

## Chapter 2

# Network Neutrality and Competition Policy: A Complex Relationship

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### I. INTRODUCTION

The broadband industry has reached a crossroads. After avoiding the issue for years,<sup>53</sup> the Federal Communications Commission eventually decided that the Internet access services of cable broadband providers should be classified as “information services” rather than “telecommunications services.”<sup>54</sup> This determination, which removes these services from the common carriage requirements of Title II of the Communications Act, was recently affirmed by the Supreme Court,<sup>55</sup> and the FCC promptly classi-

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<sup>53</sup> See *Nat’l Cable & Telecomms. Ass’n v. Gulf Power Co.*, 534 U.S. 327, 348-51 (2002) (Thomas, J., concurring in part and dissenting in part) (criticizing the FCC for its reticence to address the proper regulatory classification of cable modem service). The FCC’s reluctance to address these issues may end up limiting its latitude in determining how broadband should be regulated. Even though the FCC has since concluded that cable modem service is more properly regarded as an “information service,” the Ninth Circuit has declined to accord *Chevron* deference to the FCC’s rulings on the grounds that it is bound by *stare decisis* to adhere to its earlier determination that cable modem service is a “telecommunications service.” See *Brand X Internet Servs. v. FCC*, 345 F.3d 1120 (9th Cir. 2003), *cert. granted*, 125 S. Ct. 654, 655 (2004). This appears inconsistent with *Chevron*’s recognition that agency interpretations of statutes should be permitted to change over time. See *Chevron USA Inc. v. Natural Res. Def. Council*, 467 U.S. 837, 863-64 (1986).

<sup>54</sup> 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 (2002).

<sup>55</sup> *Nat’l Cable & Telecomms. Ass’n v. Brand X Internet Services*, 128 S. Ct. 2688 (2005).

fied the broadband Internet access services provided by telephone companies as information services.<sup>56</sup>

Having largely failed to take the Internet into account when enacting the Telecommunications Act of 1996, Congress is preparing to undertake its second major overhaul of the communications laws in less than a decade.<sup>57</sup> And notwithstanding the classification of broadband Internet services as information services, the FCC continues to consider whether it should impose some common carrier-type open access and nondiscrimination requirements on broadband operators in response to a chorus of commentators asking the agency to require that all broadband network owners adhere to certain principles of network neutrality.<sup>58</sup> At their core, network neutrality proposals stem from the concern that network owners will use their claimed control over last-mile broadband technologies to discriminate against nonproprietary Internet service providers (ISPs) and unaffiliated content and applications. According to these advocates, mandating interoperability is essential if the environment for competition and innovation on the Internet is to be preserved.<sup>59</sup>

I believe that the current debate over network neutrality has overlooked several key insights. As an initial matter, the leading network neutrality proposals overstate the threat posed by vertical integration in the broadband industry. Although commentators differ widely on many aspects of vertical integration theory, there is widespread agreement that certain structural preconditions must be satisfied before vertical integration can plausibly threaten competition. An empirical analysis reveals that these preconditions are not met with respect to the broadband industry.

Even more importantly, one of the core insights of vertical integration theory is that any chain of production can maximize economic welfare

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<sup>56</sup> See Appropriate Framework for Broadband Access to Internet Over Wireline Facilities, Report and Order and Notice of Proposed Rulemaking, FCC 05-150, CC Docket No. 02-33, September 23, 2005.

<sup>57</sup> See, e.g., Stephen Labaton, *What U.S. Businesses Are Looking for During Bush's 2nd Term: New Telecom Rules*, INT'L HERALD TRIB., Nov. 5, 2004, at 19.

<sup>58</sup> See the Policy Statement containing "net neutrality" principles issued in the above-referenced cable and wireline broadband docketed proceedings released in September 2005. Policy Statement, FCC 05-151, CC Docket No. 02-33, September 23, 2005.

<sup>59</sup> See, e.g., Lawrence Lessig, *THE FUTURE OF IDEAS*, 34-48, 147-75 (2001); 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 (2001); Lawrence B. Solum & Minn Chung, *The Layers Principle: Internet Architecture and the Law*, 79 NOTRE DAME L. REV. 815, 851, 878 (2004); Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. TELECOMM. & HIGH TECH. L. 37, 65-67 (2002); Timothy Wu, *Network Neutrality, Broadband Discrimination*, 2 J. ON TELECOMM. & HIGH TECH. L. 141 (2003).

only if every level of production is competitive. In other words, any chain of production will only be as efficient as its least competitive link, which in the case of broadband is undoubtedly the last mile. This insight suggests that the major network neutrality proposals are focusing on the wrong policy problem. In attempting to preserve and encourage competition and innovation in applications, content, and ISP services, these proposals are focused on increasing competition in those segments of the broadband industry that are already the most competitive and the most likely to remain that way. Instead, basic economic principles suggest that the better course would be to eschew attempting to foster competition in ISP services, content, and applications and instead to pursue regulatory options that would promote more competition in last-mile technologies. Restated in terms of the existing models of “layered competition,” the major network neutrality proposals advocate regulating the logical layer in a way that promotes competition in the application and content layers. Instead, the focus of public policy should be to promote competition at the physical layer, which remains the level of production that is currently the most concentrated and the most protected by barriers to entry.

The irony is that network neutrality is likely to have the perverse effect of retarding, if not forestalling, the emergence of greater competition at the physical layer. The standardization implicit in compelled interoperability tends to reinforce and entrench the sources of market failure in last-mile technologies. The traditional justification for regulating wireline communications networks is that the presence of large, up-front sunk costs creates large supply-side economies of scale that cause markets for telecommunications services to collapse into natural monopolies. Interestingly, allowing networks to differentiate the services they offer can mitigate whatever tendency towards natural monopoly that may be present by allowing multiple last-mile technologies to coexist notwithstanding the presence of unexhausted returns to scale. Permitting variations in the protocols and network infrastructure employed by each network might enable smaller providers to overcome the cost disadvantages inherent in the smaller scale of their operations. They could tailor their networks to the needs of smaller subgroups that place a particularly high value on one particular type of network service and charge those subgroups more for those services, in much the same manner that specialty stores survive in a world dominated by one-stop shopping.

Allowing network owners to differentiate their offerings would promote economic welfare by increasing the degree of price competition among last-mile providers. It would also increase utility more directly by allowing network owners to respond to the underlying heterogeneity in

consumer preferences by varying the services they offer. Conversely, network neutrality can prevent the realization of these sources of economic efficiency. Even worse, it has the inevitable effect of introducing a regulation-induced bias in favor of certain types of applications and against others. Mandating universal interoperability may be effective in promoting the applications that currently dominate the Internet, such as e-mail and web browsing, which operate solely at the network's edge. It is, however, ill suited to the more bandwidth intensive applications emerging today, which often depend on a greater degree of innovation in the network's core.

For example, allowing networks to differentiate themselves might make it possible for three different types of last-mile networks to coexist by serving the needs of a different subgroup: one optimized for conventional Internet applications such as e-mail and website access, another incorporating security features to facilitate e-commerce, and a third employing routers that prioritize packets in the manner needed to facilitate time-sensitive applications such as Internet telephony, generally known as "voice over Internet protocol" (VoIP). Conversely, mandating interoperability commodifies bandwidth in ways that sharply limit opportunities to compete on dimensions other than price, which in turn reduces the network owners' ability to satisfy the underlying heterogeneity of consumer preferences and reinforces the advantages enjoyed by the largest and most established players.

Network neutrality is also particularly inappropriate when entry by alternative network technologies is technologically and economically feasible. This is because compelled access requirements represent something of a policy anomaly. By rescuing competing firms from having to supply the relevant input for themselves, compelled access destroys the incentives for those who need access to networks to invest in alternative network technologies. As a result, compelled access can have the perverse effect of entrenching any supposed bottleneck facility by forestalling the emergence of the alternative network technologies.

This is particularly problematic in technologically dynamic industries, such as broadband, in which the prospects of developing new means for circumventing or competing directly with the alleged bottleneck are the highest. For example, DSL and cable modem providers are currently engaged in a spirited competition for new customers. At the same time, a host of other technologies are waiting in the wings, including such innovative services as satellite broadband, fixed terrestrial wireless, mesh networks, WiFi, and third-generation mobile wireless devices (3G), just to name a few. Those unable to obtain access to a broadband technology

represent the natural strategic partners to provide the financing necessary to deploy these technologies.

Other commentators have invoked the burgeoning literature on network economic effects as an alternative justification for regulatory intervention.<sup>60</sup> Network economic effects exist when the value of network access depends on the number of other users connected to the network, rather than the network's technological characteristics or price. As a result, a user's decision to join a network increases the value of the network for others. The fact that new users cannot capture all of the benefits generated by their adoption decisions has led many theorists to regard network economic effects as a kind of externality that causes overall network utilization to drop below efficient levels. Some commentators also argue that network externalities can turn network access into a competitive weapon. By refusing to interconnect with other networks, network owners can force users to choose one network to the exclusion of others and induce them to flock to the largest network. In short, network economic effects can create demand-side economies of scale analogous to the supply-side economies of scale caused by the presence of sunk costs.

The current debate has overlooked a number of critical considerations that make it implausible that network economic effects are likely to harm competition. Even more importantly for the debates surrounding network neutrality, the economic literature recognizes that network differentiation can ameliorate the anticompetitive effects of the demand-side economies of scale associated with network economic effects in much the same manner as it can mitigate the problems caused by supply-side economies of scale. Imposing network neutrality would prevent such competition from emerging and would instead force networks to compete solely in terms of price and network size, considerations that give the largest players a decisive advantage. As a result, mandating network neutrality could have the perverse effects of reinforcing the sources of market failure and of dampening incentives to invest in the alternative network capacity that remains the most sustainable long-run solution to the problems of broadband policy. In other words, mandating network neutrality raises the real danger that regulation would become the source of, rather than the solution to, market failure.

This is not to say that network differentiation represents a panacea. For example, in order for network differentiation to ameliorate supply-side

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<sup>60</sup> See, e.g., Jerry A. Hausman et al., *Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers*, 18 YALE J. ON REG. 129 (2001).

and demand-side economies of scale in the manner I have described, the underlying preferences of network users must be sufficiently heterogeneous, otherwise users will tend to flock to the largest network regardless of whether multiple differentiated networks exist. Thus, although it is possible for network differentiation to counteract the tendency towards market failure, it will not necessarily have that effect in all cases. It also bears emphasizing that the potential harms associated with compelling network neutrality as a regulatory matter is not in any way inconsistent with recognizing that most network owners will adhere to network neutrality as a matter of choice. Interoperability clearly offers benefits to both providers and consumers, and network designers should hesitate before deviating from those central precepts. Indeed, I would expect that most industry participants would voluntarily design their technologies to be fully interoperable and compatible in the vast majority of cases even in the absence of regulation.

At the same time, circumstances do exist in which the basic principles of economic welfare would be better served by allowing last-mile broadband networks to deviate from principles of universal interoperability. Adoption of any of the major network neutrality proposals currently pending before the FCC would effectively foreclose these benefits from being realized.

The balance of this paper is organized as follows. Part I demonstrates the close relationship between network neutrality and the economics of vertical integration. It also examines the structure of the broadband industry, concluding that the preconditions needed for vertical integration to pose a threat to competition do not exist. Part II analyzes the potential welfare benefits of allowing last-mile providers to deviate from complete interoperability. Allowing last-mile providers to use vertical integration to differentiate their networks would allow the realization of certain efficiencies and would permit them to offer a broader range of services better attuned to consumers' preferences. Even more importantly, I show how requiring all broadband networks to use nonproprietary protocols can actually reduce competition by reinforcing the economies of scale already enjoyed by large telecommunications providers. Part III critiques some of the leading network neutrality proposals. Part IV analyzes the proper role of regulation, concluding that regulatory authorities will be more effective at promoting entry by new network platforms than they would be in ascertaining whether a particular exclusivity arrangement would promote or hinder competition. Even more importantly, promoting entry has embedded within it a built-in exit strategy. Once a sufficient number of broad-

band network platforms exist, regulatory intervention will no longer be necessary.

## **II. THE INTERRELATIONSHIP BETWEEN NETWORK NEUTRALITY AND VERTICAL INTEGRATION**

This part examines the insights that vertical integration theory provides into the network neutrality debate. Section A describes the structure of the broadband industry and demonstrates how the network neutrality is designed to redress the supposed problems caused by vertical integration. Section B reviews vertical integration theory and shows how it is now widely recognized that vertical integration can create economic harms only if certain structural preconditions are met. An empirical analysis reveals that these structural preconditions are not satisfied with respect to the broadband industry. This in turn undermines claims that the types of vertical integration that network neutrality is designed to foreclose pose a serious policy concern.

### **A. Two Conceptions of the Structure of the Broadband Industry**

The major network neutrality proposals have embedded within them two, rather different conceptions of the vertical structure of the broadband industry. Multiple ISP access proposals implicitly conceive of providers being organized in a traditional, three-step chain of distribution, in which the ISPs act as a wholesaler and the last-mile providers play the role of the retailer. Other approaches conceive of the broadband industry as consisting of a series of layers. I will discuss each in turn.

#### **1. The Conventional Vertical Market Structure Implicit in Multiple ISP Access**

Although the structure of the broadband industry may at times seem mysterious, when viewed from a certain perspective it is in fact quite ordi-

nary.<sup>61</sup> Its basic organization differs little from that of the typical manufacturing industry, which is divided into a three-stage chain of production. The first and last stages are easiest to understand. The manufacturing stage is occupied by companies that create the actual products to be sold. The retail stage consists of those companies responsible for the final delivery of the products to end users. Although it is theoretically possible for retailers to purchase products directly from manufacturers, in practice logistical complications often give rise to an intermediate stage mediating between manufacturers and retailers. Firms operating in this intermediate stage, known as wholesalers, purchase goods directly from manufacturers, assemble them into complete product lines, and distribute them to retailers.

Despite claims that the Internet is fundamentally different from other media, the broadband industry can easily be mapped onto this three-stage vertical chain of distribution. The manufacturing stage consists of those companies that generate the webpage content and Internet-based services that end users actually consume. The wholesale stage is occupied by the ISPs and backbone providers, which aggregate content and applications and deliver them to retailers. Finally, last-mile providers, such as DSL and cable modem systems, represent the retailers who deliver the content and service packages assembled by the ISPs to end customers. The proponents of multiple ISP access in essence are concerned that vertical integration between the retail and wholesale levels of this chain of distribution will allow network owners to use their control of the retail stage to harm competition in the wholesale stage.

## **2. The “Layered” Approach Implicit in Connectivity Principles**

Recent scholarship has increasingly turned to a somewhat different way to conceive of the structure of the broadband industry known as the “layered” approach.<sup>62</sup> The version of the layered approach that has gained the most popularity disaggregates networks into four horizontal layers that cut

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<sup>61</sup> The following discussion is adapted from Christopher S. Yoo, *Vertical Integration and Media Regulation in the New Economy*, 19 YALE J. ON REG. 171, 182, 250-51 (2002).

<sup>62</sup> The layered model is related to the Open Systems Interconnection (OSI) model developed by the International Standards Organization (ISO) in the 1980s, which divides seven different layers: application, presentation, session, transport, network, data link, and physical. Some of these distinctions between those layers have greater relevance for technologists than for policy analysts.



across different network providers.<sup>63</sup> The bottommost layer is the “physical layer,” which consists of the hardware infrastructure that actually carries and routes the communications. The second layer is the logical layer, which is composed of the protocols responsible for routing particular communications within the network. The third layer is the applications layer, comprised of the particular programs used by consumers. The fourth layer is the content layer, which consists of the particular data being conveyed.

**Figure 1**  
**The Layered Model of Broadband Architecture**

<b>Content Layer</b> (e.g., individual e-mail, webpages, voice calls, video programs)
<b>Applications Layer</b> (e.g., web browsing, e-mail, VoIP, streaming media, database services)
<b>Logical Layer</b> (e.g., TCP/IP, domain name system, telephone numbering system)
<b>Physical Layer</b> (e.g., telephone lines, coaxial cable, backbones, routers, servers)

The distinction between the layers can easily be illustrated in terms of the most common Internet application: e-mail. Assuming that the particular e-mail in question is sent via DSL, the physical layer consists of the telephone lines, e-mail servers, routers, and backbone facilities needed to convey the e-mail from one location to another. The logical layer consists of the SMTP protocol employed by the network to route the e-mail to its destination. The application layer consists of the e-mail program used, such as Microsoft Outlook. The content layer consists of the particular e-mail sent.

Network neutrality is motivated by a concern that last-mile providers will use their ability to control the physical layer to reduce competition in

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<sup>63</sup> Werbach, *supra* note 59, at 37, 57-64; Richard S. Whitt, *A Horizontal Leap Forward: Formulating a New Communications Public Policy Framework Based on the Network Layers Model*, 56 FED. COMM. L.J. 587, 624 (2004).

the application and content layer by entering into exclusivity arrangements with content and applications providers and by replacing the nonproprietary protocol currently used on the Internet—known as the transmission control protocol/Internet protocol (TCP/IP)—with a proprietary, noninteroperable set of protocols. Network neutrality is designed to short-circuit this dynamic by mandating that last-mile providers adhere to nonproprietary protocols and to open their networks to all applications and content on a nondiscriminatory basis.

## B. Market Structure and Vertical Integration

Vertical integration has long been one of the most contentious topics in economic theory, having spawned an extensive debate between what have become known as the Chicago and post-Chicago Schools of antitrust law and economics.<sup>64</sup> A full analysis of the scope of this controversy exceeds the scope of this chapter. For our purposes, it suffices to note that both sides agree that certain structural preconditions must be satisfied before vertical integration can plausibly harm competition. First, the vertically integrated firm must have market power in its primary market, because a firm that lacks market power has nothing to use as leverage. Second, the market into which the firm seeks to vertically integrate (called the secondary market) must also be concentrated and protected by barriers to entry. If no such barriers to entry exist, any attempt to raise price in the secondary market will simply attract new competitors until the price drops back down to competitive levels. The broad acceptance that these structural preconditions now enjoy is demonstrated by the fact that they are enshrined in the Merger Guidelines promulgated by the Justice Department and the Federal Trade Commission to evaluate vertical mergers.<sup>65</sup>

Applying these principles to the broadband industry strongly suggests that the FCC should not erect the *per se* bar to vertical integration implicit in network neutrality. Considering first the requirement that the primary market be concentrated, the Merger Guidelines employs a measure of concentration known as the Hirschman-Herfindahl index (HHI) that has become the standard concentration under modern competition policy. HHI is calculated by adding the square of the market share of each competi-

<sup>64</sup> The discussion that follows is based on Yoo, *supra* note 61, at 185-205.

<sup>65</sup> See U.S. Department of Justice & Federal Trade Commission, Non-Horizontal Merger Guidelines, §§ 4.131-133, 4.21, 4.212, *available at*: <http://www.usdoj.gov/atr/public/guidelines/2614.htm>.

tor.<sup>66</sup> The result is a continuum that places the level of concentration on a scale from just above 0 (in the case of complete market deconcentration) to 10000 (in the case of monopoly). The Guidelines indicate that the anti-trust authorities are unlikely to challenge a vertical merger unless HHI in the primary market exceeds 1800,<sup>67</sup> which is the level of concentration that would result in a market comprised of between five and six competitors of equal size.

Determining whether the market is concentrated depends on market definition, which in turn requires the identification of the relevant product and geographic markets. Defining the relevant product market is relatively straightforward: The empirical evidence indicates that broadband represents an independent product market that is distinct from narrowband services.<sup>68</sup> Defining the relevant geographic market has proven more problematic.<sup>69</sup> Many analyses have mistakenly assumed that the relevant geographic market is the local market in which last-mile broadband providers meet end users. Because these markets are typically dominated by two players—the incumbent cable operators offering cable modem service and the incumbent local telephone companies offering DSL service—defining the geographic market in this manner yields HHIs well in excess of 4000.<sup>70</sup>

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<sup>66</sup> For example, a market of four firms with shares of 30%, 30%, 20% and 20% would have an HHI of  $30^2 + 30^2 + 20^2 + 20^2 = 2600$ .

<sup>67</sup> Non-Horizontal Merger Guidelines, *supra* note 65, §§ 4.131. Note that the relevant threshold for vertical mergers is more lenient than the HHI thresholds applicable to horizontal mergers. Under the Horizontal Merger Guidelines, markets with HHIs between 1000 and 1800 are regarded as “moderately concentrated” and thus “potentially raise significant competitive concerns.” U.S. Department of Justice & Federal Trade Commission, 1992 Horizontal Merger Guidelines § 1.51(b), *available at*:

<[http://www.usdoj.gov/atr/public/guidelines/horiz\\_book/hmg1.html](http://www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html)>. Because vertical mergers are less likely than horizontal mergers to harm competition, the Merger Guidelines apply a more lenient HHI threshold to vertical integration. Non-Horizontal Merger Guidelines, *supra* note 65, § 4.0. The Merger Guidelines also reserve the possibility of challenging a vertical merger at HHI levels below 1800 if “effective collusion is particularly likely.” *Id.* § 4.213.

<sup>68</sup> Applications for Consent to Transfer of Control of Licenses & Section 214 Authorizations by Time Warner, Inc. and America Online, Inc., Transferors, to AOL Time Warner Inc., Transferee, Memorandum Opinion and Order, 16 F.C.C.R. 6547, 78-88 (2001); Jerry A. Hausman et al., *Cable Modems and DSL: Broadband Internet Access for Residential Customers*, 91 AM. ECON. REV. 302, 303-04 (2001).

<sup>69</sup> Yoo, *supra* note 61, at 253-54.

<sup>70</sup> Amendment of Parts 1, 21, 73, 74 and 101 of the Commission’s Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 Mhz Bands, Notice of Proposed Rule Making and Memorandum Opinion and Order, 18 F.C.C.R. 6722, 6774-75 (2003); Hausman et al., *supra* note 60, at 155; Rubinfeld & Singer, *supra* note 59, at 649.

The problem with this analysis is that network neutrality proposals are designed to limit the exercise of market power not in the final downstream market in which last-mile providers meet end users, but rather in the upstream market in which last-mile providers meet ISPs and content/application providers. This is easily seen if one hypothesizes a broadband market that is totally vertically disintegrated. Preventing last-mile providers from offering ISP services, content, or applications would not cause any changes in the fundamental economic relationship between last-mile providers and end users, which would remain a *de facto* duopoly. Compelled vertical disintegration would, however, substantially change the bargaining power between last-mile providers and ISPs and content/application providers.

Thus, if network neutrality proposals are to have any effect at all, it is by changing the economics in the upstream market in which last-mile providers meet ISPs and providers of Internet content and applications. In contrast to the end-user market that has represented the focus of prior analyses, these markets are national in scope. Major web-based providers, such as Amazon.com or eBay, are focused more on the total customers they are able to reach nationwide than they are on their ability to reach customers located in any specific metropolitan area. They would, of course, prefer to be able to reach all consumers nationwide. The fact that they may be unable to reach certain customers is of no greater concern, however, than the fact manufacturers of particular brands of cars, shoes, or other conventional goods are not always able to obtain distribution in all parts of the country. The fact that some manufacturers may be cut off from certain customers should not cause economic problems so long as those manufacturers are able to obtain access to a sufficient number of customers located elsewhere. The proper question is thus not whether the broadband transport provider wields market power over broadband users in any particular city, but rather whether that provider has market power in the national market for obtaining broadband content.

When the relevant geographic market is properly framed as being national in scope, it becomes clear that the market is too unconcentrated for vertical integration to pose a threat to competition.<sup>71</sup> The HHI is 987, well below the 1800 threshold for vertical integration to be a source of economic concern. In addition, the two largest broadband providers (Com-

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<sup>71</sup> The following discussion updates earlier data previously presented in Yoo, *supra* note 61, at 253-59; and Christopher S. Yoo, *Would Mandating Broadband Network Neutrality Help or Hurt Competition?: A Comment on the End-to-End Debate*, 3 J. ON. TELECOMM. & HIGH TECH. L. 23, 50-53 (2004).

cast and SBC) control only 20% and 14% of the national market respectively. Absent collusion or some other impermissible horizontal practice (which would be a basis for sanction independent of concerns about vertical integration), the national broadband market is sufficiently unconcentrated to vitiate concerns about the vertical integration in the broadband industry.

**Figure 2**  
**Last-Mile Broadband Subscribers as of Year End 2004**

<b>Provider</b>	<b>Technology</b>	<b>Subscribers (thousands)</b>	<b>Share</b>	<b>HHI</b>
Comcast Cable Communications	cable modem	6,992	20%	384
SBC Communications	DSL	5,104	14%	204
Time Warner Cable	cable modem	3,913	11%	120
Verizon Communications	DSL	3,600	10%	102
Cox Communications	cable modem	2,590	7%	53
BellSouth	DSL	2,096	6%	34
Charter Communications	cable modem	1,884	5%	28
Earthlink	mixed	1,364	4%	15
Adelphia Communications	cable modem	1,360	4%	14
Cablevision Systems	cable modem	1,316	4%	14
Qwest Communications	DSL	1,000	3%	8
Bright House Networks	cable modem	725	2%	4
Covad Communications	DSL	533	1%	2
Sprint	DSL	492	1%	2
Mediacom Communications	cable modem	367	1%	1
Insight Communications	cable modem	331	1%	1
Alltel	DSL	243	1%	0
RCN	cable modem	222	1%	0
Hughes Direcway	satellite	220	1%	0
Citizens Communications	DSL	212	1%	0
Cable One	cable modem	178	0%	0
Century Tel	DSL	143	0%	0
Cincinnati Bell	DSL	131	0%	0
Other		700	2%	1
<b>Total</b>		<b>35,697</b>	<b>100%</b>	<b>987</b>

In addition, the precondition that the secondary markets be concentrated and protected by entry barriers is also not met. As the FCC has recognized, the market for ISPs has long been quite competitive, and entry into ISP services has historically been quite easy.<sup>1</sup> As of the end of 2004, the HHI for ISPs appears to be below 800.<sup>2</sup> Similarly, the markets for applications and content have long been the most competitive segments of the entire industry, marked by low levels of concentration and low barriers to entry. The failure to satisfy these structural preconditions renders implausible any claims that vertical integration in the broadband industry constitutes a threat to competition.

### III. THE POTENTIAL BENEFITS OF NETWORK DIVERSITY

Conventional economic theory thus indicates that allowing last-mile providers to vertically integrate is unlikely to harm competition. In this Part, I analyze how allowing last-mile broadband providers to deviate from the principles of network neutrality can actually enhance competition. Section A discusses how allowing network owners to deviate from complete interoperability can increase economic welfare by increasing the diversity of products available. Conversely, imposing network neutrality as a regulatory matter may actually have the effect of reducing innovation and limiting consumer choice by skewing the Internet towards certain types of applications and away from others. Section B analyzes the impact that connectivity principles can have on the concentration of last-mile technologies, which looms as a far more central threat to the competitive performance of the Internet than does the robustness of competition among content and applications providers. Specifically, it details how standardizing network protocols can reinforce the supply-side and demand-side economies of scale that are the primary source of the tendency toward concentration in last-mile technologies. By forcing broadband providers to compete solely on price and network size, network neutrality reinforces the advantages already enjoyed by the largest players. Conversely, network diversity can provide new last-mile platforms, such as

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<sup>1</sup> Applications for Consent to Transfer of Control of Licenses and Section 214 Authorizations from Tele-Communications, Inc., Transferor, to AT&T Corp., Transferee, Memorandum Opinion and Order, 14 F.C.C.R. 3160, 3206 (1999); see also Yoo, *supra* note 61, at 259.

<sup>2</sup> See Alex Goldman, *Top 22 U.S. ISPs by Subscriber: Q4 2004*, available at: <<http://www.isplanet.com/research/rankings/usa.html>>.

3G, with a strategy for survival. Section C briefly examines the economic efficiencies that can result from vertical integration.

These arguments should not be misconstrued as favoring noninteroperability as a general matter. On the contrary, I would expect most network owners will voluntarily adhere to a basic architecture based TCP/IP. Maintaining interoperability provides network owners with substantial financial advantages that in most cases should prove so overwhelming that mandating network neutrality would have no real effect. Imposing network neutrality as a regulatory matter would, however, foreclose last-mile providers from employing proprietary technologies even in those cases in which doing so would yield substantial economic benefits. The lack of a plausible case that the use of such proprietary technologies would harm competition suggests that even though most network owners will adhere to network neutrality, imposing it as a regulatory matter would provide no tangible benefits and would impose harm by preventing network owners from pursuing certain strategies that would be economically beneficial.

## **A. The Tradeoff Between Network Standardization and Product Variety**

One of the biggest shortcomings of the current debate is that it has largely ignored how network neutrality can harm economic welfare by limiting the variety of products.<sup>3</sup> The predominance of price theory, in which the sole source of economic welfare is economic surplus (i.e., the difference between reservation prices and the actual prices charged), has caused commentators studying the economics of broadband networks to overlook the potential benefits associated with product differentiation. Simply put, allowing network owners to employ different protocols can foster innovation by allowing a wider range of network products to exist. Conversely, compulsory standardization can reduce consumer surplus by limiting the variety of products available. In the words of two leading commentators on network economics, “market equilibrium with multiple incompatible products reflects the social value of variety.”<sup>4</sup>

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<sup>3</sup> The following discussion is based on Christopher S. Yoo, *Beyond Network Neutrality*, 19 HARV. J. L. & TECH. (forthcoming 2005); Yoo *supra* note 71, at 56-59.

<sup>4</sup> Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSP. 93, 106 (1994); accord Joseph Farrell & Garth Saloner, *Standardization and Variety*,

Viewed from this perspective, the pressure towards proprietary standards may not represent some sinister attempt by last-mile providers to harm competition. Instead, it may represent nothing more than the natural outgrowth of the underlying heterogeneity of consumer preferences. It is for this reason that economic theorists have uniformly rejected calls for blanket prohibitions of exclusivity arrangements and other means for differentiating network services.<sup>5</sup>

Indeed, the advent of broadband technologies has also largely coincided with a number of fundamental changes that have increased the heterogeneity of the demands that users are placing on the Internet that have placed increasing pressure on the continued adherence to a uniform, TCP/IP-based architecture. Although the forces are somewhat complex, a few examples illustrate the forces driving this fundamental shift.<sup>6</sup>

## 1. The Shift from Institutional to Mass-Market Users

The termination of NSF support for backbone services in 1995 eliminated the few remaining restraints on the commercialization of the Internet. The Internet's transformation from a network designed primarily to facilitate academic interchange into a medium of mass communications has made management of the Internet considerably more complicated. The Internet was once only charged with bringing together a relatively small number of fairly sophisticated, institutional users who generally shared a broad set of common goals. It now must mediate among an increasingly disorderly onslaught of private users each pursuing increasingly divergent objectives. This has greatly complicated traffic management, as the variability in usage patterns has increased. At the same time, the influence of overlapping institutional norms and relationships has dwindled. This shift has also created pressure to simplify the demands imposed on end users by incorporating more of those functions into the core network.

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20 ECON. LETTERS 71 (1986); S.J. Liebowitz & Stephen E. Margolis, *Should Technology Choice Be a Concern of Antitrust Policy?*, 9 HARV. J. L. & TECH. 283, 292 (1996).

<sup>5</sup> See, e.g., David Balto, *Networks and Exclusivity: Antitrust Analysis to Promote Network Competition*, 7 GEO. MASON L. REV. 523 (1999); David S. Evans & Richard Schmalensee, *A Guide to the Antitrust Economics of Networks*, ANTITRUST, Spr. 1996, at 36; Carl Shapiro, *Exclusivity in Network Industries*, 7 GEO. MASON L. REV. 673, 678 (1999).

<sup>6</sup> The discussion that follows draws on the analysis offered by Marjory S. Blumenthal & David D. Clark, *Rethinking the Design of the Internet: The End-to-End Arguments vs. the Brave New World*, 1 ACM TRANSACTIONS ON INTERNET TECH 70 (2001).



## **2. The Emergence of Bandwidth-Intensive Applications**

By contemporary standards, early Internet applications, such as e-mail, web access, newsgroups, and file transfer, placed fairly modest demands on the network. Overall file sizes were relatively small, and delays of a second or two typically went unnoticed. The commercialization of the Internet has spurred the development of applications which place greater demands on network services. Bandwidth-intensive applications, such as multimedia websites and music downloads are placing increasing pressure on network capacity, as is the increase in telecommuting and home networking. Equally important is the emergence of applications that are less tolerant of variations in throughput rates, such as streaming media, on-line gaming, and Internet telephony, also known as voice over Internet protocol (VoIP).

These concerns have led many network providers to make the terms of interconnection vary to some extent with bandwidth usage. For example, many last-mile providers either forbid end users to use bandwidth-intensive applications or instead require that they pay higher charges before doing so. Similarly, backbone providers often base the amounts they charge for interconnection on volume-related considerations. Backbones who exchange traffic of roughly equal value enter into “peering” arrangements that are similar to telecommunications arrangements known as “bill and keep.” Under peering arrangements, the originating backbone collects and retains all of the compensation for the transaction notwithstanding the fact that other backbones also incur costs to terminate the transaction. So long as the traffic initiated and terminated by each backbone is roughly equal in value, peering allows backbones to forego the costs of metering and billing these termination costs without suffering any adverse economic impact. Peering is less economical, however, in cases where the value of the traffic being terminated is not reciprocal. As a result, smaller-volume backbones are often required to enter into “transit” arrangements in which they must pay larger backbones compensation for terminating their traffic.

The growing importance of time-sensitive applications is also placing pressure on system designers to employ routers that can discriminate among packets and to assign them different levels of priority, depending upon the source of the packet or the nature of the application being run. This represents a marked departure from TCP/IP, which manages packets on a “first come, first served” basis and in which packets are routed without regard to the nature of the communications being transmitted.

### **3. The Growth in Distrust of Other Endpoints**

As noted earlier, the Internet's reliance on TCP/IP has dictated that all packets be routed without regard to their source. The anonymity of this system of transmission was implicitly built on the presumption that the other endpoints in the system were relatively trustworthy and were cooperating in order to achieve common goals.

The rise of e-commerce has created the need for increased levels of confidence in the identity of the person on the other end of the connection. At the same time, end users have become increasingly frustrated by intrusions thrust upon them by other end users. Although some examples, such as spam, are relatively innocuous, others are considerably more malicious, such as viruses, worms, Trojan horses,<sup>7</sup> pornographic websites masquerading as less objectionable content, and programs that mine cookies for private information. Although end users are in a position to undertake measures to protect themselves against these harms, some Internet providers are interposing elements into the body of their network to shield end users from such dangers.

### **4. The Needs of Law Enforcement**

The demands of law enforcement represent another factor that is driving the Internet away from the anonymous, fully interoperable architecture that existed in the narrowband era. For example, the Communications Assistance for Law Enforcement Act ("CALEA") requires that all telecommunications carriers configure their networks in a way that permits law enforcement officials to place wiretaps on telephone calls.<sup>8</sup> Emerging Internet telephone systems, such as VoIP, are not easily rendered wiretap compatible. In contrast to the architecture of conventional telephone networks, which requires that all voice traffic pass through a discrete number of network gateways, VoIP technologies rely upon the decentralized structure inherent in the Internet. Furthermore, even if law enforcement officials found an appropriate location to intercept VoIP traffic, the packet anonymity inherent in TCP/IP would make it extremely difficult for law enforcement officials to separate the telephony-related packets from the other packets in the data stream. As a result, the FCC has recently opened

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<sup>7</sup> Trojan horses are malicious pieces of code concealed within programs that perform beneficial functions.

<sup>8</sup> 47 U.S.C. §§ 1002(a).

a proceeding to address how to reconcile VoIP with CALEA.<sup>9</sup> Similarly, states' desire to impose sales taxes on Internet transactions may prompt them to push for changes to the architecture of the Internet to permit them to conduct some degree of monitoring of on-line commercial activity. Any solution to either problem would almost certainly require a deviation from the content and application transparency that is inherent in TCP/IP.

## 5. The Impact of the Shifts in Demand

The current forces that are motivating network providers to consider introducing increasing levels of intelligence into their core networks provide an apt illustration of this dynamic. As discussed earlier, consumers' demand for more time-sensitive applications, such as VoIP and streaming media, may be providing much of the impetus away from standardization. Refusing to allow network owners to introduce routers that can assign different priority levels to packets based on the nature of the application being run would have the effect of precluding consumers from enjoying the benefits of certain types of applications. The current ubiquity of TCP/IP makes it seem like an appropriate default rule and appears to justify placing the burden on those who would deviate from it. A moment's reflection makes clear how adherence to the Internet's nonproprietary structure may actually impede innovation. Indeed, some models indicate that the deployment of proprietary network standards may actually prove more effective in promoting innovation and the adoption of socially optimal technologies.<sup>10</sup>

There is thus considerable irony in the network neutrality proponents' insistence that allowing Internet providers to introduce intelligence into their core networks would skew innovation and that technological humility demands adherence to an end-to-end architecture. The decisions to concentrate intelligence at the edges of the network and to require packet nondiscrimination would itself skew the market towards certain applications and away from others. The choice is thus not between neutrality and nonneutrality in the overall direction of innovation. Mandating either

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<sup>9</sup> Communications Assistance for Law Enforcement Act and Broadband Access and Services, Notice of Proposed Rulemaking, 19 F.C.C.R. 15676 (2004).

<sup>10</sup> Michael L. Katz & Carl Shapiro, *Product Introduction with Network Externalities*, 40 J. INDUS. ECON. 55, 73 (1992); Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822, 825, 838-39 (1986).

would have the inevitable effect of determining technological winners and losers.

## **B. Network Neutrality and Competition in the Last Mile**

On a more fundamental level, network neutrality advocates' focus on innovation in content and applications appears to be misplaced.<sup>11</sup> Application of the basic insights of vertical integration theory reveals that markets will achieve economic efficiency only if each stage of production is competitive. In other words, any vertical chain of production will only be as efficient as its most concentrated link. The intuition underlying this insight can be easily discerned by the thought experiment outlined above imagining how competitive the broadband industry would be if regulators required that it be completely vertically disintegrated. Complete vertical disintegration would not increase consumer choice among last-mile providers. If anything, to the extent that it prevents network owners from realizing the available efficiencies, it might have the effect of reducing the number of last-mile options. In addition, the last-mile providers' bargaining leverage against ISPs and content and application suppliers would remain the same.

Viewing the issues in this manner reveals that the major network neutrality proposals are focusing on the wrong policy problem. These proposals direct their efforts towards encouraging and preserving competition among ISPs and content/application providers, which operate in the industry segments that are already the most competitive and the least protected by entry barriers. Instead, broadband policy should focus on increasing the competitiveness of the most concentrated level of production in the broadband industry, which in the case of broadband is the last mile.

The central questions of broadband policy are thus more properly framed in terms of how to best to foster competition in alternative network technologies operating in the last mile. The current degree of concentration in the physical layer has traditionally been attributed to both supply-side and demand-side considerations.<sup>12</sup> The supply-side consideration is the fact that building the physical network of wires needed to provide DSL and cable modem service requires the incurrence of substantial sunk costs. The presence of high sunk costs in turns gives rise to a tendency towards

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<sup>11</sup> Yoo, *supra* note 61, at 241-42.

<sup>12</sup> The following discussion is based on Yoo, *supra* note 3; and Yoo, *supra* note 71, at 248-49. For a briefer discussion applying a similar analysis to another type of electronic communications, see Yoo, *Rethinking Free, Local Television*, *supra* note 13, at 1603 & n.61.

natural monopoly. On the demand side is a series of considerations generally termed network economic effects. Network economic effects exist when the value of a network is determined by the number of other people connected to that network. The more people that are part of the network, the more valuable the network becomes. This dynamic in turn can create considerable demand-side economies of scale that will reinforce the tendency towards concentration.

What has been largely overlooked in the current debates is how allowing networks to differentiate in the services they offer can mitigate the forces traditionally thought to induce market concentration in communications networks. Conversely, measures that limit networks' ability to differentiate their services only serve to reinforce these tendencies. There is thus a real possibility that imposing network neutrality may actually worsen rather than alleviate the central policy problem confronting the broadband industry.

## **1. Declining Average Costs and Supply-Side Economies of Scale**

The supply-side considerations that cause last-mile services to exhibit a tendency towards natural monopoly can most easily be understood by focusing on the shape of the average cost curve.<sup>13</sup> If the average cost curve is decreasing, firms with the largest volumes can provide services the most cheaply, which in turn allows them to underprice their smaller competitors. The price advantage allows the largest players to capture increasingly large shares of the market, which reinforces their cost advantage still further. Eventually the largest firm will gain a sufficient cost advantage to drive all of its competitors out of the market.

Whether average cost is increasing or decreasing is determined by magnitude of the sunk costs. On the one hand, the ability to spread sunk costs over increasing large volumes places downward pressure on average cost. For example, spreading a \$100 million sunk-cost investment across 1 million customers would require allocating an average of \$100 in sunk costs to each customer. If the same sunk-cost investment were spread over 10 million customers, each consumer would have to pay only an average of \$10 in order to cover sunk costs. The larger the sunk costs relative to the overall demand, the more pronounced these scale economies will be, although the marginal impact of this effect will decay exponentially as production increases. At the same time, the scarcity of factors of

production and the principle of diminishing marginal returns typically cause variable costs to increase as volume increases.

Whether average cost is rising or falling at any particular point is determined by which of these two effects dominates the other. When the necessary sunk-cost investments are large, the former effect tends to loom as the more important and causes average cost to decline. Because entry by new broadband networks tends to require large sunk-cost investments, the market for last-mile providers is generally expected to exhibit a natural tendency towards concentration.

What network neutrality advocates have failed to recognize is how allowing last-mile broadband providers to differentiate their product offerings can help prevent declining-cost industries from devolving into natural monopolies.<sup>14</sup> It is not unusual for small-volume producers to survive against their larger rivals even in the face of unexhausted economies of scale by targeting those customers who place the highest value on the particular types of products or services they offer, as demonstrated by the survival of high-cost, low-volume specialty stores in a world increasingly dominated by lower-cost, higher-volume discounters. Although consumers of these small-volume producers will pay more for these specialized products, it is difficult to see how these consumers are worse off. The value that they derive from the specialized product necessarily exceeds the amount they must pay for it, otherwise they simply would not agree to the transaction. Indeed, it is the ability to use prices to signal the intensity of their preferences that allows the particular low-volume version to be available for purchase at all.

Last-mile providers have a number of avenues open to them for differentiating the networks. One way is by entering into exclusivity arrangements with respect to content, as demonstrated by the role played by such arrangements in helping direct broadcast satellite (DBS) provider DirecTV emerge as a viable alternative to cable television. For example, DirecTV is offering an exclusive programming package known as "NFL Sunday Ticket" that allows sports fans to watch the entire NFL schedule and not just the games being shown by the broadcast networks in their service area. Many cable customers have been frustrated by their inability to purchase NFL Sunday Ticket through their local cable operators. If regulators were to view this exclusivity arrangement solely in static terms, they might be tempted to increase consumer choice by requiring that the programming package also be made available to cable subscribers. The problems underlying such a reaction become manifest when one recalls that the central problem confronting the television industry is the local cable operators' historic dominance over multichannel video distribution. The

market reaction has already demonstrated how permitting exclusivity arrangements can drive the deployment of alternative retail delivery networks. Conversely, requiring that such programming be made available to cable as well as DBS customers would run the risk of eliminating one of the primary inducements to shift from cable to DBS, which would in turn only serve to entrench the local cable operator still further.

Another way that last-mile providers can differentiate the services they provide is by optimizing the architecture of their networks for different types of applications. To offer an illustration in the context of broadband, it is theoretically possible that three different broadband networks could co-exist notwithstanding the presence of unexhausted economies of scale. The first network could be optimized for conventional Internet applications, such as e-mail and website access. The second network could incorporate security features designed to appeal to users focusing on e-commerce. The third network could employ policy-based routers that prioritize packets in the manner that allows for more effective provision of time-sensitive applications such as VoIP. If this were to occur, the network with the largest number of customers need not enjoy a decisive price advantage. Instead, each could survive by targeting and satisfying those consumers who place the highest value on the types of service they offer.

The example I have sketched illustrates how imposing network neutrality could actually frustrate the emergence of platform competition in the last mile. Simply put, protocol standardization tends to commodify network services. Limiting networks' ability to compete in terms of content or quality of services effectively forces networks to compete on price, which in turn accentuates the advantages enjoyed by the largest players and reinforces the market's tendency towards concentration. Conversely, increasing the dimensions along which networks can compete by allowing them to deploy a broader range of architectures may make it easier for multiple last-mile providers to co-exist.

## **2. Network Externalities and Demand-Side Economies of Scale**

Other commentators have argued that network neutrality must be mandated as a regulatory matter in order to redress the competitive problems posed by network economic effects. For reasons that I have discussed in detail elsewhere, such claims are subject to a number of important analyti-

cal limitations and qualifications.<sup>15</sup> A few brief comments on two of the more salient limitations will suffice to make my point.

First, for reasons analogous to the similar requirement with respect to vertical integration, the existing theories require that the network owner have a dominant market position before network economic effects can even plausibly harm competition. The classic illustration of this phenomenon is the development of competition in local telephony during the 1890s made possible by the expiration of the initial telephone patents.<sup>16</sup> After the Bell System's market share was cut in half, it attempted to rely on network economic effects to reverse its losses. Specifically, it refused to interconnect with the upstart independent telephone companies, hoping that its greater network size would make it sufficiently more attractive to consumers to give it a decisive advantage. This effort ultimately failed, however, since the independent companies that comprised the other half of the industry were able to forestall any negative impact from network economic effects by allying to form a network that was similar in size to the Bell network. In the end, it was control of certain patents critical to providing high-quality long distance service and not network economic effects that allowed the Bell System to return to dominance. The clear implication is that the presence of a single competitor of roughly the same size as the network owner will likely be sufficient to eliminate any such anticompetitive problems.

Second, the argument that network economic effects create externalities that lead to market failure is wholly inapplicable in the context of telecommunications networks. This is because any externalities that may exist will necessarily occur within a physical network that can be owned.<sup>17</sup> Thus, although individual users may not be in a position to capture all of the benefits created by their demand for network services, the network owner will almost certainly be in a position to do so. Any benefits created by network participation can thus be internalized and allocated through the interaction between the network owner and network users.<sup>18</sup>

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<sup>15</sup> Yoo, *supra* note 61, at 278-82; Daniel F. Spulber & Christopher S. Yoo, *Access to Networks: Economic and Constitutional Connections*, 88 CORNELL L. REV. 885, 924-33 (2003).

<sup>16</sup> Roger Noll & Bruce M. Owen, *The Anticompetitive Uses of Regulation: United States v. AT&T*, in *THE ANTITRUST REVOLUTION* 290, 291-92 (John E. Kwoka, Jr. & Lawrence J. White eds., 1989).

<sup>17</sup> The literature refers to network externalities that occur in the context of a physical network as "direct network externalities." Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424, 424 (1985).

<sup>18</sup> 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. Mar-



The commentary on network economic effects thus does not support the contention that imposing network neutrality is necessary to protect competition. Even if such problems were to exist, it is far from clear that imposing network neutrality would help. Quite the contrary, the literature indicates that compelling interoperability could make matters worse. This is because allowing last-mile providers to differentiate their networks can mitigate the problems resulting from any demand-side economies of scale created by network economic effects that may exist. Simply put, allowing networks to tailor their services to the needs of different groups of customers can offset the economic advantages enjoyed by larger networks in much the same manner as differentiation can offset the supply-side economies of scale. Targeting those customers who place a particularly high value on a particular type of service makes it possible for smaller networks to survive despite the greater inherent appeal of larger networks.<sup>19</sup>

Conversely, mandating that all broadband networks employ nonproprietary protocols can foreclose network owners from using differentiation to mitigate the pressures towards concentration. Preventing network owners from varying the services that they offer forces networks to compete solely on price and network size, further reinforcing and accentuating the benefits already enjoyed by the largest players. As a result, network neutrality runs the danger of becoming the source of, rather than the solution to, market failure.

### C. Economic Efficiencies from Vertical Integration

In addition to finding common ground on the structural preconditions necessary for vertical integration to harm competition, both Chicago and post-Chicago School theorists agree that vertical integration can yield substantial cost efficiencies.<sup>20</sup> The potential for vertical integration to enhance economic welfare is reflected in the Merger Guidelines, which explicitly recognize that efficiencies may exist that permit a vertical merger

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golus, *Network Externality: An Uncommon Tragedy*, 8 J. ECON. PERSP. 133, 137, 141-44 (1994).

<sup>19</sup> Joseph Farrell & Garth Saloner, *Standardization and Variety*, 20 ECON. LETTERS 71 (1986); Katz & Shapiro, *supra* note 4, at 106; Liebowitz & Margolis, *supra* note 4, at 292.

<sup>20</sup> See Yoo, *supra* note 61, at 192-200 (reviewing efficiencies resulting from vertical integration identified by Chicago School commentators); *id.* at 204 (reviewing the acknowledgement by post-Chicago theorists that vertical integration can yield substantial efficiencies).

to go forward even when the market structure raises the possibility of anti-competitive effects.<sup>21</sup>

As I have discussed at some length elsewhere, aspects of the broadband industry make it likely that allowing a greater degree of vertical integration could yield substantial economic efficiencies.<sup>22</sup> For example, ISPs minimize traffic by “caching,” a process in which the ISP gathers information from popular websites and stores it locally. Once it has done so, the ISP can provide access to the content without tying up resources outside of the ISP’s proprietary system. Like all systems involving fixed costs, however, caching systems must spread their costs over as large a number of subscribers as possible in order to be economically viable. If other ISPs are allowed access to cable modem and DSL systems, each ISP’s caching costs will be spread across fewer subscribers, a result which would raise the cost of providing high-quality service. Worse yet, the unaffiliated ISPs would either have to create caching systems of their own, a result which would duplicate costs and waste resources, or would simply provide consumers with a lower quality product. Neither alternative seems particularly attractive.

In addition, allowing ISPs to integrate with cable modem systems would also enable broadband providers to take advantage of the available economies of scope. For example, requiring open access would prevent cable modem systems from realizing the transaction cost economies associated with marketing, billing, and servicing both products together. Joint provision can be particularly important when the overall performance of the final product depends upon inputs provided by two different companies and when consumers have trouble distinguishing which of the two companies is responsible for any performance inadequacies. In such cases, the two companies may simply blame each other for the system’s poor performance. Customers that experience unsatisfactory performance with an emerging technology may simply choose to drop the product without attempting to identify the cause of the poor performance. In such cases, allowing a single company to provide both complementary services better enables it to ensure the overall performance of the system. As the Supreme Court has implicitly recognized in an early cable television case, such concerns are particularly important in the case of new products, such

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<sup>21</sup> Non-Horizontal Merger Guidelines, *supra* note 65, §§ 4.135, 4.24. In addition, the Guidelines give more weight to expected efficiencies in the case of vertical integration than with respect to a horizontal merger. *Id.* § 4.24.

<sup>22</sup> Yoo, *supra* note 61, at 260-64; see also 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, 97-105 (2004).

as cable modem service, since an emerging industry's "short and long-term well-being depend[s] on the success of the first systems sold."<sup>23</sup>

The presence of large, up-front fixed costs also leaves both network owners and content/application providers vulnerable to a range of opportunistic behavior that vertical integration can substantially mitigate. Since each user and each ISP do not internalize all of their costs, each has inadequate incentives to conserve bandwidth. In addition, the last-mile provider will eventually have to make additional capital investments to upgrade its system to accommodate increases in traffic. Theoretically, simply forcing each ISP to bear the full costs of their usage could solve such problems. To the extent that open access is limited to marginal cost, however, the existence of such externalities also gives ISPs the incentive to free ride on the last-mile provider by avoiding making any contribution to the additional capital costs that the ISP itself is responsible for creating. Even if regulators attempt to allocate such fixed costs fully, the allocation of fixed costs has proven quite difficult and even arbitrary. In addition, rate making authorities have had little success setting the appropriate cost of capital to reflect the true *ex ante* risks once the market has arrived in the *ex post* world.

In addition, the migration from narrowband to broadband has effected a fundamental structural change in the role played by last-mile providers.<sup>24</sup> Under a narrowband architecture, most residential and small business customers connected to the Internet by using a dial-up modem to place a conventional telephone call. The local telephone company simply connected the local telephone call to the offices of the ISP. As a result, the last-mile provider could serve as a mere pass through. It did not need to maintain any packet-switching capability of its own.

The situation is rather different with respect to broadband technologies. Because both DSL and cable modem providers use the same infrastructure to provide two different types of service (either cable television combined with cable modem service or local telephone service combined with DSL), both types of providers must maintain equipment to segregate the two different communication streams. As a result, last-mile broadband providers must maintain a packet-switched network in their main facilities to hold

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<sup>23</sup> *United States v. Jerrold Elecs. Corp.*, 187 F. Supp. 545, 557 (E.D. Pa. 1960), *aff'd*, 365 U.S. 567 (1961) (per curiam); see also Bruce M. Owen & Gregory L. Rosston, *Cable Modems, Access and Investment Incentives* 19 (Dec. 1998) (unpublished manuscript), *available at*: <[www.gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6006242167](http://www.gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6006242167)>; J. Gregory Sidak, *An Antitrust Rule for Software Integration*, 18 YALE J. ON REG. 1, 9-10 (2001).

<sup>24</sup> See Yoo, *supra* note 71, at 33-34.

and route the stream of data packets after they have been separated from other types of communications. Thus, under a broadband architecture, last-mile providers no longer serve as mere pass throughs. They must instead necessarily perform the same routing functions previously carried out by ISPs. Indeed, some last-mile broadband providers have negotiated their own interconnection agreement with backbone providers and require all of their customers to use their own proprietary ISP, thereby supplanting the role of independent ISPs altogether. The migration of Internet users from narrowband to broadband technologies has thus had the inevitable effect of reducing the viability of many independent ISPs and encouraging last-mile providers to bundle their offerings with ISP services.

The fact that last-mile broadband providers must necessarily maintain packet-switched networks within their primary facilities makes it unsurprising that last-mile broadband providers would find it more economical to provide ISP services themselves. The existence of these efficiencies is demonstrated most dramatically by the manner in which the multiple ISP access mandated during the AOL-Time Warner merger has been implemented. Contrary to the original expectations of the FTC, the unaffiliated ISPs that have obtained access to AOL-Time Warner's cable modem systems under the FTC's merger clearance order have not placed their own packet network and backbone access facilities within AOL-Time Warner's headend facilities. Instead, traffic bound for these unaffiliated ISPs exits the headend via AOL-Time Warner's backbone and is handed off to the unaffiliated ISP at some external location. It is hard to see how consumers benefit from such arrangements, given that they necessarily use the same equipment and thus provide the same speed, services, and access to content regardless of the identity of their nominal ISP.<sup>25</sup> The fact that these unaffiliated ISPs have found it more economical to share AOL Time Warner's existing ISP facilities rather than build their own strongly suggests that integrating ISP and last-mile operations does in fact yield real efficiencies.

The absence of consumer benefits underscores the extent to which compelled access represents something of a competition policy anomaly. When confronted with an excessively concentrated market, competition policy's traditional response is to deconcentrate the problematic market, either by breaking up the existing monopoly or by facilitating entry by a competitor. Compelled access, in contrast, leaves the concentrated market

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<sup>25</sup> Columbia Telecommunications Corporation, *Technological Analysis of Open Access and Cable Television Systems*, December 2001, at 22-23, *available at*: [http://archive.aclu.org/issues/cyber/broadband\\_report.pdf](http://archive.aclu.org/issues/cyber/broadband_report.pdf).

intact and instead simply requires that the bottleneck resource be shared. Such an approach may be justified if competition in the concentrated market is infeasible, as was generally believed to be the case with respect to local telephone service until recently. Simply requiring that the monopoly be shared is inappropriate when competition from new entrants is technologically and economically achievable.<sup>26</sup>

#### IV. CRITIQUE OF THE PRINCIPAL NETWORK NEUTRALITY PROPOSALS

Allowing last-mile broadband providers to employ proprietary protocols and enter into exclusivity arrangements thus offers the promise of enabling the realization of economic efficiencies and allowing the deployment of products that better satisfy consumer preferences. Even more importantly, network differentiation can alleviate the supply-side and demand-side economies of scale that represent the primary theoretical sources of market failure in the broadband industry. Preventing last-mile providers from using proprietary protocols and exclusivity arrangements to differentiate the network can thus have the perverse effect of forestalling the emergence of alternative network platforms and of entrenching the existing oligopoly into place.

Nonetheless, a number of advocates continue to offer their support for network neutrality. This part will address three of these proposals: the end-to-end argument championed most prominently by Lawrence Lessig, the “connectivity principles” backed by the HTBC, and the “layered model” currently being advanced by MCI. Upon close analysis, it becomes clear that each suffers from some fundamental conceptual problems.

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<sup>26</sup> The feasibility of platform competition underscores the problems with viewing previous efforts to standardize and compel access to the local telephone service as precedent for imposing network neutrality on the Internet. See Lessig, *supra* note 59, at 147-51; Lemley & Lessig, *supra* note 59, at 934-36, 938. Most steps to mandate access to local telephone networks were justified by the fact that competition in local telephony was believed impossible at the time. Such arguments do not apply to broadband, in which platform competition has emerged as a real possibility. See Yoo, *supra* note 3.

## A. The End-to-End Argument

Many network neutrality advocates have drawn much of the inspiration for their regulatory proposals from the “end-to-end argument” first advanced by Jerome Saltzer, David Reed, and David Clark in 1981.<sup>27</sup> Simply put, the end-to-end argument counsels against introducing intelligence into the core of the Internet and in favor of restricting higher levels of functionality to the servers operating at the edges of the network. The “pipes” that constitute the core of the network should be kept “dumb” and should focus solely on passing along packets as quickly as possible. The fundamental logic of the end-to-end argument is most easily understood by examining the core illustration offered by Saltzer, Reed, and Clark to articulate it: careful file transfer, in which a file stored on the hard drive of computer *A* is transferred to the hard drive of computer *B* without errors. Roughly speaking, this function can be divided into five steps:

1. Computer *A* reads the file from its hard disk and passes it to the file transfer program.
2. The file transfer program running on computer *A* prepares the file for transmission by dividing it into packets and hands off the packets to the data communication network.
3. The data communication network moves the packets from computer *A* to computer *B*.
4. The file transfer program running on computer *B* reassembles the packets into a coherent file.
5. The file transfer program saves the file onto computer *B*’s hard disk.

Errors can emerge at any step in this process. Computer *A* can misread the file from the hard disk. The file transfer program on Computer *A* can introduce mistakes when copying the data from the file. The communication network can drop or change bits in a packet or lose a packet altogether. The file transfer program on Computer *B* can also produce errors when converting the packets back into a coherent file. Computer *B* can

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<sup>27</sup> J.H. Saltzer et al., *End-to-End Arguments in System Design*, 2 ACM TRANSACTIONS ON COMPUTER SYS. 277 (1984) (revised version of paper first presented in 1981).

miswrite the file to its hard disk. The transfer can also be jeopardized by larger-scale hardware or software failures.

Saltzer, Reed, and Clark compared two different approaches to managing the risk of such errors. One approach is to perform error checking at each intermediate step along the way. The other approach is known as “end-to-end check and retry.” Under this approach, no error checking is performed at any of the intermediate steps. Instead, the only error checking occurs when the terminating end of the process (computer *B*) verifies the accuracy of the file transfer with the initiating end (computer *A*) after the entire transaction has been completed.

As a result, Saltzer, Reed, and Clark concluded that system designers should adopt a presumption in favor of the latter approach. They based their argument on two insights. First, no matter how many intermediate error checks are introduced, the terminating end of the file transfer must still verify the transaction with the originating end after all of the steps have been completed. The fact that such end-to-end verification is necessary no matter what other intermediate reliability measures are built into the system renders any additional measures redundant and raises further doubts as to the justifiability of incurring the burdens imposed by those additional measures.

Second, intermediate error checking should properly be regarded as an engineering tradeoff between reliability and performance. Errors can be reduced, but only at the cost of introducing a degree of redundancy that will have the inevitable effect of slowing the network down. They emphasize that different applications vary in their tolerance for unreliability as well as their demand for speed. Imposing reliability checks in low-level subsystems that are common to all applications may have the uneconomical result of forcing all applications to incur the performance costs even if the increase in reliability does not provide particular applications with commensurate benefits.

Together these insights suggest that system designers should avoid designing higher-level functions into the core of the network. Instead, the Internet should presumptively be engineered with any such functions concentrated in the servers that operate at the network’s edge. Saltzer, Reed, and Clark applied the same basic rationale to other system functions, such as delivery guarantees, secure transmission of data, duplicate message suppression, and transaction management.

Network neutrality proponents contend that the end-to-end argument justifies prohibiting Internet providers from introducing additional degrees of intelligence into their core networks. In short, all of the intelligence should be restricted to the servers operating at the edge of the network.

They also argue that the end-to-end argument supports mandating that broadband network owners employ protocols like TCP/IP that ensure that the core of the network remains relatively transparent and dumb.

A close analysis of the end-to-end argument reveals that network neutrality proposals are based on an overreading of Saltzer, Reed, and Clark's work that expands it far outside its proper scope. In fact, a careful examination of the rationale underlying the end-to-end argument reveals that it is fundamentally incompatible with network neutrality advocates' attempt to turn the end-to-end argument into a regulatory mandate.

Although the end-to-end argument does support a presumption against introducing higher-level functions into the network's core, it does not provide any support for elevating this presumption into an inviolable precept. Conceding that it is "too simplistic to conclude that the lower levels should play no part in obtaining reliability," Saltzer, Reed, and Clark's original article articulating the end-to-end argument squarely concludes that "the end-to-end argument is not an absolute rule, but rather a guideline that helps in application and protocol design analysis." In fact, the cost-performance tradeoff underlying the end-to-end argument requires "subtlety of analysis" and can be "quite complex."<sup>28</sup> Indeed, a later article by the same authors responding to calls for allowing the core of the Internet to exercise a greater level of functionality explicitly recognizes that "[t]here are some situations where applying an end-to-end argument is counterproductive" and concludes that the proper approach is to "take it case-by-case." The end-to-end argument is thus more properly regarded as merely "one of several important organizing principles for systems design" rather than as an absolute. Although Saltzer, Reed, and Clark suggest that deviations from it will be rare, they acknowledge that "there will be situations where other principles or goals have greater weight."<sup>29</sup>

Other technologists have drawn similar conclusions. One of the original authors of the end-to-end argument, writing with Marjory Blumenthal, candidly acknowledges that "the end-to-end arguments are not offered as an absolute" and that "[t]here are functions that can only be implemented in the core of the network." Indeed, they argue that the developments described in Part I has made the case for introducing greater intelligence into Internet's core all the more compelling. They conclude that in many cases

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<sup>28</sup> *Id.*, at 280, 284, 285. To take but one example, the desirability of end-to-end depends in part on the length of the file. If a system drops one message per one hundred messages sent, the probability that all packets will arrive correctly decreases exponentially as the length of the file increases (and thus the number of packets composing the file) increases. *Id.*, at 280-81.

<sup>29</sup> David P. Reed et al., *Commentaries on "Active Networking and End-to-End Arguments,"* IEEE NETWORK, May/June 1998, at 69, 69 n.1, 70.



“an end-to-end argument isn’t appropriate in the first place.”<sup>30</sup> Samrat Bhattacharjee, Kenneth Calvert, and Ellen Zegura conclude that the end-to-end argument “do[es] *not* rule out support for higher-level functionality within the networks” and instead simply requires that the costs and benefits inherent in the engineering tradeoff be carefully evaluated. Indeed, there are services that depend on information that is only available inside the network and thus cannot exist without relying to some degree of what has been called “active networking.”<sup>31</sup> Dale Hatfield acknowledges that the desire to improve the security, manageability, scalability, and reliability of the Internet may justify introducing greater intelligence into the core of the network. As a result, Hatfield argues against allowing regulation that prevents network owners from deviating from the end-to-end architecture and instead simply warns that deviations from the end-to-end argument should be undertaken with extreme care.<sup>32</sup>

At this point, the incongruity of invoking the end-to-end argument as support for network neutrality as a regulatory mandate should be apparent. Far from justifying an absolute prohibition against placing intelligence in the core of the network, the end-to-end argument stands squarely opposed to such a simplistic approach.<sup>33</sup> Simply put, a close analysis of the end-to-end argument reveals that it does not support the proposition for which many network neutrality proponents cite it. Indeed, as Marjory Blumenthal has noted, this incongruity demonstrates the extent to which network neutrality advocates’ embrace of the end-to-end argument has left the realm of cost-benefit analysis and has instead entered the realm of ideology.<sup>34</sup> As a result, it is critical that network neutrality proposals not evade critical analysis by masquerading as nothing more than the application of sound engineering principles.

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<sup>30</sup> Blumenthal & Clark, *supra* note 6, at 71, 80. Jerome Saltzer apparently concurs. See *Id.*, at 102 n.19.

<sup>31</sup> Samrat Bhattacharjee et al., *Active Networking and the End-to-End Argument*, in PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON NETWORK PROTOCOLS 220, 221 (1997); Samrat Bhattacharjee et al., *Commentaries on “Active Networking and End-to-End Arguments,”* IEEE NETWORK, May/June 1998, at 66.

<sup>32</sup> Dale N. Hatfield, *Preface*, 8 COMM.LAW CONSPECTUS 1, 3 (2000).

<sup>33</sup> Although the end-to-end argument only supports a case-by-case approach to network design, it is arguable that such cases will prove so rare that the costs of evaluating the merits of each individual case exceed the benefits of doing so. Such categorical balancing is particularly perilous in industries, such as broadband, that are in a state of technological and economic flux.

<sup>34</sup> Marjory S. Blumenthal, *End-to-End and Subsequent Paradigms*, 2002 L. REV. MICH. ST. U. DET. C.L. 709, 710.

The foregoing discussion also casts a new and somewhat ironic light on Lessig's observation that "code is law."<sup>35</sup> Lessig's point was that the architecture enshrined in the Internet's communications protocols can have as dramatic an impact on competition and innovation as direct regulation. Network neutrality advocates have failed to appreciate that this admonition cuts both ways. While it is true that allowing Internet providers to impose proprietary protocols could have a significant impact on innovation and competition, forbidding them from doing so could have equally dramatic effects. Either decision necessarily involves policymakers in the unenviable task of picking technological winners and losers, a fact that undercuts claims that elevating the end-to-end argument into a regulatory mandate represents the proper way to show humility about the shape that the Internet may assume in the future.<sup>36</sup>

Not only does government-imposed network neutrality contradict the letter of the end-to-end argument; it turns Lessig's admonition on its head. Lessig intended the statement to indicate how the architecture of the Internet could provide a privately provided substitute for many of the functions previously served by law. Indeed, Lessig warned of the dangers of allowing the government to dictate the standards that must be included in their code.<sup>37</sup> It would be a strange inversion of this argument to give the phrase "code is law" literal rather than figurative meaning and to sanction greater governmental control over the architecture of the Internet.

## B. HTBC's Connectivity Principles

Other proposals have shifted their attention away from preserving ISP competition and have instead focused on preserving competition among content and applications providers. For example, Professors Timothy Wu and Lawrence Lessig have proposed a network neutrality regime that would prohibit last-mile providers from imposing any restrictions on end users' ability to run the applications, attach the devices, and access the content of their own choosing except those restrictions that are necessary to comply with a legal duty, prevent physical harm to the network, prevent interference with other users' connections, ensure quality of service, and

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<sup>35</sup> Lawrence Lessig, *CODE AND OTHER LAWS OF CYBERSPACE* 6 (1999).

<sup>36</sup> See Lessig, *supra* note 59, at 35, 39.

<sup>37</sup> See Lawrence Lessig, *The Limits in Open Code: Regulatory Standards and the Future of the Net*, 14 BERKELEY TECH. L.J. 759, 764-67 (1999).

prevent violations of security.<sup>38</sup> A recent speech by then-FCC Chairman Michael Powell sounded similar themes.<sup>39</sup>

The High Tech Broadband Coalition has advanced a similar proposal that would impose a series of “connectivity principles” on all last-mile broadband providers. This proposal would require that all last-mile broadband providers give end users unrestricted access to all content and allow them to run any applications and attach any devices they desire, so long as these efforts do not harm the providers’ network, enable theft of services, or exceed the bandwidth limitations of the particular service plan.<sup>40</sup> The HTBC’s proposal has drawn the support of a group composed primarily of software and content providers known as the Coalition of Broadband Users and Innovators (CBUI).<sup>41</sup> Network neutrality proponents assert that such nondiscrimination is essential to promoting innovation and to preserving consumer choice in content and applications.

These proposals are motivated by a concern that last-mile providers will use their control of the physical layer to reduce competition in the application and content layer by deviating from TCP/IP currently employed in the logical layer and replacing it with a proprietary, noninteroperable set of protocols. The connectivity principles are designed to short-circuit this dynamic by mandating that last-mile providers adhere to nonproprietary protocols and to open their networks to all applications and content on a nondiscriminatory basis, which in turn would preserve applications and content providers’ access to end users.

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<sup>38</sup> *Ex parte* Submission in CS Docket No. 02-52 at 12-15, *Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities*, F.C.C. filed Aug. 22, 2003, CS Dkt. No. 02-52, *available at*:

<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6514683884](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514683884)>; Lessig, *supra* note 59, at 156-58; Wu, *supra* note 59, at 165-72.

<sup>39</sup> Michael K. Powell, *Preserving Internet Freedom: Guiding Principles for the Industry*, 3 J. ON TELECOMM. & HIGH TECH. L. 5 (2004).

<sup>40</sup> Comments of the High Tech Broadband Coalition at 6-9, *Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities* (F.C.C. filed June 17, 2002) (CC Dkt. No. 02-52), *available at*:

<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513198026](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513198026)>.

<sup>41</sup> *Ex parte* Communication from the Coalition of Broadband Users and Innovators at 3-4, *Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities* (F.C.C. filed Jan. 8, 2003) (CS Dkt. No. 02-52), *available at*:

<[http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6513401671](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513401671)>. CBUI includes such notable content and software providers as Microsoft, Disney, Amazon.com, eBay, and Yahoo!, as well as the Media Access Project, the Consumer Electronics Association, and the National Association of Manufacturers.

Viewing these proposals from the perspective of vertical integration theory reveals they suffer from some fundamental conceptual flaws. As discussed earlier, the structural preconditions that must be satisfied before vertical integration between last-mile providers and content/applications providers can plausibly threaten competition are not satisfied. In addition, these proposals are attempting to protect and promote competition in the segments of the industry that are already the most competitive and the least protected by entry barriers, which underscores the extent to which these proposals have misframed the central policy problem confronting the broadband industry.

In addition, the connectivity principles fail to take into account the extent to which the broadband industry is being confronted with the fundamental pricing problem that arises with respect to all shared facilities that are subject to congestion. Under the standard measures of economic performance, welfare is maximized when customers use the shared facility only up to the point where the benefits from consuming an additional unit of the shared facility no longer exceeds the costs of allowing them to consume an additional unit. Firms that charge prices that are not sensitive to the amount of bandwidth used will soon confront a quandary. Since the cost to customers of incremental use is zero, they will increase their use of the facility until the marginal utility of an additional use is zero. The congestion costs of the additional uses are not zero, however. The result is an equilibrium in which the number of visits is economically excessive.

This problem can be solved by employing a two-part pricing scheme in which the customer pays both a fixed amount for its connection as well as a per-use amount that is set equal to the congestion costs associated with an incremental use of the system. This would result in a pricing system in which the amount paid would vary with the actual bandwidth used.<sup>42</sup>

Unfortunately, this solution involves a number of administrative difficulties. Experience in other communications-related industries suggests that the costs of monitoring and billing on a per-use basis may be prohibitively expensive. In the absence of a precisely calibrated per-use pricing system, many last-mile providers have turned to rough proxies by prohibiting applications and equipment associated with more intensive bandwidth use. For example, some last-mile providers have prohibited customers from streaming media, from attaching content servers, or serving as an ISP. Other last-mile providers have begun offering two-tier plans

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<sup>42</sup> Jeffrey K. MacKie-Mason & Hal R. Varian, *Pricing Congestible Network Resources*, 13 IEEE J. ON SELECTED AREAS IN COMMUNICATIONS 1141 (1995).

that charge more to users who want to use bandwidth-intensive applications, such as home networking and virtual private networking.<sup>43</sup>

These pricing innovations and equipment/allocation restrictions represent an economically rational response to the congestion problems associated with broadband service. The proposals advanced by the proponents of connectivity principles would have the unfortunate effect of unduly limiting last-mile providers' ability to address this fundamental problem.

### C. MCI's Layered Model

A public policy paper authored Richard Whitt of MCI has expanded upon the layered model discussed in Part I.A.2 has advanced another proposal that has emerged as a focal point in the discussions about network neutrality.<sup>44</sup> Although the MCI policy paper covers a broad range of issues, its core proposal can be boiled down into two main principles. First, it builds on ideas advanced by other commentators to argue that the FCC should regulate in a manner that respects and maintains the integrity of the layers of the broadband industry. In particular, MCI offers a series of examples purporting to demonstrate why the FCC should not use regulation of the physical and logical layer in order to protect competition at the content and applications layers.<sup>45</sup> Second, MCI's proposal argues in favor of subjecting last-mile broadband providers to a wholesale access requirement similar to the unbundled network access requirement currently imposed on incumbent local exchange carriers under the Telecommunications Act of 1996. MCI bases this aspect of its proposal on the supposed need to prevent last-mile broadband providers from "leveraging" their supposed market power in a way that will harm the applications layer.

Although MCI's analysis has its merits,<sup>46</sup> it suffers from a number of fundamental flaws. By invoking the notion of monopoly leverage, it relies

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<sup>43</sup> Wu, *supra* note 59, at 158-62; Lemley & Lessig, *supra* note 59, at 944.

<sup>44</sup> Whitt, *supra* note 63.

<sup>45</sup> *Id.*, at 36-44.

<sup>46</sup> In particular, I agree with its call to reject the technology-specific approach embodied in the basic structure of the Communications Act of 1934 which treats each communications medium as a regulatory universe unto itself. *Id.*, at 2-26. As I have noted elsewhere, the technologically oriented division reflected in the basic structure of Communications Act of 1934 could provide a satisfactory basis for policy making only so long as the various technologies did not act as substitutes for one another, since the FCC could focus on each medium in isolation and could craft solutions tailored to the particular type of communications conveyed, as well as to the economics underlying the means of transmission. The emergence of technologies such as cable television and wireless telephony, which allowed consumers to receive both

on an economic theory that is analytically suspect. In addition, in arguing for subjecting last-mile providers to unbundled access requirements, the MCI proposal adopts an unnecessarily static vision that ignores the basic insights of classic property theory. Although MCI correctly identifies the promotion of competition among alternative network platforms as the proper focus for broadband policy, it ignores that compelling access to the existing platforms can forestall the emergence of precisely the type of platform competition that MCI seeks to promote. In other words, the regulatory response that MCI would impose in an attempt to redress market power might have the perverse effect of cementing the existing oligopoly into place. Under such circumstances, the intervention that MCI envisions would be the source of market failure, rather than its solution.

## 1. The Economic Critique of Leverage

As noted earlier, a consensus has emerged that certain structural preconditions must be met before a coherent leveraging claim could even be stated. Simply put, absent market power in the primary market, a firm has nothing to use for leverage. Chicago School theorists offered a more radical attack to the leverage theory of vertical integration. They argued that even when the structural preconditions identified in the first attack were met, vertical integration did not provide firms with any additional market power. In other words, although firms with monopoly power may have the *ability* to exercise leverage over vertically related markets, those firms typically lack the *incentive* to do so. This is because there is only one monopoly profit in any chain of production, and any monopolist can capture all of that profit without having to resort to vertical integration. All it has to do is simply price its goods at the monopoly level. Thus, even if firms can exercise leverage, they will generally find it unnecessary to do so.<sup>47</sup>

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voice and video communications through either wireline or wireless media, caused this neat, dichotomous universe to unravel. Moreover, the problem is about to get much worse. The impending shift of all networks to packet-switched technologies, in which all communications are reduced to data bits that can be transmitted through any network, promises to cause all of the distinctions based on the means of conveyance and the type of speech conveyed to collapse entirely. See Yoo, *supra* note 61, at 286-90.

<sup>47</sup> See Robert H. Bork, *THE ANTITRUST PARADOX* 226-31, 372-73, 375 (1978); Richard A. Posner, *ANTITRUST LAW: AN ECONOMIC PERSPECTIVE* 173, 197 (1976); Ward S. Bowman, Jr., *Tying Arrangements and the Leverage Problem*, 67 *YALE L. J.* 19, 20-21 (1957); Aaron Director & Edward H. Levi, *Law and the Future: Trade Regulation*, 51 *Nw. U. L. REV.* 281, 290 (1956). Chicago School scholars recognized a number of exceptions to their critique of lever-

Post-Chicago theorists have identified a number of circumstances under which leverage can be profitable.<sup>48</sup> The context-specific nature of these models provides little support for a blanket prohibition of vertical integration. Indeed, many of these models suggest that in many circumstances vertical integration may well be welfare enhancing.<sup>49</sup>

## 2. The Problematic Nature of Compelled Access as a Remedy

Furthermore, scholars of competition policy generally agree that compelled access is, in many ways, quite problematic as a remedy.<sup>50</sup> If regulators compel non-discriminatory access without putting any restrictions on the price charged, the monopolist will simply charge the full monopoly price. While such access would be beneficial to the monopolist's competitors, it provides no benefits to consumers, since the monopoly is left intact, and no improvements in price or output can be expected. Absent some regulation of the terms and conditions of access, compelled access represents something of an anomaly. As Professors Areeda and Hovenkamp note, the purpose of the competition policy "is not to force firms to share their monopolies, but to prevent monopolies from occurring or to break them down when they do occur."<sup>51</sup>

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age. None of them are apposite to the context of broadband. See Yoo, *supra* note 59, at 189-91.

<sup>48</sup> See, e.g., Oliver Hart & Jean Tirole, *Vertical Integration and Market Foreclosure*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROECONOMICS 205 (1990); Louis Kaplow, *Extension of Monopoly Power Through Leverage*, 85 COLUM. L. REV. 515 (1985); Janusz A. Ordover et al., *Equilibrium Vertical Foreclosure*, 80 AM. ECON. REV. 127 (1990); Michael H. Riordan, *Anticompetitive Vertical Integration by a Dominant Firm*, 88 AM. ECON. REV. 1232 (1998); Michael A. Salinger, *Vertical Mergers and Market Foreclosure*, 103 Q. J. ECON. 345 (1988); Steven C. Salop & David T. Scheffman, *Raising Rivals' Costs*, 73 AM. ECON. REV. 267 (1983); Michael D. Whinston, *Tying, Foreclosure, and Exclusion*, 80 AM. ECON. REV. 837 (1990); Ian Ayres, *VERTICAL INTEGRATION AND OVERBUYING: AN ANALYSIS OF FORECLOSURE VIA RAISED RIVALS' COSTS* (Am. Bar Found., Working Paper No. 8803, 1988).

<sup>49</sup> Hart & Tirole, *supra* note 48, at 212; Michael W. Klass & Michael A. Salinger, *Do New Theories of Vertical Foreclosure Provide Sound Guidance for Consent Agreements in Vertical Merger Cases?*, 40 ANTITRUST BULL. 667, 679-82 (1995); Michael H. Riordan & Steven C. Salop, *Evaluating Vertical Mergers: A Post-Chicago Approach*, 63 ANTITRUST L. J. 513, 522-27, 544-51, 564 (1995); Salinger, *supra* note 48, at 349-50; Ayres, *supra* note 48, at 17-20, 23-24.

<sup>50</sup> The following discussion is based on Yoo, *supra* note 59, at 243-47, 268-69.

<sup>51</sup> 3A Phillip E. Areeda & Herbert Hovenkamp, *ANTITRUST LAW* 771b, at 174 (1996).

Thus, if an access remedy is to benefit consumers, it must necessarily include a requirement that the rates charged be reasonable. Any attempt at regulating rates would likely be extremely difficult to administer. Since the monopolist has already evinced a lack of willingness to deal with its competitor, the relationship is likely to be surrounded by disputes over the terms and conditions of the compelled access. As Professors Areeda and Hovenkamp have noted, once access is ordered,

[t]he plaintiff is likely to claim that the defendant's price for access to an essential facility (1) is so high as to be the equivalent of a continued refusal to deal, or (2) is unreasonable, or (3) creates a 'price squeeze' in that the defendant charges so much for access and so little for the product it sells in competition with the plaintiff that the latter cannot earn a reasonable profit.<sup>52</sup>

The disputes, moreover, will not be limited just to price. The parties are likely to disagree on non-price terms and conditions as well. It goes without saying that rate regulation in declining cost industries has been plagued by complicated valuation and second-best pricing problems that have bordered on insurmountable. Previous attempts at imposing rate regulation on cable television have largely been a failure, as the variability in the quality of cable programming has frustrated efforts to impose meaningful rate regulation.<sup>53</sup>

The FCC's history with policing access regimes provides ample reason to question whether it is institutionally capable of executing this charge. For example, leased access to cable television systems has been plagued by precisely the type of problems predicted by Areeda and Hovenkamp. Simply put, the regulatory regime went almost entirely unused, with the various parties disagreeing vehemently on the reason for the regime's failure. Firms that sought leased access complained that local cable operators demanded excessively high prices and failed to bargain in good faith, while the cable operators claimed that the lack of leased access reflected a lack of demand for it.<sup>54</sup> Even more spectacular has been the inability of

<sup>52</sup> *Id.*, 774c, at 227-28; see also *Id.*, 765c, at 103-04, 772, at 197.

<sup>53</sup> See Thomas W. Hazlett & Matthew L. Spitzer, PUBLIC POLICY TOWARD CABLE TELEVISION (1997); Gregory S. Crawford, *The Impact of the Household Demand and Welfare*, 31 RAND J. ECON. 422 (2000).

<sup>54</sup> See *Time Warner Entm't Co. v. FCC*, 93 F.3d 957, 970 (D.C. Cir. 1996); 1990 Report on Cable Competition, *supra* note 207, at 5048, 177; Donna M. Lampert, *Cable Television: Does Leased Access Mean Least Access?*, 44 FED. COMM. L.J. 245 (1992).



the FCC and the state public utility commissions to use access requirements to foster competition in local telephone markets as mandated by the Telecommunications Act of 1996.<sup>55</sup> The FCC's experience in policing other access regimes thus provides little reason to be optimistic that it will be able to manage the myriad problems associated with administering a regime of compelled access in this instance. It is telling that two distinguished scholars of network industries not particularly noted for deregulatory views have suggested that access regimes have proven so unworkable that they should be abandoned altogether.<sup>56</sup>

Compelled access regimes are thus extremely questionable from the standpoint of static efficiency, since it is far from clear whether they can deliver the requisite benefits in price and quantity needed to justify the enterprise. Even more profound is the impact that compelled access regimes have on dynamic efficiency. From the perspective of dynamic efficiency, the only viable way to solve the problems caused by monopoly bottlenecks is the appearance of a new entrant that directly competes with the bottleneck facility. Access regimes, however, may actually retard such entry.

Access dampens investment in two ways that harm consumers. First, it is now well recognized that resources are most likely to receive the appropriate level of conservation and investment if they are protected by well-defined property rights. As Garrett Hardin pointed out in his path-breaking work on the "Tragedy of the Commons," resources that are in effect jointly owned tend to be overused and receive suboptimal levels of investment.<sup>57</sup> Hardin's insights apply with equal force to compelled access regimes. Since any benefits gained from investments in capital or research must be shared with competitors, forcing a monopolist to share its resources reduces incentives to improve their facilities and pursue technological innovation.

In addition, compelling access to an input also discourages other firms that need the input from entering into business alliances with potential alternative suppliers of the input. In effect, forcing a dominant provider to share an input rescues other firms from having to supply the relevant input for themselves. While such access would clearly benefit other ISPs by

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<sup>55</sup> See *United States Telecom Ass'n v. FCC*, 359 F.3d 554, 595 (D.C. Cir. 2004) (criticizing "the Commission's failure, after eight years, to develop lawful unbundling rules").

<sup>56</sup> See Paul L. Joskow & Roger G. Noll, *The Bell Doctrine: Applications in Telecommunications, Electricity, and Other Network Industries*, 51 STAN. L. REV. 1249 (1999).

<sup>57</sup> Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968); accord Harold Demsetz, *Toward a Theory of Property Rights*, AM. ECON. REV. (papers and procs.), May 1967, at 347, 354–59.

rescuing them from having to make the capital investments that would have otherwise been required for them to secure carriage through other means, it would provide no tangible benefit to consumers, as price and output would remain at monopoly levels. Attempts at forcing prices below monopoly levels, however, would force regulators to referee a never-ending series of disputes over the terms and conditions of access, a role for which the FCC has historically proven ill-suited.

Thus, access should not be compelled whenever the resource is available from another source, even if it is only available at significant cost and in the relatively long run. This is particularly true in technologically dynamic industries, in which the prospects of developing new ways either to circumvent or to compete directly with the bottleneck are the highest. The inevitable lag in adjusting regulation also raises the risk that regulations, such as access, that protect incumbents from new entry will continue to exist long after the justifications for enacting the regulation have long disappeared.<sup>58</sup>

This suggests that compelling access to the physical layer would harm dynamic efficiency as well, by slowing the deployment of high-speed broadband services. The fact that any positive developments would need to be shared with competitors would represent a deviation from the well-defined property rights needed to provide last-mile providers with the incentive to engage in efficient levels of investment in their own technology. In addition, compelled access would also rescue unaffiliated ISPs and content/application providers from having to support the development of alternative broadband providers. These unaffiliated ISPs represent the natural strategic partners for DSL, satellite, and other broadband transport providers seeking to build services to compete directly with incumbent last-mile providers. Providing them with access to DSL and cable modem systems would remove any incentive to support such initiatives.

This insight underscores the core problem in the broadband industry, which is the paucity of providers capable of delivering broadband transport services into the home. Network neutrality would do nothing to alleviate this central problem, since compelling access would not provide consumers with any additional options for broadband transport services. Likewise, allowing vertical integration will not make this problem any worse. On the contrary, network neutrality could well make the problem worse by preventing last-mile providers from realizing the available effi-

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<sup>58</sup> See, e.g., Stephen Breyer, REGULATION AND ITS REFORM 286-87 (1982); 2 Alfred E. Kahn, THE ECONOMICS OF REGULATION 127 (1971); Richard A. Posner, *Natural Monopoly and Its Regulation*, 21 STAN. L. REV. 548, 611-15 (1969).

ciencies and by depriving alternative broadband transport providers of their natural strategic partners.

### 3. The Potential Advantages of Interlayer Combinations and Competition

Economic theory also undercuts the other principal aspect of MCI's proposal, i.e., that the FCC should regulate the broadband industry to preserve the integrity of the layers. As discussed in Part II, prohibiting broadband providers from combining layers can prevent the realization of certain efficiencies and can prevent providers from offering innovative and differentiated services that are more responsive to consumer needs. Furthermore, MCI's principle of layer inviolability ignores the fact that providers operating at a different level often provide one of the primary sources of competition in the layered world. Indeed, as Timothy Bresnahan has noted, it is to be expected that providers operating at adjacent layers would exert constant pressure against one another by attempting to extend their dominance into the adjacent layer.<sup>59</sup> Indeed, regulatory intervention into the interfaces between the various layers might actually hurt competition by locking in the existing relationships in ways that decrease the level of vertical competition.<sup>60</sup>

## V. THE ROLE OF REGULATION

It is thus clear that permitting last-mile providers to deviate from the universal interoperability envisioned by the proponents of network neutrality may actually yield substantial economic benefits. Not only does differentiation potentially put networks in a better position to satisfy any underlying heterogeneity in consumer preferences; it also has the potential to alleviate the supply-side and demand-side economies of scale that are the sources of market failure that justifies regulatory intervention in the first place.

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<sup>59</sup> Timothy F. Bresnahan, *New Modes of Competition: Implications for the Future Structure of the Computer Industry*, COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST IN THE DIGITAL MARKETPLACE 155, 167-69 (Jeffrey A. Eisenach & Thomas M. Lenard eds., 1999).

<sup>60</sup> See Yoo, *supra* note 3.

The case against network neutrality is further bolstered by the risk that regulation might itself induce market failure by causing the existing oligopoly in last-mile technologies to persist long after technological improvements have made real competition possible. If access to a bottleneck network were not compelled, those who did not want to pay anticompetitively excessive prices for network services would have the incentive to invest in alternative network capacity. Compelling access, on the other hand, would rescue those who would otherwise be financing the buildout of other last-mile technologies from having to undertake those investments. Network neutrality may thus have the effect of starving alternative broadband platforms of the resources they need to build out their networks. Although such a policy might have been reasonable during previous eras, when the fact that construction of new network platforms was infeasible, it is unjustifiable in an environment in which competition from alternative network platforms is a real option.

The task confronting policy makers is made all the more difficult by the fact that making any difference would require policy makers to intervene at a fairly early stage in the technology's development, since governmental intervention after the market has settled on the optimal technology would serve little purpose.<sup>61</sup> Although whether regulation or private ordering would provide the better means for determining the optimal technology is ultimately an empirical question, there are a number of considerations that suggest that public policy would be better served by relying on the latter. There are a number of salient examples where allowing competition among different protocols promoted a degree of experimentation. For example, during its early years the electric power industry went through an extended period of competition between standards based on direct current (DC) and alternating current (AC) that enhanced competition and promoted innovation in electrical appliances.<sup>62</sup> Even now, the electrical power network is diverse enough to accommodate appliances designed to run on the predominant 110 volt standard as well as larger appliances

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<sup>61</sup> Bresnahan, *supra* note 59, at 200-03.

<sup>62</sup> Bruce M. Owen & Gregory L. Rosston, *LOCAL BROADBAND ACCESS: PRIMUM NON NOCERE OR PRIMUM PROCESSU? A PROPERTY RIGHTS APPROACH* 11-12 (AEI-Brookings Joint Center for Regulatory Studies Related Publication No. 03-19, Aug. 2003), available at: <<http://www.aei.brookings.org/admin/authorpdfs/page.php?id=285>> (citing Paul A. David & Julie Ann Bunn, *Gateway Technologies and the Evolutionary Dynamics of Network Industries: Lessons from Electricity Supply History*, in *EVOLVING TECHNOLOGY AND MARKET STRUCTURE* 121 (Arnold Heertje & Mark Perlman eds., 1990)). There is thus some irony in the fact that some network neutrality proponents point to the example of electric power as supporting the need for early governmental intervention. See *Ex parte* Submission, *supra* note 38, at 3; Wu, *supra* note 62, at 1165.

requiring 220 volts. Another example drawn from the telecommunications industry is the competition between TDMA and CDMA standards for mobile telephony. Rather than imposing a particular technological vision, the government has allowed these standards to compete in the marketplace.

In addition, governmental processes are subject to a number of well-recognized biases. Regulatory decisions are all too often shaped by political goals that are not always consistent with good policy. In addition, policymakers may also find it tempting to give too little weight to the future benefits associated with the entry of alternative network capacity, which will no doubt seem uncertain and contingent, and to overvalue the more immediate and concrete benefits of providing consumers with more choices in the here and now. Indeed, the FCC has allowed short-term considerations to override longer-term benefits in the past.<sup>63</sup> Public choice theory strongly suggests that the bias in favor of the former over the latter is no accident.

There thus appears to be considerable danger that compelling access will forestall the buildout of 3G, fixed wireless, and other alternative broadband platforms. I acknowledge the possibility that last-mile broadband providers may be able to use the market power provided by the degree of concentration in local markets to harm competition. For example, it is conceivable that cable operators might prohibit cable modem customers from streaming video in order to protect their market position in the market for conventional television. At the same time, such a prohibition might also represent an understandable attempt to prevent high-volume users from imposing congestion costs on other users. Even network neutrality proponents acknowledge how difficult it can be to determine which is the case.<sup>64</sup>

In effect, policymakers are presented with a choice between two possible responses. On the one hand, they can trust their ability to distinguish between these two different situations and limit network neutrality to those situations in which deviations from full interoperability are motivated by anticompetitive considerations. The costs of doing so include the danger that regulators might err in making this determination as well as the risk that compelling access might delay entry by alternative last-mile technologies. On the other hand, regulators can adopt a more humble posture about their ability to distinguish anticompetitive from procompetitive

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<sup>63</sup> See Christopher S. Yoo, *The Rise and Demise of the Technology-Specific Approach to the First Amendment*, 91 GEO. L.J. 245, 272-75 (2003).

<sup>64</sup> See Lessig, *supra* note 59, at 46-47, 167-76; Cooper, *supra* note 59, at 1050-52.

behavior and attempt to resolve the problem by promoting entry by alternative broadband platforms. Once a sufficient number of alternative last-mile providers exist, the danger of anticompetitive effects disappears, as any attempt to use an exclusivity arrangement to harm competition will simply induce consumers to obtain their services from another last-mile provider. In this case, the primary costs stem from delay. Because entry by new network platforms will not be instantaneous, there will necessarily be a period of time during which consumers may remain vulnerable to anticompetitive behavior.

Choosing between these two approaches depends upon weighing their relative merits, with the understanding that each represents a second-best alternative. Although a formal analysis of the tradeoff exceeds the scope of my comments, my instinct is to favor the latter. It is motivated in part by my belief that regulatory authorities will be more effective at pursuing the goal of stimulating entry by new network platforms than they would be in ascertaining whether a particular exclusivity arrangement would promote or hinder competition. In addition, because the long-term benefits will be compounded over an indefinite period of time, they should dominate whatever short-run static inefficiency losses that may exist.<sup>65</sup> Perhaps most importantly, promoting entry has embedded within it a built-in exit strategy. Once a sufficient number of broadband network platforms exist, regulatory intervention will no longer be necessary. This stands in stark contrast with access-oriented solutions, which implicitly assume that regulation will continue indefinitely.

## VI. CONCLUSION

The claim that guaranteeing interoperability and nondiscrimination would benefit consumers has undisputed intuitive appeal. The fact that interoperability has represented the historical norm may lead some to put the burden of persuasion on those who would move away from that architecture. However, a close examination of the economic tradeoffs underlying network neutrality reveals a number of countervailing considerations that may not be readily apparent at first blush. Not only does network neutrality risk reducing consumer choice in content and applications, it raises the even more significant danger of stifling the development of further com-

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<sup>65</sup> See Janusz Ordover & William Baumol, *Antitrust Policy and High-Technology Industries*, 4 OXFORD REV. ECON. POL'Y 13, 32 (1988); David J. Brennan, *Fair Price and Public Goods: A Theory of Value Applied to Retransmission*, 22 INT'L REV. L. & ECON. 347, 355 (2002).

petition in the last mile by forestalling the continued emergence of new broadband technologies. Although such an admonition would be well taken under any circumstances, it carries particular force in dynamic industries like broadband that are undergoing rapid technological and marketplace changes.

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