *See* Yoo, *supra* note 178, at 261–63 (citing United States v. Jerrold Elecs. Corp., 187 F. Supp. 545, 556–57 (E.D. Pa. 1960), *aff'd*, 365 U.S. 567 (1961) (per curiam)).

270. *See* Yoo, *supra* note 127, at 27–37.

B. THE GROWING IMPORTANCE OF EDITORIAL DISCRETION

The Internet has historically been regarded as a "pull" technology in which end users specified the exact content that they wished to see. The explosion of content on the World Wide Web has increasingly given the Internet the characteristics of a "push" technology in which end users rely on intermediaries to aggregate content into regular e-mail bulletins. Even search engine technologies have begun to exhibit forms of editorial discretion as they begin to compete on the quality of their search methodologies.

Mandating content nondiscrimination would represent an ill-advised interference with the exercise of editorial discretion that is playing an increasingly important role on the Internet.[271] Editors perform numerous functions, including guaranteeing quality and ensuring that customers receive an appropriate mix of material. For example, consider the situation that would result if a publication such as *Sports Illustrated* could not exercise editorial control over its pages. One particular issue of the magazine might consist solely of articles on one sport without any coverage of other sports, and there would be no way to guarantee the quality of the writing.

This insight is confirmed by Congress's and the Supreme Court's longstanding recognition of the benefits of editorial discretion when the transmission of content is involved. The seminal statutes with respect to broadcasting reflect the critical role that editorial discretion plays when content is being transmitted.[272] For example, Congress rejected proposals to provide a limited right of nondiscriminatory access in both the Radio Act of 1927 and the Communications Act of 1934 and instead enacted a provision specifically prohibiting the regulation of broadcasters as common carriers.[273] In so doing, "Congress specifically dealt with—and firmly rejected—the argument that the broadcast facilities should be open on a nonselective basis."[274] The Supreme Court has concurred, repeatedly reiterating the importance of preserving broadcasters' editorial discretion.[275] Exercise of such discretion inevitably favors some content, but as a plurality of the Supreme Court has acknowledged, "[F]or better or worse, editing is what

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271. *See id.* at 45–48; *see also* J. MacKie-Mason et al., *Service Architecture and Content Provision: The Network Provider as Editor*, 20 TELECOMM. POL'Y 203 (1996) (providing an early analysis of how application-aware networks can play editorial functions that help manage clutter and attention costs).

272. *See* FCC v. Midwest Video Corp., 440 U.S. 689, 702–05 (1979) (reviewing the legislative history of the Radio Act of 1927 and the Communications Act of 1934 with respect to whether they should be treated as common carriers); Columbia Broad. Sys. Inc. v. Democratic Nat'l Comm., 412 U.S. 94, 105–11 (1973) (plurality opinion) (same).

273. Communications Act of 1934, ch. 652, § 3(h), 48 Stat. 1062, 1066 (codified as amended at 47 U.S.C. § 153(10)); Radio Act of 1927, ch. 169, § 17, 44 Stat. 1162, 1169–70 (superseded by the Communications Act of 1934).

274. *Columbia Broad. Sys.*, 412 U.S. at 105 (plurality opinion); *see also id.* at 140 n.9 (Stewart, J., concurring); *id.* at 151–53 & n.2 (Douglas, J., concurring in the judgment).

275. *See* Ark. Educ. Television Comm'n v. Forbes, 523 U.S. 666, 673–75 (1998); FCC v. League of Women Voters of Cal., Inc. 468 U.S. 364, 378–80 (1984); *Columbia Broad. Sys.*, 412 U.S. at 105 (plurality opinion); *id.* at 140 n.9 (Stewart, J., concurring); *id.* at 151–53 & n.2 (Douglas, J., concurring in the judgment).

editors are for; and editing is selection and choice of material."[276]

The same pattern can be discerned with respect to cable television. At first, the FCC embraced requirements that cable operators make a portion of their channel capacity available on a nondiscriminatory basis,[277] only to see those regulations struck down by the Supreme Court as inconsistent with the policy of preserving editorial control over content embodied in the Communications Act of 1934.[278] In the process, the Court emphasized "Congress' stern disapproval . . . of negation of the editorial discretion otherwise enjoyed by broadcasters and cable operators alike."[279]

The Court's subsequent decisions reiterated the importance of preserving cable operators' editorial discretion.[280] Indeed, editorial discretion over content was so important that courts invalidated restrictions prohibiting local telephone companies from establishing cable television networks, finding these restrictions constituted an impermissible burden on the telephone companies' First Amendment rights.[281] Congress later enacted a provision limiting cable operators' editorial control over portions of their channel capacity, requiring cable operators to set aside a portion of their channel capacity for leased access to unaffiliated programmers.[282] A majority of the Court recognized that leased access represents an intrusion into the cable operators' editorial discretion.[283] On a more practical level, regulations designed to guarantee access to content have proven quite difficult to implement.[284] Indeed, empirical evidence suggests

276. *Columbia Broad. Sys.*, 412 U.S. at 124 (plurality opinion).

277. *See* Amendment of Part 76 of the Commission's Rules and Regulations Concerning the Cable Television Channel Capacity and Access Channel Requirements of Section 76.251, Report and Order, 59 F.C.C.2d 294 (1976); Amendment of Part 74, Subpart K, of the Commission's Rules and Regulations Relative to Community Antenna Television Systems, Notice of Proposed Rulemaking and Notice of Inquiry, 15 F.C.C.2d 417, 427 ¶ 26 (1968).

278. *See* FCC v. Midwest Video Corp., 440 U.S. 689, 699–707 (1979).

279. *Id.* at 708.

280. *See* Turner Broad. Sys., Inc. v. FCC, 512 U.S. 622, 636 (1994); City of Los Angeles v. Preferred Commc'ns, Inc., 476 U.S. 488, 494 (1986); *cf.* Leathers v. Medlock, 499 U.S. 439, 444 (1984) ("Cable television provides to its subscribers news, information, and entertainment.").

281. *See* US West, Inc. v. United States, 48 F.3d 1092 (9th Cir. 1995), *vacated and remanded*, 516 U.S. 1155 (1996); Chesapeake & Potomac Tel. Co. v. United States, 42 F.3d 181 (4th Cir. 1994), *vacated*, 516 U.S. 415 (1996); S. New Eng. Tel. Co. v. United States, 886 F. Supp. 211 (D. Conn. 1995); BellSouth Corp. v. United States, 868 F. Supp. 1335 (N.D. Ala. 1994); Ameritech Corp. v. United States, 867 F. Supp. 721 (N.D. Ill. 1994); NYNEX Corp. v. United States, Civ. 93-323-P-C, 1994 WL 779761 (D. Me. Dec. 8, 1994). The issue had already been briefed and argued before the Supreme Court when it was rendered moot by a provision of the Telecommunications Act of 1996 eliminating the rule. *See* Telecommunications Act of 1996, Pub. L. No. 104-104, § 302(b)(1), 110 Stat. 56, 124 (repealing 47 U.S.C. § 533(b) (1994)).

282. Cable Communications Policy Act of 1984, Pub. L. No. 98-549, sec. 2, § 611, 98 Stat. 2779, 2782 (codified as amended at 47 U.S.C. § 532).

283. *See* Denver Area Educ. Telecomms. Consortium v. FCC, 518 U.S. 727, 761 (1996) (plurality opinion) (noting that § 10(a) restored part of cable operators' editorial discretion over leased access channels); *id.* at 796 (Kennedy, J., concurring in part, concurring in the judgment in part, and dissenting in part) (noting that leased access represents a derogation of the cable operators' editorial control).

284. *See* Yoo, *supra* note 178, at 244–45.

that practical problems have rendered leased access largely ineffective.[285]

The same principles apply to the Internet as it moves away from person-to-person communications to media content. This shift argues in favor of allowing telecommunications networks to exercise editorial control. Indeed, anyone confronting the avalanche of content available on the Internet can attest to the benefits provided by editorial filters. This transition also weakens the case for network neutrality.

CONCLUSION

On its face, the vision of an Internet in which every user can access any content, run any application, and attach any device on a nondiscriminatory basis has considerable intuitive appeal. Such unfettered choice would appear to be a natural part of promoting consumer welfare. Indeed, the fact that end users have long been free from any end user restrictions makes network neutrality appear to be a natural baseline and would seem to justify placing the burden of proof on those who wish to deviate from it.

There is considerable danger in reflexively regarding deviations from the status quo with suspicion.[286] Upon closer inspection, nonstandard practices are all too often revealed to have procompetitive benefits. Such is the case with the network neutrality debate. An examination of the economics of congestion provides policy justifications for precisely the type of restrictions that network neutrality would condemn. Each of the restrictions challenged by network neutrality proponents is associated with bandwidth-intensive uses and thus may represent a plausible Coasean proxy for heavy consumption of network resources. As a result, if transaction costs render direct metering prohibitively expensive, network owners may well find it beneficial to impose restrictions on bandwidth-intensive network uses. Access tiering and caching by content delivery networks represent other alternative solutions to the problems of congestion and latency. Although exclusivity arrangements place some limits on customer and producer freedom, those limits should not pose a threat to economic welfare

285. *See* S. REP. NO. 102-92, at 30–32 (1991), *reprinted in* 1992 U.S.C.C.A.N. 1133, 1163–65; H.R. REP. NO. 102-628, at 39–40 (1992); Time Warner Entm't Co. v. FCC, 93 F.3d 957, 968–69 (D.C. Cir. 1996); Implementation of Sections of the Cable Television Consumer Protection and Competition Act of 1992: Rate Regulation, Order on Reconsideration of First Report and Order and Further Notice of Proposed Rulemaking, 11 F.C.C.R. 16933, 16937 ¶ 6 (1996); Donna M. Lampert, *Cable Television: Does Leased Access Mean Least Access?*, 44 FED. COMM. L.J. 245, 266–67 & n.122 (1992).

286. As Ronald Coase noted:

> One important result of this preoccupation with the monopoly problem is that if an economist finds something—a business practice of one sort or another—that he does not understand, he looks for a monopoly explanation. And as in this field we are very ignorant, the number of understandable practices tends to be rather large, and the reliance on a monopoly explanation frequent.

R.H. Coase, *Industrial Organization: A Proposal for Research*, *in* POLICY ISSUES AND RESEARCH OPPORTUNITIES IN INDUSTRIAL ORGANIZATION 59, 67 (V.R. Fuchs ed., 1972).

so long as competition is sufficiently robust, because any frustrated customer would remain free to switch providers. In this sense, the resolution that I propose parallels the development of vertical integration theory by showing how transaction costs can render vertical integration economically preferable to the type of atomistic competition that would arise under network neutrality.

Exclusivity arrangements may in fact promote consumer welfare in ways that are often overlooked. By placing limits on bandwidth-intensive activities, end user restrictions can have the effect of reducing or eliminating the de facto cross subsidy that low-intensity users pay high-intensity users. These limits can also expand consumption by lowering the price of basic access to the network. As a result, low-intensity users may well see the prices they pay for broadband services decrease.

Given the ambiguity about whether mandating network neutrality would promote or impede economic welfare, the more technologically humble course would be for policymakers to embrace a principle of network diversity, which would permit individual network owners to explore alternative business arrangements until concrete harm to competition can be demonstrated. Although prophylactic regulation might be justified under extreme circumstances, deviations from network neutrality would not seem to pose the kind of irreversible and catastrophic risks that would justify foreclosing this type of experimentation. Whatever risks that broadband providers will use, their control over the last-mile to protect their legacy business models is more properly addressed by targeted prohibitions of the type imposed by the FCC in *Madison River* rather than by a categorical nondiscrimination requirement.