UNINTENDED CONSEQUENCES OF NET NEUTRALITY REGULATION

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Policymakers are in the midst of an active debate over how best to accelerate the build-out of next-generation broadband networks. The U.S. economy has a significant economic stake in the outcome. It is increasingly apparent in the global economy linked together by the Internet that the future competitiveness of individual firms, and indeed entire economies, depends heavily on state-of-the-art networks. Next-generation broadband networks will be significantly more expensive than earlier versions. In the U.S. alone, the required investment to deploy such networks ubiquitously could exceed $140 billion. This investment will not occur unless those who supply the funds for it are compensated with a rate of return commensurate with the risk. In virtually all private-sector markets, firms that undertake investments have sufficient freedom to fashion the way in which they offer the products and services those investments make possible, and to price them in ways that meet demands and optimize returns. In the broadband Internet access market, however, advocates of proposed network neutrality ("net neutrality") regulation would restrict those planning to build out next-generation networks from these freedoms.

This paper examines one particular aspect of the "net neutrality" proposals: "non-discrimination" requirements relating to the provision of network quality of service ("QoS") to content providers. The paper concludes that such requirements, however innocuous they may seem, would be detrimental to the objectives that all Americans seemingly should want—namely, the accelerated construction of next-generation networks, and the lower prices, broader consumer choices, and innovations these networks would bring. The paper also concludes that under the best of circumstances, even if networks are significantly upgraded in the presence of net neutrality rules, the proposed non-discrimination provisions would provide incentives for those who would build and operate networks to offer "blended" QoS levels that are "too high" for some applications and "too low" for others. Mediocrity in broadband service is hardly an objective that policymakers in the United States should be trying to achieve.

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I. INTRODUCTION AND POLICY BACKGROUND

There is a broad consensus among policymakers that it is in the economic interest of the United States and its citizens that broadband penetration not only increase, but that the next generation of "high bandwidth" broadband be built out as rapidly as possible. More advanced broadband networks not only will make the services and products offered over the Internet more attractive, but will accelerate innovation in the development of new content. There is one issue, however, which up to now has divided those who want a better and faster Internet: the assertion by some that consumers and content providers would be better off if the communications companies that will build the next-generation networks are subject to a series of "neutrality" restrictions. In particular, proponents of various forms of "net neutrality" argue that broadband network providers be prohibited from discriminating in any way in the provision of quality of service ("QoS") to content providers.

This seemingly innocuous requirement in fact would have far-reaching—and we believe demonstrably negative—implications for the U.S. broadband industry. In this introduction, we preview the issues and then examine them in-depth in subsequent sections. We show how net neutrality requirements very likely would lead to net mediocrity in service offerings, an outcome totally inconsistent with the desire of many end-users of the Internet and those offering many goods and services on the Internet. Such an outcome is clearly inconsistent with the objectives of policymakers to make the U.S. broadband networks and services the world leaders in technology, utilization, and customer value. There is much investment at stake in designing the optimal regulatory framework, as next-generation broadband networks will be significantly more expensive than earlier versions. In the United States, the cost per home of deploying these advanced facilities could reach $1,400,[1] which implies that the required investment to deploy next-generation networks ubiquitously could exceed $140 billion (equal to the product of $1,400 per home and 100 million U.S. homes).

A. The ABCs of QoS

Broadband networks are used to move data packets from one place on the network to another. Unfortunately, many bad things can happen to data packets as they travel across the Internet. For example, a packet may get dropped, may incur a delay, or may suffer from jitter. QoS is one antidote to such bad things. Internet applications differ in the extent to

1. VERIZON COMMC'NS INC., FIOS BRIEFING SESSION 40 (2006), *available at* http://investor.verizon.com/news/20060927/20060927.pdf (estimating net capital expenditure per home to be $1,434 for its planned FiOS deployment).

which they are "QoS-needy"—that is, the level of QoS they require to function properly.[2] The most popular QoS-needy applications include streaming multimedia, online gaming, voice-over-Internet protocol ("VoIP"), video teleconferencing, alarm signaling, and safety-critical applications such as remote surgery. In the future, there will be even more QoS-needy applications. Under the current regulatory regime, a content provider can contract for a certain level of QoS from an access provider by entering into a Service Level Agreement ("SLA"), which provides a guaranteed level of QoS.

Under a broad definition, QoS supplied by an access provider can take many forms and can be provided at several different layers of a broadband network, from the transmission media layer ("layer one") through the IP packet layer ("layer three") all the way up to the service application layer. For example, an access provider can cache external Internet content within its network in close proximity to end-users, thereby providing an enhanced performance for content providers and their customers. Access providers can also offer content providers enhanced hosting services at Internet data centers ("IDCs") deployed at strategic nodes of their networks, thereby bypassing possible intermediate bottlenecks between content servers and customer locations. A business with multiple office locations can purchase a virtual private network ("VPN") to secure a preferred level of service for all of its data traffic (including Internet-bound traffic) that traverses the access provider's network.

Alternatively, QoS can be defined more narrowly to apply only to layer three capability built into the routers and the IP packet header. For example, a customer (including content providers) could buy Internet access with QoS options that would ensure that any traffic the customer marked as high priority would get priority treatment on the access provider's network. Or a VoIP provider can buy QoS to give its packet streams preference through an access provider's network.

B. Various Forms of "Net Neutrality"

Non-discrimination typically implies similar treatment for similar types of customers or traffic. For example, a non-discrimination or duty-to-deal requirement could mandate that if an access provider offers a certain level of QoS to one content provider at a given price, then it must offer the same level of QoS to all content providers at the same price. Alternatively, an access provider could be prohibited from charging more

2. The technical term for content that requires a certain level of QoS to function properly is "inelastic." Because the term elastic has a different meaning for an economist (namely, the sensitivity of demand for a service in response to a change in prices or income), we use the term "QoS-needy" for ease of exposition.

for a steady 50 kbps VoIP stream than for a steady 50 kb/s gaming application where the QoS requirements—that is, the incremental cost of providing QoS to the two content providers—are the same.[3]

But under each of the net neutrality bills in Congress, non-discrimination in the supply of QoS means something more extreme: if a broadband provider offers enhanced QoS to any individual content provider, *then it must offer the same enhanced QoS to all content providers for free*. The apparent motivation for such a restriction is to stymie efforts by any content provider to secure enhanced QoS from broadband providers, and instead to force all contracting for QoS to occur between broadband providers and end-users.[4] These bills generally do not distinguish between broadband services offered by access providers versus those offered by backbone networks, and they would presumably impose their net neutrality restrictions on both types of networks. Because of the unquestioned lack of market power in backbone services—for example, even a combination of the backbone of Verizon (including MCI's backbone) and AT&T (including the old SBC's backbone) would account for less than 30 percent of all Internet traffic, while combining the top seven backbones would account for roughly 65 percent of total Internet traffic—there is certainly no competitive virtue in imposing non-discrimination restrictions on backbone networks.[5] If this non-discrimination objective has any sense, it must relate to competitive issues in the access network. Hence, we discuss the implications of net neutrality for broadband access networks.

One net neutrality bill in the House, H.R. 5273, explains in its preamble that "a network neutrality policy based upon the principle of nondiscrimination is essential to ensure that broadband telecommunications networks, including the Internet, remain open to independent service and content providers."[6] With respect to end-users, H.R. 5273 would require that access providers "not block, impair, degrade, discriminate against, or interfere with the ability of any person

3. *See* Jon M. Peha, *The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy*, 34TH TELECOMM. POL'Y RES. CONF., at 17 (2006), *available at* http://web.si.umich.edu/tprc/papers/2006/574/Peha_balanced_net_neutrality_policy.pdf.

4. *See*, *e.g.*, *Net Neutrality: Hearing Before the S. Comm. on Commerce, Science, and Transportation*, 109th Cong. 2 (2006) (statement of Lawrence Lessig, Professor of Law, Stanford Law School) ("To oppose access tiering [with content providers], however, is not to oppose all tiering. I believe, for example, that consumer-tiering should be encouraged. Network providers need incentives to build better broadband services. Consumer-tiering would provide those incentives.").

5. *See* Opinion of the Cal. Attorney Gen. on Competitive Effects of Proposed Merger of Verizon Commc'ns, Inc. & MCI, Inc., Cal. PUC Dkt No. 05-04-020 (2005), *available at* http://www.cpuc.ca.gov/word_pdf/news_release/49697.pdf. Thus, this analysis will focus only on the potential effects of imposing such restrictions on access networks.

6. H.R. 5273, 109th Cong. § 2(10) (2006) [hereinafter H.R. 5273].

to utilize their broadband service."[7] With respect to content providers, the bill would require that access providers "not discriminate *in favor of itself* in the allocation, use, or quality of broadband services or interconnection with other broadband networks."[8] In addition, access providers must ensure that unaffiliated content is delivered "at least equal to the speed and quality of service that the *operator's* content, applications, or service is accessed and offered, and without interference or surcharges on the basis of such content, applications, or services."[9] Finally, "if the broadband network provider prioritizes or offers enhanced quality of service to data of a particular type, [then it must] prioritize or offer enhanced quality of service to all data of that type (regardless of the origin of such data) *without imposing a surcharge* or other consideration for such prioritization or quality of service."[10] The bill defines a "broadband network provider" as "a person or entity that owns, controls, or resells, facilities used in the transmission of a broadband service and includes any affiliate, joint venture partner, or agent of such provider."[11] Note that there is no distinction between an access provider and a backbone provider—both backbone networks and access networks are comprised of "facilities used in the transmission of a broadband service." Hence, enhanced QoS provided at either the access level or the backbone level for a fee by an access provider would presumably be prohibited under this bill. Indeed, because the bill defines "broadband service" as "two-way transmission capability that . . . enables the user to access content, applications, and services,"[12] the bill could implicate *any* supplier along the bit stream, including a supplier of enhanced QoS like Akamai. An important exception to the non-discrimination provision contained in H.R. 5273 is that access providers may "offer varying levels of transmission speed or bandwidth,"[13] presumably to both end-users and content providers. Nonetheless, under H.R. 5273, access providers cannot offer different levels of QoS, and they cannot set a price for enhanced QoS.

Another "net neutrality" bill, S. 2360, similarly would prevent an access provider from discriminating in the provision of QoS to content providers,[14] and it would ban any charges for QoS.[15] But S. 2360 also

7. *Id.* § 4(a)(2).
8. *Id.* § 4(a)(5) (emphasis added).
9. *Id.* § 4(a)(6) (emphasis added).
10. *Id.* § 4(a)(7) (emphasis added).
11. *Id.* § 4(e)(1).
12. H.R. 5273, 109th Cong. § 4(e)(2) (2006).
13. *Id.* § 4(b)(2).
14. S. Res. 2360, 109th Cong. § 4(a)(6) (2006) (An access provider must "treat all data traveling over or on communications in a non-discriminatory way").
15. *Id.* § 4(a)(4) (An access provider must "offer communications such that a subscriber can access, and a content provider can offer, unaffiliated content or applications or services in

would deny an access provider from discriminating against either a content provider or end-user with respect to bandwidth.[16] Another net neutrality bill, S. 2917, would prevent an access provider from discriminating against a content provider with respect to bandwidth or QoS.[17] Access providers could offer prioritization to end-users but could not impose a fee for such service.[18]

In December 2006, the FCC approved an $86 billion merger between AT&T and BellSouth, two large providers of DSL service in non-overlapping territories.[19] Two FCC commissioners would not approve the merger unless AT&T promised to abide by several conditions, one of which concerned network neutrality. Under the network neutrality condition, AT&T agreed to conduct business in accordance with the principles set out in the FCC's Policy Statement for a period of 30 months.[20] In particular, the condition required that AT&T not provide or sell any service that "privileges, degrades or prioritizes any packet transmitted over AT&T/BellSouth's wireline broadband Internet access service based on its source, ownership or destination."[21]

Three provisions in the merger commitments narrowed the scope of the network neutrality conditions. First, the requirement did not apply to service available only to enterprise customers, including VPN and managed-IP services.[22] Second, the requirement applied only from "the network side of the customer premise equipment up to and including the Internet Exchange Point closest to the customer's premise . . . ."[23] This implies that the merged entity has the right to offer prioritization to content providers at portions of its network just beyond the network side of the customer premise equipment such as edge services.[24] Third, the

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the same manner that content of the network operator is accessed and offered, without interference or surcharges").

16. *Id.* § 4(a)(2) (An access provider must "not discriminate in favor of itself or any other person, including any affiliate or company with which such operator has a business relationship in—(A) allocating bandwidth").

17. S. Res. 2917, 109th Cong. § 12(a)(4)(A) (2006) [hereinafter S. 2917].

18. *Id.* § 12(a)(5).

19. Press Release, FCC, FCC Approves Merger of AT&T Inc. and Bellsouth Corporation (Dec. 29, 2006), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269275A1.pdf.

20. Letter from Robert W. Quinn Jr., Senior Vice President, AT&T Servs. Inc. to Marlene H. Dortch, Sec'y FCC, in Response to *Notice of Ex Parte Communication* in Review of AT&T Inc. and BellSouth Corp. Application for Consent to Transfer of Control, WC Dkt. No. 06-74 (Dec. 28, 2006), *available at* http://www.fcc.gov/ATT_FINALMergerCommitments12-28.pdf.

21. *Id.* at 8.

22. *Id.* at 9.

23. *Id.* at 8.

24. *See*, *e.g.*, *FTC Able to Address Broadband Discrimination, Majoras Says*, TR DAILY, Jan. 9, 2007 ("The network geography to which this applies is between the end user and the first network server reached . . . . Things that happen upstream [under agreements with

commitment does not apply to AT&T's Internet Protocol television service, which is expected to compete against cable television and direct broadcast satellite service.[25]

FCC Chairman Kevin Martin supported the AT&T-BellSouth merger, but not the concessions relating to network neutrality. In his joint statement of dissent with Commissioner Deborah Taylor Tate, Martin supported the merger for enabling a wider array of IP-enabled services for customers and faster speed of broadband deployment in the BellSouth region.[26] But Martin argued that the condition involving network neutrality was not merger-related and he expressed concern that the network neutrality condition might deter facilities investment, thus creating a major obstacle to the FCC's key goal of broadband deployment to all Americans.[27] Martin also explained that the provision would in no way bind the FCC in future decisions regarding Internet policy.[28]

Following on the heels of the merger approval and AT&T's merger commitments, on January 6, 2007, Senators Byron Dorgan and Olympia Snowe reintroduced network neutrality legislation.[29] According to Senator Snowe, "[t]he reintroduction of this legislation and the FCC's imposition of net neutrality conditions as part of the merger are significant victories in the fight to ensure nondiscrimination on the Internet."[30] The reintroduced bill was identical to the original bill introduced in 2006. Thus, the bill would prevent *any* contracting between access providers and content providers. That provision would greatly expand the common meaning of "non-discrimination," which typically would require that an offering to an affiliated content provider be extended to non-affiliated content providers.[31] Moreover, the reintroduced bill appeared to ignore the limitations in the scope of the network neutrality provisions contained in the AT&T merger commitments.

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carriers] are fair game.").

25. Quinn, *supra* note 20, at 9.

26. *See* Press Release, FCC Joint Statement of Chairman Kevin J. Martin and Commissioner Deborah Taylor Tate in AT&T Inc. and BellSouth Corporation Application for Transfer of Control, WC Dkt. No. 06-74 (Oct. 29, 2006), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269275A2.pdf.

27. *Id.* at 2.

28. *Id.*

29. *Dorgan, Snowe Take Another Stab at Net Neutrality Legislation*, TR DAILY, Jan. 9, 2007.

30. *Id.*

31. *See*, *e.g.*, *'Nondiscrimination' Will Become Focus of Net Neutrality Debate, Martin Says,* TR DAILY, Jan. 10, 2007 (explaining that the FCC traditionally has meant by "'non-discrimination' that a carrier had to offer the same deal to all customers, but some net neutrality advocates seem to use the term to mean that broadband Internet access providers cannot charge content providers" any price).

Thus, the reintroduced network neutrality legislation is more restrictive than the AT&T merger commitments in the sense that the legislation forbids an access provider's contracting with content providers at *any* portion of the network, whereas the AT&T merger commitments tolerate an access provider's contracting with content providers beyond the Internet exchange point nearest to the customer. This is not to say that the merger commitments relating to network neutrality will not impose costs on AT&T and society. Efficient contracting for prioritization that could occur between "the network side of the customer premise equipment up to and including the Internet Exchange Point closest to the customer's premise"[32]—and the associated welfare gains that could flow from such contracting—will be prohibited under the merger commitments. The mere fact that, at the time of merger approval, such contracting had yet to occur at that portion of the access provider's network (yet had occurred beyond that portion of the network) does not imply that such contracting could not occur in the subsequent 30 month period.

C. A Guide to the Debate

According to net neutrality proponents, any surcharge for enhanced QoS would impair an unaffiliated content provider's ability to compete in the upstream content market.[33] For example, an unaffiliated content provider might be denied the same QoS as that offered to an affiliated provider, or an unaffiliated content provider might be offered the same QoS at a higher price than that offered to an affiliated content provider.[34] Net neutrality proponents also argue that surcharges for enhanced QoS would deter entry among upstart content providers by reducing expected profits.[35] We analyze those anticompetitive claims in Part II.C.

Finally, net neutrality proponents argue that the mere offering of enhanced QoS to any content provider (affiliated or not) implicitly or explicitly degrades the effective QoS received by all other content providers.[36] This position, of course, could be correct only to the extent

32. Quinn, *supra* note 20, at 8.

33. *See, e.g.*, Lawrence Lessig & Robert W. McChesney, *No Tolls on the Internet*, WASH. POST, June 8, 2006, at A23.

34. It generally does not matter to net neutrality proponents whether the affiliated provider offers content that competes with the unaffiliated content. They argue that QoS preference for any traffic necessarily discriminates against all other traffic.

35. Ben Klemens, *Net Neutrality Fosters Competition Between Technologies*, SCRIPPS HOWARD NEWS SERVICE, Aug. 17, 2006, http://www.shns.com/shns/g_index2.cfm?action=detail&pk=NET-NEUTRALITY-08-17-06.

36. *Net Neutrality: Hearing Before the S. Comm. on Commerce, Science, and Transportation*, 109th Cong. 8 (2006) (statement of Lawrence Lessig, Professor of Law, Stanford University) ("Thus, working with the network provider, large video companies could secure sufficient provisioning to enable their content to be served while leaving insufficient

that overall broadband network capacities are constant and no content application ever tries to absorb more than its fair share of capacity—both counterfactual assumptions. Broadband access network capacities have been growing rapidly over the past several years,[37] and many popular applications seek to absorb all available access bandwidth.[38] Thus, the analogy of unaffiliated content providers being relegated to the "digital equivalent of a winding dirt road"[39] is hyperbole. Such providers likely will continue to have more and more access to bandwidth available to them year after year. And for the same reason as painting a stripe down the middle of a road to create two lanes is likely to speed all traffic (no driver is permitted to hog both lanes by driving down the middle), offering enhanced QoS to some content providers at a surcharge may even benefit content providers that decline the option.

Against these alleged costs, one must weigh the social benefits associated with permitting access providers to offer enhanced QoS to content providers at a positive price.[40] Net neutrality proponents speak of enhanced QoS as if it were a hypothetical offering that would be employed by an access provider for anticompetitive reasons only. In reality, enhanced QoS offerings at certain layers of the networks for both end-users (primarily enterprise customers) and content providers are already prevalent in the marketplace, presumably because some (but not all) customers value those services. Access providers are considering extending QoS offerings more broadly through their networks.[41] Because these QoS offerings at service application layers of the network have

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bandwidth to other competitors.").

37. *Cable Broadband Prices Stable; Video Rates Increase*, COMM. DAILY, Oct. 2, 2006 ("Transmission speeds rose at major operators. Cablevision raised download speeds 50% for Optimum Online customers this year to 15 Mbps and doubled upload speeds to 2 Mbps maximum . . . . Prices haven't risen in 3 years, said a Cablevision spokesman. Road Runner download speeds top out at 10 Mbps, compared with 1.5 Mbps in 1996, TW said. Comcast increased online speeds 4 times and added many features at no charge the past 3 years, said a spokeswoman.").

38. For a discussion of how Skype supernodes may saturate users' connections, *see* Juha Saarinen, *Skype Supernodes Sap Bandwith*, COMPUTERWORLD, Oct. 25, 2005, http://www.computerworld.co.nz/news.nsf/news/7AB67323D6305E49CC2570A1001698C0; Posting of Om Malik to GigaOM, http://gigaom.com/2006/01/10/skype-the-bandwidth-hog (Jan. 10, 2006).

39. Lessig & McChesney, *supra* note 33.

40. Other articles have examined the consumer welfare effects associated with net neutrality provisions. *See*, *e.g.*, J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet*, 2 J. COMPETITION L. & ECON. 349 (2006), *available at* http://jcle.oxfordjournals.org/cgi/reprint/2/3/349; LARRY DARBY, AM. CONSUMER INST., CONSUMER WELFARE, CAPITAL FORMATION AND NET NEUTRALITY: PAYING FOR NEXT GENERATION BROADBAND NETWORKS (2006), *available at* http://www.theamericanconsumer.org/Net%20Neutrality%20Study.pdf.

41. Net neutrality proponents generally have not attacked current QoS offerings, but they express immense concern for any expansion of QoS.

been good for content providers and their subscribers, expansions of these QoS offerings to other layers of network may also be beneficial.

In Part II, we survey some of the current tiered QoS offerings in the marketplace. Some of the most compelling QoS offerings in the market are caching and prioritization services for content providers that supply "QoS-needy" content, such as online multiplayer video game providers. These enhanced QoS service offerings are not costless. As we shortly explain, access providers in fact incur costs for providing enhanced QoS. We also review findings in the economics literature that show how a network without QoS-type management would be prohibitively expensive for end-users. These two results combined—(1) positive costs of providing QoS and (2) consumer benefits associated with managed networks relative to unmanaged networks—provide a procompetitive, efficiency justification for offering enhanced QoS at a surcharge.

We also critique in Part II the anticompetitive hypothesis that is proffered by net neutrality proponents. In particular, we examine the incentives and the ability of an access provider to foreclose unaffiliated content providers by offering enhanced QoS at a surcharge. We conclude that an access provider that lacks monopoly power in the broadband access market—a condition that applies to the vast majority of all access providers in the United States—lacks any ability to foreclose unaffiliated content providers—and even if some of these access providers may enjoy some market power in some local markets, they still lack significant economic incentives to foreclose unaffiliated content providers.

In Part III, we explore how an access provider would respond if required to comply with the non-discrimination provisions in the proposed legislation. Under one scenario, an access provider would withdraw its enhanced QoS offerings, thereby depriving its customers of those options entirely. Under another scenario, an access provider would standardize its QoS offerings and embed the surcharge for "blended QoS" into the basic service price of a complementary offering such as hosting or access. We analyze some of the consumer welfare and innovation effects associated with both outcomes. We estimate that by 2009, the consumer surplus associated just with online multiplayer video games, which depend critically on QoS, will be between $729 million and $1.458 billion. The same analysis is broadly applicable across all other QoS-needy content—both existing content and content still under development. We also estimate the welfare effects of higher monthly broadband prices that would result from forcing access providers to meet the growing demand for Internet services without building intelligence into their networks. Using highly conservative estimates of the elasticity of demand for broadband, we calculate up to one-third of broadband subscribers might disconnect their broadband connections in response to cost increases for access providers (which get passed on to consumers in

the form of higher prices).

Finally, we explore the implications for U.S. broadband leadership that would result from net neutrality regulation. Proponents of net neutrality consider more regulation of access providers to be an elixir for all that ails the U.S. broadband industry, including the allegedly low broadband penetration rates or network capabilities in the United States. By increasing broadband access prices, however, net neutrality would undermine the particular objective of maximizing broadband penetration rates, and limiting the overlay of QoS capabilities seems unlikely to result in more capable networks. Of course, maximizing broadband penetration should not be the sole objective of policymakers. Future welfare depends on innovation by both access providers and content providers. By undermining the ability to contract for QoS, net neutrality would cause content providers to divert resources away from real-time applications or other QoS-needy applications. And by limiting the deployment of intelligent network engineering and preventing the tapping of ancillary revenue streams by access providers, net neutrality would undermine an access provider's incentives to expand and enhance their networks. As a result, the U.S. broadband industry would begin slouching towards mediocrity.

II. NET NEUTRALITY PROPONENTS ASSUME INCORRECTLY THAT ENHANCED QOS OFFERINGS CURRENTLY ARE HYPOTHETICAL AND WILL BE USED FOR ANTICOMPETITIVE REASONS ONLY

Net neutrality proponents speak of "access tiering"—that is, offering tiered levels of access or QoS at different prices—as if it is some hypothetical strategy that will be employed at some future date to foreclose unaffiliated content providers. In reality, tiered QoS offerings are already here at different layers of an access provider's network and for legitimate technical and economic reasons. Content providers are *voluntarily* entering into contracts with access providers presumably because content providers (and their customers) value these service enhancements more than the prices for these enhancements. Enhanced QoS is not forced upon content providers as part of some bundle of services that the providers otherwise do not want, or because the access provider has monopoly power over the supply of one of the products in the bundle. Furthermore, access providers offer enhanced QoS at a surcharge to content providers, not because they are trying to foreclose potential rivals in an upstream market or to degrade the quality for content providers that decline the QoS option, but because it is costly to offer such enhancements and because a managed network ultimately generates benefits for Internet users.

A. Enhanced QoS Offerings are Prevalent in the Marketplace Because They are Valuable to Some (But Not All) Consumers

There are two types of customers who are already purchasing enhanced QoS offerings: end-users (primarily enterprise customers) and content providers. For some subset of customers, enhanced QoS is valuable. For others, it is not. It necessarily follows that it makes little economic sense to force all customers to acquire the same level of QoS at the same price. In this section, we provide a handful of examples of enhanced QoS offerings for end-users and content providers in the marketplace today. This discussion is by no means exhaustive. Rather, it is intended to provide an overview for a non-technical audience.

1. Examples of Tiered QoS Offerings for End-Users

Not all end-users demand enhanced QoS. Typically, this option is sought only by businesses that have special communications needs. For example, medium and large businesses or "enterprise customers" want intranet (to allow employees to gain access to secured corporate information), extranet (to support business-to-business communications), and remote access (to provide traveling workers the same level of connectivity as individuals who work in branch offices). Enterprise customers can receive these services from an access provider through a private data network or a virtual private network, which provides the attributes of a private data network within a shared network infrastructure. A VPN allows a company to communicate confidentially over a publicly accessible network at a price significantly less than that of a comparable wide area network ("WAN"). VPN traffic can be carried over the Internet on top of standard protocols (such as IPsec) or over an access provider's private network with a defined Service Level Agreement between the customer and the service provider. A VPN customer can obtain enhanced QoS as a VPN option or as part of a defined SLA. Because Internet traffic traverses inside a customer's VPN on the access provider's network, that traffic gets preferential treatment vis-à-vis standard Internet traffic.

Most access providers offer VPN with a QoS option. For example, Verizon markets a VPN service called "IP VPN Dedicated" that allows a customer to send data across its global IP infrastructure with the security of a private network.[42] In conjunction with this service, Verizon offers a "Traffic Shaping/ Bandwidth Allocation" option that "helps provide real-time prioritization of outbound data from your LAN to the edge of our IP

42. Verizon Business, IP VPN Dedicated, http://www.verizonbusiness.com/us/data/dedicated (last visited Sept. 7, 2006).

network."[43] Verizon also offers SLAs for all access types and optional resiliency features.[44] AT&T markets two types of IP VPNs: network-based VPN and premises-based VPN.[45] On its website, AT&T explains that network-based VPNs use "advanced IP routing technology establishing and prioritizing route assignments."[46] AT&T also offers QoS and Class of Service ("CoS") traffic engineering capabilities for a customer's applications.[47] Qwest offers IP VPN under the name "Private Routed Network."[48] In conjunction with its VPN service, Qwest provides "optional security solutions including intrusion detection services, vulnerability assessments and customized professional services at an additional cost."[49] As part of its denial of service ("DoS") protection, Qwest offers an inspection engine that "extracts state-related information required from all application layers from the security decision and interprets these packets into 'conversations' . . . and looks for any abnormal behavior in a conversation."[50]

2. Examples of Tiered QoS Offerings for Content Providers

As is the case for end-users, not all content providers demand enhanced QoS. This option is demanded only by those content providers that supply QoS-needy content. Real-time applications represent an important type of QoS-needy content. Real-time video, VoIP, and online video game traffic cannot be experienced properly by the end-user if it is subjected to jitter (unevenness in the rate of data packet delivery). Accordingly, real-time content providers demand enhanced QoS.

Access providers currently may offer enhanced QoS to content providers in the form of managed hosting, local caching of content in nearby data centers, and prioritization of traffic at the IP packet layer. By purchasing hosting services from an access provider, a content provider can gain immediate access to the access provider's network. A content provider can also take advantage of the access provider's SLAs, under which the access provider is required to provide proof of a promised level of service. Each SLA contains a technical component, which offers

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43. *Id.*
44. *Id.*
45. AT&T, Network-Based VPN, http://www.business.att.com/service_fam_overview.jsp?repoid=ProductSub-Category&repoitem=eb_network-based_vpn&serv_port=eb_vpn&serv_fam=eb_network-based_vpn&segment=ent_biz (last visited Aug. 28, 2006).
46. *Id.*
47. *Id.*
48. Qwest, Private Routed Networks (VPN), http://www.qwest.com/pcat/large_business/product/1,1016,782_4_28,00.html (last visited Sept. 7, 2006).
49. *Id.*
50. *Id.*

several classes of service. A content provider can request that an access provider offer a fully managed hosting solution or it can manage its own applications hosted in an IDC owned by an access provider. For example, Qwest offers the following commitment to customers that outsource their web presence: "[y]ou receive industry-leading SLAs. Many data centers are built with high degrees of redundancy in critical systems such as power, HVAC, fire detection and suppression and security."[51]

Online video game providers may purchase enhanced QoS as an option with hosting services from access providers. For example, Sony produces *EverQuest*, a three-dimensional fantasy massively multiplayer online role-playing game ("MMORPG") that requires users to pay a recurring monthly fee.[52] For a time, *EverQuest* was the most popular MMORPG in the industry.[53] Blizzard Entertainment produces *World of Warcraft*, another MMORPG set in a fantasy environment. As of September 2006, *World of Warcraft* had almost seven million active subscriptions worldwide.[54] In both games, online subscribers control a character avatar "exploring the landscape, fighting monsters and performing quests on behalf of computer-controlled characters."[55] In addition to cash incentives for good performance, a player is rewarded with experience that allows her character to improve in skill and power.[56] MMORPG games have hundreds of thousands of users playing simultaneously. To achieve the best possible fantasy environment for their online gaming websites, Sony and Blizzard place their servers in Internet data centers ("IDCs") owned by access providers around the world. They simply cannot afford for the players of their games to experience jitter.

AT&T hosts many of the largest online games.[57] AT&T's hosting service spans 30 IDCs across four continents, including locations in Paris, Shanghai, California, and Singapore.[58] A content provider that purchases managed hosting service can obtain SLAs relating to (1)

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51. Qwest, Qwest® Dedicated Hosting Services – Infrastructure, http://www.qwest.com/largebusiness/products/esolutions/hosting/hostingInf.html (last visited Sept. 7, 2006).

52. Wikipedia, EverQuest, http://en.wikipedia.org/wiki/Everquest (last visited Aug. 26, 2006).

53. *Id.*

54. Seth Schiesel, *Online Game, Made in U.S., Seizes the Globe*, N.Y. TIMES, Sept. 5, 2006, at A1.

55. Wikipedia, World of Warcraft, http://en.wikipedia.org/wiki/World_of_Warcraft (last visited Sept. 7, 2006).

56. *Id.*

57. *See* Podcast: AT&T Hosts Multiplayer Online Gaming (providing a podcast of an interview by Larry Meyer with Chris Costello, Director of Product Management for managed hosting at AT&T), *available at* http://www.att.com/gen/landing-pages?pid=7728.

58. *Id.*

network response time, (2) application response time, and (3) application performance.

As part of an enterprise hosting service, a content provider can place its content on the access provider's servers to reach end-users faster and more reliably than from the content provider's servers alone. For example, Verizon markets a service called "Application Acceleration" on its website, which offers content providers "a high-performance web application delivery platform so [their] distant end-users get the same level of performance [their] local users enjoy."[59] AT&T markets a similar service under the name "Intelligent Content Distribution Service."[60] It bears emphasis that this form of QoS (along with other forms) may be supplied by third parties in addition to access providers. For example, Akamai Technologies provides a similar content-acceleration service by caching content closer to the end-user for over 2,000 customers.[61] One measure of the size of the market for acceleration services is Akamai's revenues, which reached $100 million in the second quarter of 2006.[62] The fact that Akamai offers enhanced QoS at a surcharge to content providers suggests that the same conduct by an access provider is based on justifiable business practices that could be found in what net neutrality proponents believe are otherwise competitive markets.

Among its many types of customers, Akamai provides enhanced QoS to online gaming providers. In August 2001, Akamai announced that it would power the first Internet-based suspense thriller, *Majestic*, on the EA.com website.[63] Akamai described the critical role of QoS in the online gamer's experience as follows:

> Akamai is providing the on-demand streaming delivery services for the *Majestic* game, delivering audio and video transmissions of information integral to the *Majestic* story, while helping to enhance the game's interactive experience for players. *Majestic* places players

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59. Verizon Business, Application Acceleration, http://www.verizonbusiness.com/us/itsolutions/acceleration (last visited Sept. 6, 2006).

60. AT&T, Intelligent Content Distribution Service, http://www.business.att.com/service_fam_overview.jsp?repoid=ProductSub-Category&repoitem=eb_intelligent_content_distribution&serv_port=eb_hosting_storage_and_it&serv_fam=eb_intelligent_content_distribution&segment=ent_biz (last visited Sept. 7, 2006).

61. Press Release, Akamai Technologies, Akamai Reports Second Quarter 2006 Results (July 26, 2006), *available at* http://www.akamai.com/html/about/press/releases/2006/press_072606.html [hereinafter *Akamai Second Quarter Results*].

62. *Id.*

63. Press Release, Akamai Technologies, Akamai Supports EA.com's Highly Interactive Internet Suspense Thriller, Majestic (Aug. 17, 2001), *available at* http://www.akamai.com/html/about/press/releases/2001/press_081701.html.

> in the center of an unfolding mystery adventure, and delivers a highly personalized experience through common everyday devices that are connected to the Internet through which to tell its story. A critical part of the *Majestic* experience comes when players explore for clues and information on the Internet using the *Majestic* search engine. As users experience the game, online newscasts, web-cam recordings and audio transmissions provide information relevant to the game while interactive streaming audio and video clips, delivered by Akamai, provide clues to help solve the mystery. With Akamai's streaming service, *Majestic* users receive reliable, high-quality broadband and narrowband experiences regardless of spikes in traffic via Akamai's globally distributed network of more than 11,600 servers located at the edge of the Internet.[64]

As Akamai makes clear, the user's experience depends heavily on streaming video and audio clips, which in turn rely on QoS. In Part III below, we rely on this evidence to model how consumers would be affected if QoS offerings were removed from the marketplace.

B. Because Enhanced QoS is Costly to Provide, and Because a Managed Network Produces Consumer Benefits, the Use of Tiered QoS Offerings is Motivated by Procompetitive Reasons

In this section, we explain why it is procompetitive for an access provider to impose a surcharge for enhanced QoS. Very simply, access with QoS or hosting with QoS is a *different* and more costly product from plain access or plain hosting. Hence, when an access provider imposes a surcharge for enhanced QoS, it is not technically engaging in price discrimination—that is, it is not offering the same product to two different customer classes (one with a high willingness to pay, one with a low willingness to pay) at two different prices.

1. Enhanced QoS is Costly to Provide

An access provider's marginal cost of carrying a given traffic stream is equal to the opportunity cost associated with allocating resources away from carrying another stream. According to Jon Peha, Professor of Electrical Engineering and Public Policy at Carnegie Mellon, "the cost per bit of a stream with strict QoS requirements is greater than the cost per bit when QoS requirements are lax."[65] Welfare considerations demand that access providers be entitled to recover any increase in marginal cost associated with supplying enhanced QoS through higher prices. In particular, under a standard "Ramsey pricing"

64. *Id.* (emphasis supplied.)
65. Peha, *supra* note 3, at 8.

formulation designed to maximize social welfare, the price of any service is proportional to the marginal cost of providing that service and inversely proportional to the elasticity of demand for that service.[66] Indeed, it would be inappropriate for the access provider not to impose a price for enhanced QoS, as such pricing would amount to a subsidy. Economists have long recognized that subsidies result in a misallocation of resources. Applied here, free QoS enhancements would encourage over-consumption of QoS-needy traffic relative to the socially optimal level (which occurs when the marginal cost of providing the last unit of QoS equals the price).

2. A Network without QoS Management Would be Prohibitively Expensive for End-Users

A network operator can expand capacity by either investing in traffic control or adding network capacity or both. Without any regulatory distortions, an access provider will invest in each input until the marginal revenue product from the last dollar invested in traffic control (scaled by the price of traffic control) equals the marginal revenue product from the last dollar invested in network capacity (scaled by the price of adding capacity). As this optimality condition makes clear, the outcome of this calculus will depend on the relative prices of processing (used for traffic control) and capacity. According to Peha, innovation in fiber-optics has decreased the cost of capacity, which has made investments in traffic control during the last decade less appealing.[67] But he cautions that "there are risks in embedding this conjecture [that the tradeoffs cut in favor of expanding capacity] into our laws and regulations."[68]

As high bandwidth, real-time services such as streaming music and video gain in popularity, access providers will be forced to upgrade their access and backbone networks. Richard Clarke, Director of Economic Analysis of AT&T, has estimated the cost per broadband subscriber of a new network that attempted to satisfy the demand for Internet traffic exclusively through bandwidth—that is, the cost per user of a new, unmanaged network.[69] He demonstrates that as Internet usage patterns

66. *See*, *e.g.*, JEAN-JACQUES LAFFONT & JEAN TIROLE, A THEORY OF INCENTIVES IN PROCUREMENT AND REGULATION 30-31 (1993).

67. *See* Peha, *supra* note 3, at 8.

68. *Id.* at 9.

69. Richard N. Clarke, Costs of Neutral/Unmanaged IP Networks (May 2006) (unpublished manuscript, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=903433). Clarke uses a simple quantitative model of the cost of an unmanaged PON-based IP network. He uses input values for the costs of the different elements of the network, including total number of broadband lines at a wire center, number of wire centers in a cluster, total broadband lines modeled, PON

become more bandwidth-intensive and real-time oriented, an unmanaged network would be extremely expensive for the typical consumer. In particular, he estimates that to provide sufficient capacity to accommodate the current typical Internet usage pattern in an unmanaged network, the cost per customer could reach $47 per month.[70] To provide sufficient capacity to accommodate expected growth in traditional Internet data services as well as use of Internet connections for bandwidth-intensive applications equivalent to just two simultaneous standard definition television channels per home, Clarke estimates that the cost per customer of an unmanaged network could reach $140 per month for Internet service only (not including the cost for video content).[71] Finally, if customers use the equivalent of viewing two simultaneous high-definition television ("HDTV") channels, Clarke estimates that the cost per customer of an unmanaged network could reach $466 per month.[72] Because current IP interoffice facilities and backbone cores are sized to provide roughly 45 Kbps that each subscriber currently uses during the network busy period, the major cost driver (from $47 per month to $466 per month) is not in the last-mile access portion of the network, but in the wire center cluster and backbone portions of the network.[73] Clarke concludes that it would be unlikely that enough customers would be willing to pay the fees to support an unmanaged network, which would render such business models commercially nonviable.[74]

C. Because Unaffiliated Content Providers Could not be Foreclosed from the Upstream Content Markets, the Use of Tiered QoS Offerings is Unlikely to be Motivated by Anticompetitive Reasons

Traditional foreclosure theories in economics require that the firm in question has monopoly power in some relevant product market and that the complementary market (in this case, Internet content) is subject

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capacity code, maximum fiber splits, fiber splits at drop terminal, average wire center to wire center distance, sharing factor for wire center-to-wire center runs, fibers per wire center-to-wire center route, network router capacity sizing factor, and fraction of traffic leaving cluster.

70. *Id.* at 20.

71. *Id.*

72. *Id.*

73. *Id.*

74. *Id.* at 22 ("While it is possible that some customers so value the possible extra freedom and diversity they may enjoy from obtaining services over an unmanaged network that they may choose to pay these lofty prices, these are daunting figures for most customers. Fewer than 5% of all households are willing to pay as much as $150 per month for a "triple play" bundle of local telephone, long distance telephone and video services that includes programming costs. Thus, it seems unlikely that unmanaged PONs with capacity adequate to stream unicast video services will gain commercial traction.") (citations omitted).

to economies of scale. Although the second condition could be satisfied here, the first condition is clearly inappropriate. Setting aside the exact foreclosure strategy contemplated here (offering enhanced QoS at a positive price), we consider whether an access provider has both the incentive and ability to foreclose an unaffiliated content provider.

1. Access Providers Lack the Incentive to Foreclose Unaffiliated Content Providers

An access provider that discriminates in the provision of QoS to content providers acts anticompetitively to the extent that such activity leads to a reduction in consumer welfare. The relevant antitrust caselaw can best be explained as embracing a test that bans a monopolist from engaging in discriminatory refusals to deal with rivals where no inefficiency would result from sharing and where denying access to rivals enhances monopoly power.[75] To an antitrust court, substantial market power or monopoly power, rather than just some market power, is required because a firm cannot extend its power into a complementary market unless it wields substantial market power in the primary market.[76]

With the possible exception of certain cases, such as when buyers purchase more than one unit of the tying product and the individual demand curve is downward sloping,[77] "Chicago school" economists have demonstrated that vertical restraints generally are not motivated by anticompetitive reasons.[78] There are some exceptions, however, to the Chicago school concept of "a single monopoly rent." As Dennis Carlton explained in an *Antitrust Law Journal* article in 2001, the monopolist can earn incremental profits in the complementary market if (1) the complementary market is subject to economies of scale and (2) there exists some class of consumers who demand the complementary good

75. *See* Einer Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253, 295–98, 305–14 (2003).

76. To an economist, the distinction between market power and monopoly power may not be as critical. For example, in one theoretical model where in a hypothetical monopolist attempts to squeeze surplus in the tying market by bundling, the only requirement is a downward sloping demand curve, which does not necessarily require monopoly power. Rather than distinguishing market power from monopoly power, it is more productive to focus on how substantial the foreclosing effects (resulting from the conduct) are.

77. For example, if the firm-level demand for the good in question could be downward-sloping and each firm demands multiple units, then the monopolist cannot capture 100 percent of the consumer surplus. *See*, *e.g.*, Patrick Greenlee, David S. Reitman & David S. Sibley, *An Antitrust Analysis of Bundled Loyalty Discounts* (Econ. Analysis Group, Discussion Paper No. 04-13, 2006), *available at* http://ssrn.com/abstract=600799. Clearly, content providers do not purchase multiple units of hosting or Internet access from access providers.

78. *See* ROBERT H. BORK, THE ANTITRUST PARADOX 290-98 (1978) (providing a review of the Chicago school literature). For example, the Chicago school models assume constant returns to scale in the tied market and a single unit purchased of the tying good.

only.[79] Critical to this model, however, is the requirement that the firm be a monopolist in the tying market.[80]

Applied here, proponents of net neutrality typically suggest that the local access market is not competitively supplied and that as a result there is a threat that the access provider could foreclose the complementary content market.[81] But although access providers have *some* power to set price (that is, some market power), there is clear evidence from marketplace that access providers lack *significant* power over prices (that is, substantial market power or monopoly power). Consider, for example, that the price of DSL service from Verizon has decreased from $49.95 per month for 768 kbps download speed in 2001[82] to $19.99 per month for the same download speed in 2007.[83] The price of cable modem service, adjusted on a per Mbps basis, also has declined significantly over the same time period.[84] With such substantial price declines, it is not reasonable to conclude that access providers have significant power to control access prices. Accordingly, a hypothetical claim involving an access provider's discriminatory pricing of QoS would not likely withstand antitrust scrutiny.

Another indicator of substantial market power or monopoly power is the ability to exclude rivals. But evidence of entry makes clear that this market power test also fails. According to the latest broadband report issued by the Federal Communications Commission ("FCC"), cable modem providers, the most popular form of broadband access

79. *See* Dennis W. Carlton, *A General Analysis of Exclusionary Conduct and Refusal to Deal - Why Aspen and Kodak Are Misguided*, 68 ANTITRUST L.J. 659 , 664-65 (2001).

80. To explain his theory, Carlton used as an example the case of a monopoly resort owner. *Id*. at 667-68. Guests at the resort, who are required to purchase all meals at the resort, are fully exploited by the monopolist. But to the extent that the resort can hold unaffiliated restaurants on the island below some minimum viable scale (condition 1) by requiring that resort guests purchase all meals at the resort, those unaffiliated restaurants will be forced to exit, and the island natives who did not demand a hotel room (condition 2) will be subjected to a monopolist in the supply of meals. Notice how Carlton's model requires that the firm be a monopolist in the resort market, else the resort would not be able to hold unaffiliated restaurants below some minimum viable scale because resort-goers who wanted to eat at those restaurants could simply go and stay at another resort without the limitation.

81. *See* H.R. 5273, 109th Cong. § 2.8 (2006) ("The overwhelming majority of residential consumers take broadband service from one of only two wireline providers, namely, from the cable operator or the local telephone company.").

82. Tom Spring, *Verizon Joins Broadband Price Hike Parade*, PCWORLD.COM, May 2, 2001, http://www.pcworld.com/resource/article/0,aid,48945,00.asp.

83. Verizon High Speed Internet, Plans, http://www22.verizon.com/ForHomeDSL/channels/dsl/packages/default.asp (last visited Feb. 15, 2007).

84. Jim Hu, *Comcast to Raise Broadband Speed*, CNET NEWS.COM, Jan. 16, 2005, http://news.com.com/2100-1034_3-5537306.html. Comcast cable modem customers with download speeds of 3 Mbps experienced an increase to 4 Mbps for no additional charge. Comcast customers with download speeds of 4 Mbps experienced an increase to 6 Mbps for no additional charge.

technology, accounted for just 57.5 percent of all residential high-speed lines in the United States as of December 2005, down from 63.2 percent in December 2003.[85] Although these data are gathered at the national level, they can be used to roughly characterize competition in a representative or average local broadband market.[86] The rapid decline in market share over a span of just two years implies that cable operators lack the ability to exclude rivals and thereby lack substantial market power. Cable providers lost share primarily to DSL providers, who upgraded their networks and slashed prices. Other broadband access methods are also growing, with satellite and wireless providers accounting for over half-a-million broadband connections according to the FCC's survey.[87] Moreover, new access technologies, such as Worldwide Interoperability for Microwave Access ("WiMAX") and broadband over powerline ("BPL"), emerged in the past few years to challenge incumbent broadband providers. WiMax technology began to develop in earnest in August 2006, when Sprint Nextel announced its plans to develop and deploy the first fourth generation ("4G") nationwide broadband mobile network, which will use the mobile WiMAX technology standard.[88] Working together with Intel, Motorola, and Samsung, "Sprint Nextel will develop a nationwide network infrastructure . . . that will support advanced wireless broadband services for computing, portable multimedia, interactive and other consumer electronic devices."[89] "The Sprint Nextel 4G mobility network will use the company's extensive 2.5GHz spectrum holdings, which cover 85 percent of the households in the top 100 U.S. markets . . . ."[90] Regarding BPL, the FCC counted over 5,000 BPL lines as of December 2005[91]—an impressive number, considering the technology's brief existence in the market.

Most importantly, proponents of net neutrality fail to grasp the nexus that compelling content drives the demand for broadband access. If real-time applications fail to emerge, then access providers will not be able to sell faster and more expensive (such as fiber-to-the-home)

85. WIRELINE COMPETITION BUREAU, FED. COMMC'NS COMM'N, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF DECEMBER 31, 2005 tbl.2 (2006), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-266596A1.pdf [hereinafter *FCC High-Speed Services*].

86. Of course, there are some local markets that are served by only one broadband provider, in which case national shares are not a good measure of the degree of competition.

87. *FCC High-Speed Services*, *supra* note 85, at tbl.3.

88. Press Release, Sprint Nextel, Sprint Nextel Announces 4G Wireless Broadband Initiative with Intel, Motorola and Samsung (Aug. 8, 2006), *available at* http://www2.sprint.com/mr/news_dtl.do?id=12960.

89. *Id.*

90. *Id.*

91. *FCC High-Speed Services*, *supra* note 85, at tbl.6.

connections to end-users. And as we demonstrate below, even if access providers were somehow convinced that their profits could be increased through foreclosure, access providers lack the ability to induce unaffiliated content providers to exit the industry or to operate at a less efficient scale.

2. Access Providers Lack the Ability to Foreclose Unaffiliated Content Providers

Even if they wanted to, access providers cannot easily monopolize, let alone effectively compete in, content markets. In this section, we focus on the most likely content markets that access providers might attempt to monopolize—namely, content markets that are currently profitable to serve. Perhaps the most important submarket among the profitable Internet content markets is the market for advertiser-supported search engines. Other profitable submarkets include online payment systems, online games, and video-sharing websites. It bears emphasis that broadband access providers generally have not attempted to enter any of these three Internet content submarkets. The current industry leaders for search engines include Google, Yahoo!, Microsoft ("MSN.com"), and IAC/Interactive ("Ask.com"). Google offers advertisers AdWords, which places advertising links next to relevant search results and charging for clicks and for keywords. Google also offers AdSense, a system that places "sponsored" links on the web pages of newspapers and other publishers that sign up to be part of Google's network. "AdWords and AdSense produced $6.1 billion in revenues for Google [in 2005]."[92] Yahoo! entered this submarket by purchasing Overture in 2003 for $1.6 billion.[93] Microsoft built adCenter, which serves as the advertising system for searches on MSN.[94] As of June 2006, *The Economist* estimated Google's market share in search at roughly 50 percent.[95] Online search is characterized by high barriers to entry: "[b]ut because barriers to entry in the search business are high—the engineering talent is limited and data centres that can simultaneously support millions of searches are expensive—most analysts think that the four big search engines will stay ahead of the tiny ones."[96] The fact that America Online ("AOL"), once a leader in dial-up Internet access, permanently outsourced its search technology to Google indicates that barriers to entry in search can impede even established and well-funded

92. *The Ultimate Marketing Machine*, ECONOMIST, July 8, 2006, at 61-62.
93. *Id.*
94. *Id.*
95. *The Un-Google,* ECONOMIST, June 17, 2006, at 65.
96. *Id.*

Internet firms.[97] Likewise, Google's stock price as of March 2007 in excess of $450 per share (and resulting market capitalization in excess of $140 billion) implies that the barriers to entry to search engines are not easily surmountable.[98] These barriers to entry would extend to all potential entrants in the search submarket, including access providers.

In addition to the high entry barriers in the content markets, local access providers have no leverage over national (and in many cases, international) content providers, further undermining the prospect of an access provider monopolizing the content markets. At least one of the authors has been cited for support of the proposition that Internet content providers are vulnerable to vertical foreclosure strategies in the net neutrality debate.[99] But this application of the theory of vertical foreclosure assumes incorrectly that a content provider is offering content that is particular to a given locality and therefore requires access to a single broadband provider's subscribers. The vast majority of Internet content appeals to all U.S. residents, not just the residents of a particular locality. Thus, the relevant geographic market for assessing hypothetical foreclosure strategies in broadband is conservatively the United States, and more realistically, the world. Because Comcast, *the largest broadband service provider in the United States*, controls access to only 23 percent of all broadband subscribers, Comcast lacks the ability to induce a content provider from exiting the industry or even operating at an inefficient scale.[100] The next largest providers are AT&T and Verizon, each with roughly 14 percent of the U.S. market.[101]

Moreover, the unique relationship between an unaffiliated Internet content provider and an access provider is not conducive to foreclosure

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97. *AOL to Use Google Searches*, WASH. POST, May 2, 2002, at E2.

98. Yahoo! Finance, GOOG: Summary for Google,,http://finance.yahoo.com/q?s=GOOG (last visited Mar. 26, 2007).

99. *See, e.g.*, Barbara van Schewick, *Towards an Economic Framework for Network Neutrality Regulation*, 5 J. ON TELECOMM. & HIGH TECH. L. 329, 334 n.13 (2007) (citing Daniel L. Rubinfeld & Hal J. Singer, *Vertical Foreclosure in Broadband Access?*, 49 J. INDUS. ECON. 299 (2001)).

100. WIRELINE COMPETITION BUREAU, FED. COMMC'NS COMM'N, HIGH-SPEED SERVICES FOR INTERNET ACCESS: STATUS AS OF JUNE 30, 2006 tbl.2 (2007) (providing total broadband subscribers), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-270128A1.pdf; RICHARD A. BILOTTI ET AL., MORGAN STANLEY RESEARCH, CABLE/SATELLITE: LOOKING INTO 3Q06 AND 2007: CAUTIOUS ON TOP LINE, CAPITAL EXPENDITURES, AND LOFTY VALUATIONS (2006) (providing Comcast's subscribers for year end 2006).

101. Press Release, Verizon Investor Relations, Verizon's 4Q 2006 Results Cap Strong Year of Organic Growth in Wireless, Broadband and Business Markets (Jan. 29, 2007), *available at* http://investor.verizon.com/news/view.aspx?NewsID=813; AT&T INVESTOR BRIEFING, AT&T POSTS STRONG THIRD-QUARTER EARNINGS GROWTH; RESULTS DRIVEN BY WIRELESS REVENUE GAINS AND MARGIN EXPANSION, MERGER INTEGRATION PROCESS, IMPROVED BUSINESS TRENDS 16 (2006), *available at* http://www.att.com/Investor/Financial/Earning_Info/docs/3Q_06_IB_FINAL.pdf.

strategies. With a few exceptions (such as ESPN360), Internet content is not acquired by access providers at a certain cost per subscriber per month, as is the case with traditional video programming. Setting aside the seldom used leased access rules, unaffiliated video content providers cannot reach a video distributor's customers *unless the distributor has acquired the content from that content provider*. By contrast, unaffiliated Internet content providers do not need to reach an agreement with a broadband access provider to reach that access provider's broadband customers. Hence, access providers and unaffiliated content providers are not likely to get into a carriage dispute arising over price or affiliation. Although such disputes are common in the video programming industry, and Congress has given the FCC powers to prevent discriminatory practices,[102] because Internet content providers do not depend on access providers to reach end-users in the same way that video programmers depend on cable or DBS providers, video programming is the wrong framework for analyzing discriminatory strategies in Internet content markets. Even if an access provider were to refuse to supply enhanced QoS to an unaffiliated content provider, the only content providers that could be affected would be real-time content providers. But even here, the refusal to supply enhanced QoS would have to be coordinated across multiple access providers to have any meaningful foreclosure effect. Internet content markets are inherently national in scope. Thus, a content provider does not depend on a single local access provider to achieve critical economies of scale. (Contrast this with localized content in traditional video markets, such as sports programming, that depends on a handful of downstream providers to reach critical scale.) Without such coordination among broadband access providers, the foreclosed content provider could still achieve its efficiencies from the customers of other access providers.

Given the barriers to entry in the Internet content market, the caliber of the firms that currently supply Internet content (which implies that foreclosure would be very costly), and the unique relationship between Internet content providers and access providers, it is difficult to conceive how an access provider could leverage its alleged power in broadband access into the content market by imposing a surcharge on content providers for enhanced QoS. The last time an Internet service provider ("ISP") with downstream market power (in this case, dial-up Internet access) tried to build a "walled garden" to leverage its customer base into the upstream content market it met with unmitigated disaster.[103] To be

102. *See* 47 U.S.C. § 536 (a) (2000).

103. Wikipedia, AOL, http://en.wikipedia.org/wiki/AOL (last visited Feb. 13, 2007) ("[AOL] has since attempted to reposition itself as a content provider similar to companies such as Yahoo! as opposed to an Internet service provider which delivered content only to

fair, AOL's attempt to extend it power into the content market was not helped by the ubiquitous deployment and adoption of broadband technologies, which rendered unaffiliated ISPs less valuable.[104] But even before the advent of broadband, AOL failed to extend its considerable market power in dial-up Internet access into content markets. There is no reason to expect a different outcome for broadband access providers. In summary, access providers lack the incentive and ability to foreclose unaffiliated content providers. Tiered QoS offerings cannot be motivated by anticompetitive reasons.

III. BY REQUIRING NON-DISCRIMINATION IN THE PROVISION OF QOS, NETWORK NEUTRALITY PROPOSALS WOULD DESTROY THE SOCIAL BENEFITS ASSOCIATED WITH CURRENT TIERED QOS OFFERINGS

In this section, we provide a non-technical discussion of how consumer welfare could be decreased by access providers' attempt to comply with the non-discrimination provisions of the net neutrality proposals. A technical analysis of the welfare reduction is provided in sections A and B. Readers who are not technically inclined can understand the mechanism by which consumers would be harmed in what immediately follows.

Consumers voluntarily purchase enhanced QoS because the value created through this feature exceeds the incremental price. The difference between a customer's willingness to pay for a feature and its price is called consumer surplus. Consumer welfare is the sum of the surplus across all consumers in the market. In this section, we examine the consumer welfare effects that would flow from an access provider's likely response if required to comply with the non-discrimination provisions in the net neutrality proposals. As explained earlier, online video games, streaming multimedia, VoIP, video teleconferencing, alarm signaling, and safety-critical applications such as remote surgery may require some level of QoS. For ease of exposition, we focus on the consumer welfare effects for one of the most popular QoS-needy applications—online gaming. The same analysis could be applied to any other QoS-needy application.

We consider the consumer welfare effects of an access provider's attempts to comply with the non-discrimination provisions relating to QoS under two scenarios. In the first scenario, access providers attempt to comply with the non-discrimination provision by (1) withdrawing their enhanced QoS offerings entirely and (2) relying entirely on

subscribers in what was termed a 'walled garden.'").

104. *See*, *e.g.*, Robert W. Crandall & Hal J. Singer, *Life Support for Unaffiliated ISPs?*, 28 REG. 46, 49 (2005).

bandwidth to accommodate the growth in demand for Internet traffic. This scenario assumes that an access provider could not embed the price of some "blended" QoS in a complementary product purchased by the content provider (the basis of the second scenario). By withdrawing enhanced QoS from the marketplace, many QoS-needy applications would not function properly, and thus the demand for those products (and the consumer welfare associated with enjoying those products) would disappear. In the extreme case, the demand for such applications would either disappear entirely or fail to develop. As explained above, the proposals define a broadband network provider so broadly that they could limit QoS offerings at positive prices by non-network QoS suppliers such as Akamai. Even if some non-network QoS suppliers were immune from the regulation, the demand for QoS-needy applications would still shift inwards to the extent that network suppliers can offer some level of QoS beyond that offered by non-network suppliers or the price of enhanced QoS would increase to monopoly levels or both.[105] The effect would be to largely eliminate any welfare that is currently enjoyed by customers of QoS-needy applications.

Next, by relying entirely on an unmanaged network, the monthly cost per subscriber would rise to levels that could not be sustained in the marketplace. If the cost per subscriber of an unmanaged network were to increase to $47 per month, then the monthly subscription fee would need to increase even further, thereby inducing a significant portion of broadband customers to disconnect from the Internet or seek less costly alternatives. Based on estimates of the elasticity of demand for broadband access, we attempt to estimate the percentage of existing broadband subscribers who would disconnect their services in response to such a price increase.

In the second scenario, we posit that access providers would attempt to comply with the non-discrimination provisions by offering a blended, one-size-fits-all QoS offering to all content providers. Because access providers could not explicitly charge for QoS, they would likely provide a blended level of QoS that came standard alongside a (slightly more expensive) purchase of Internet access or hosting products—that is, an access provider would embed the price of blended QoS in some complementary product. But a uniform level of QoS—even at a lower price—would harm QoS-needy content providers such as Sony and Blizzard by depriving them of the QoS needed to make their applications function properly. Even worse, a blended QoS would harm the vast majority of content providers that have no demand for QoS but would

105. With enhanced QoS capabilities at both the access level and the backbone level, however, an access provider could set its content distribution service apart from Akamai's offering.

now be forced to pay for it. The theoretical underpinnings of such a reaction (and the resulting reduction in consumer welfare) have been recently provided by Professors Michael Katz and Benjamin E. Hermalin of the University of California at Berkeley.[106] In particular, they examine the effects of product-line restrictions in a duopoly (a market supplied by two firms).[107] They demonstrate that a restriction of the number of products that each firm can offer (applied here, the levels of QoS that can be associated with access or hosting service) may lead firms to choose the same quality of service (high or low), or it may lead them to choose non-overlapping products (high and low) where they would otherwise have engaged in head-to-head competition across all product variants.[108] They show that the resulting loss of competition can harm both consumers and economic efficiency,[109] and provide the following intuition:

> [t]here are two mechanisms through which a single-product restriction harms welfare in our duopoly model. In the unrestricted equilibrium, both firms offer both products. In the restricted equilibrium, the firms sometimes offer identical products and sometimes offer vertically differentiated products. When the firms offer identical products, the single-product restriction reduces welfare by eliminating what would have been efficient variety. When the firms offer vertically differentiated products the loss of direct competition leads to inefficient reductions in consumption levels. Consequently, both consumer and total surplus fall.[110]

In summary, total surplus is higher when the two firms compete without a single-product restriction than under three plausible outcomes (each firm chooses high quality, each firm chooses low quality, or one firm chooses high and the other choose low) with a single-product restriction.

The section concludes with a non-technical discussion of the effect of a non-discrimination provision on a content provider's incentive to innovate and on an access provider's incentive to deploy next-generation broadband networks. We discuss the implications of such competitive responses on our nation's leadership in the broadband industry.

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106. Benjamin E. Hermalin & Michael L. Katz, *The Economics of Product-Line Restrictions With an Application to the Network Neutrality Debate* (Inst. of Bus. & Econ. Research Competition Policy Center, Working Paper No. CPC06-059, 2006), *available at* http://repositories.cdlib.org/iber/cpc/CPC06-059/.

107. *Id.* at 24-28.

108. *Id.* at 28-33.

109. *Id.* at 33-34.

110. *Id.* at 35.

A. Consumer Welfare Effects: An Access Provider Would be Forced to Withdraw or Standardize Its Tiered QoS Offerings

We posit that an access provider would attempt to comply with a non-discrimination provision in the supply of QoS by either withdrawing its enhanced QoS offering from the marketplace or by replacing its tiered QoS offerings with a one-size-fits-all or "blended" QoS offering. Under either scenario, consumer welfare associated with the purchase of enhanced QoS would be largely eliminated. To make our analysis concrete, we consider the demand for enhanced QoS by content providers that supply online multiplayer video games. A similar analysis could be performed for other content providers.

1. Consumer Losses Associated with Withdrawal of Current Tiered QoS Offerings

The net neutrality proposals in Congress would effectively establish a market price of zero for enhanced QoS. To the extent that QoS can be considered a standalone product offering (that is, a complementary offering to hosting and access), one can analyze an access provider's decision to offer QoS under the standard shut-down decision in economics. According to the Markey bill, if an access provider gives priority or offers enhanced QoS "to data of a particular type, [then it must] prioritize or offer enhanced quality of service to all data of that type (regardless of the origin of such data) *without imposing a surcharge* or other consideration for such prioritization or quality of service."[111] Content providers that did not yet contract for QoS could demand free QoS from access providers. Although the provision would not nullify existing contracts for QoS between access providers and content providers, a content provider that previously contracted for QoS would likely demand to renegotiate its terms after learning that its rivals were getting the same QoS for free. The classic shut-down decision in economics is to withdraw from supplying a service if the price is less than the average variable cost of supplying that service.[112] As explained above, the average variable cost of providing QoS is the opportunity cost of carrying a given traffic stream and thus exceeds zero.[113] Hence, it is

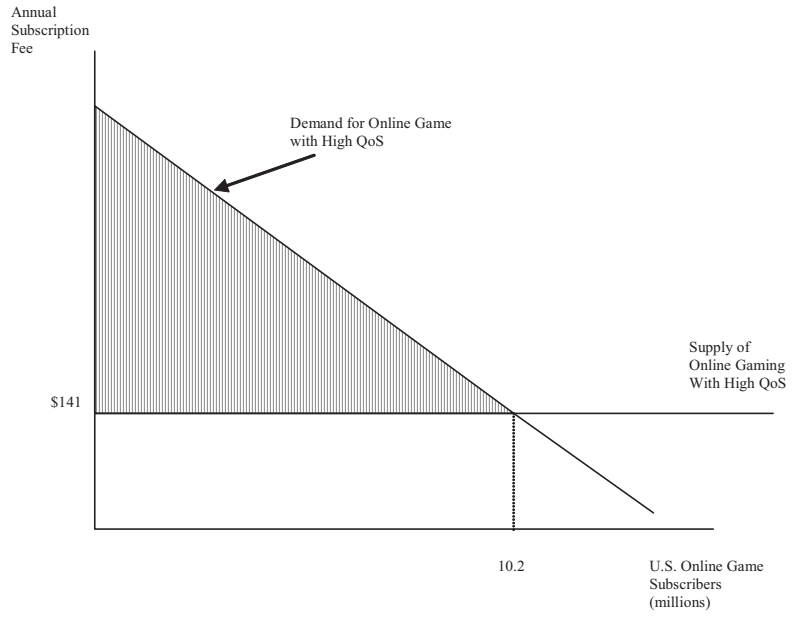
111. H.R. 5273, 109th Cong. § 4(a)(7) (2006) (emphasis added).

112. DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 60 (1990).

113. These costs have been quantified. *See* Qiong Wang, Jon M. Peha & Marvin A. Sirbu, *Optimal Pricing for Integrated Services Networks*, *in* INTERNET ECONOMICS 353-76 (Joseph P. Bailey & Lee W. McKnight eds., 1997). *See also* Hermalin & Katz, *supra* note 106, at 19 ("Some participants in the network neutrality debate have argued that increased quality is essentially costless, at least up to some point. We doubt the empirical validity of this

reasonable to assume that an access provider would withdraw its QoS offering from the market entirely to comply with the non-discrimination provision.[114]

FIGURE 1: CONSUMER WELFARE LOSS OF ONLINE GAMERS ASSOCIATED WITH ELIMINATION OF ENHANCED QOS OFFERING



a. Elimination of Consumer Surplus Associated with the Purchase of Enhanced QoS

The consumer welfare eliminated under this "withdrawal" scenario is equal to the welfare currently enjoyed by consumers of enhanced QoS. To make our discussion concrete, we focus on the consumer welfare associated with the supply of enhanced QoS from content providers (obtained from access providers) to online gamers.[115] Clearly, the withdrawal of QoS enhancements by access providers will affect consumer surplus associated with other applications such as streaming video and music. Without QoS purchased by content providers like Sony and Blizzard, online gamers could not experience the game as it was

claim . . . .").

114. Even if these costs were entirely fixed, the access provider would not be able to recover its costs in the long run.

115. By online gamers, we refer to consumers of QoS-needy gaming content. For example, video poker would not constitute QoS-needy gaming content. By contrast, MMORPG or any other interactive or real-time gaming would be QoS-needy.

meant to be played. According to AT&T's Director of Product Management for Managed Hosting, "a couple of hundred milliseconds can make a big difference" in a user's experience during a MMORPG.[116] Figure 1 shows the demand curve for online games in 2006. The vertical access is the average annual subscription fee for online gamers (equal to the product of $11.75 per month and 12 months).

PriceWaterhouse Coopers projects 10.2 million online video game subscribers in the United States by the end of 2006.[117] Hence, annual industry revenue is equal to the product of 10.2 million subscribers and $141 per year, which is depicted graphically as the rectangular area under the supply curve. The number of online subscribers is expected to increase to 28.5 million by 2009.[118] With an average monthly subscription fee of $11.75 in 2006, the annual subscription spending in the United States in 2006 was estimated to be $1.438 billion (equal to $11.75 per month x 12 months x 10.2 million subscribers).[119]

To estimate the area under the demand curve, one needs an estimate of the elasticity of demand for online gaming. The elasticity of demand is equal to the percentage change in quantity demanded in response to a one-percent increase in the price of the good. The demand curve for a good with elastic (that is, more price-sensitive) demand is flatter than is the demand curve for a good with inelastic demand. Clements and Ohashi estimated the price elasticity of demand for entertainment software consoles between the years 1994 to 2002.[120] The average price elasticity across all consoles estimated by Clements and Ohashi was -2.58. We estimate the consumer welfare associated with the purchase of $1.4 billion in online games in 2006 under two scenarios. In the first scenario, we assume that the price elasticity of demand for online games is equal to Clements' and Ohashi's average price elasticity of demand across all gaming consoles (equal to -2.58). In the second scenario, we assume that the demand for online games is less elastic than the demand for consoles by a factor of two (equal to -1.29). The elasticity of demand for online gaming appears to be low, as recent price increases for online games have not reduced subscriptions.[121] Of course, the elasticity of demand will depend on the particular game. For example, the demand for

116. Podcast, *supra* note 57.

117. PRICEWATERHOUSECOOPERS LLP, GLOBAL ENTERTAINMENT AND MEDIA OUTLOOK: 2005-2009, 344 (2005). PriceWaterhouseCoopers defines online games as games that "enable players to compete against each other over the Internet." *Id.* at 343. Hence, this figure excludes any games that enable a user to play against a computer.

118. *Id.*

119. *Id.*

120. Matthew T. Clements & Hiroshi Ohashi, *Indirect Network Effects and the Product Cycle: Video Games in the U.S., 1994-2002* 29 (NET Inst., Working Paper No. 04-01, 2004).

121. *Console Wars: A Rare Bright Spot in the Gloomy Technology Industry, Video Games Are Growing Up*, ECONOMIST, June 20, 2002, at 1.

a cult favorite such as *World of Warcraft* may be less price elastic than the demand for the average online game.

Our estimate of the surplus associated with consuming online video games in the United States is $195 million for 2006—that is, consumers of video games were willing to spend roughly $195 million more than the price of online games. When one assumes that the elasticity of demand for online games is less elastic, our consumer welfare estimate increases to $250 million. Similar calculations can be performed for 2009, when the number of online subscribers is expected to increase to 28.5 million and the average monthly subscription fee is expected to decline slightly to $11. By 2009, the consumer surplus associated with online gaming will be between $729 million and $1.458 billion. The withdrawal of QoS offerings by access providers could jeopardize the consumer surplus associated with online gaming for every year in which net neutrality regulations are in force.

The same analysis could be used to calculate the destruction in consumer surplus associated with any real-time application. For example, in a VoIP application, which requires low jitter and delay, the packets must be received within 50 milliseconds.[122] Best efforts delivery, which does not ensure that packets travel in the same path and arrive serially at even intervals, could lead to unacceptable QoS for a VoIP. Although VoIP is currently acceptable to some users without QoS, in a network flooded with increased traffic from streaming video and HDTV, it is conceivable that VoIP would no longer be acceptable without QoS. To the extent that the demand curve for VoIP would shift inward as a result of unacceptable QoS, the consumer surplus associated with VoIP would be eliminated as well.

Finally, it is not clear whether the net neutrality bills would prevent access providers from offering any enhanced QoS to end-users at positive prices. For example, under the Snowe-Dorgan bill, access providers could offer prioritization (a form of QoS) to end-users but could not impose a fee for such service.[123] To the extent that access providers withdrew such offerings for end-users to comply with that provision, one would have to include the consumer welfare loss associated with the consumption of VPNs and other end-users services that make use of QoS.

122. Peha, *supra* note 3, at 7. According to Peha, if packets for a VoIP application are not received in 50 milliseconds, they are "useless."

123. S. 2917, 109th Cong. § 12(a)(5) (2006).

b. More Expensive Internet Access Associated with Unmanaged IP Networks

As we demonstrated above, the cost per customer of providing basic Internet access (and thus the price) would increase significantly if access providers were prohibited from using intelligent traffic control, including QoS, to meet the demand for Internet traffic. According to Clarke, the monthly cost of providing broadband access on an unmanaged network would increase by roughly one third (from $35 to $47) just to accommodate the transition from current typical Internet usage to that displayed by today's "power" users.[124] If the cost per subscriber were to increase to $47, then the price for broadband access would likely exceed $47 to allow access providers to earn a positive margin. Unfortunately, the demand for broadband access may be sufficiently elastic that many broadband subscribers would cancel their services before paying in excess of $47 per month for broadband access. As evidence of this sensitivity to prices around $50 per month, note that U.S. residential high-speed lines nearly *doubled* from 17.3 million in December 2002 to 42.9 million in December 2005[125] as broadband rates fell below $50 per month. Using a conservative estimate of a monthly price of $47 (which would not allow any incremental margin) and an own-price elasticity of demand for broadband access of -1.0, which is at the low end of estimates from several empirical studies,[126] we estimate that 14.7 million (34.3 percent) broadband subscribers would cancel their services before paying $47 per month for broadband access. The associated loss in annual consumer welfare for these "marginal" broadband customers would be large (roughly $1 billion per year), and the loss in annual consumer welfare associated with higher prices for the remaining broadband customers would be even larger (roughly $4 billion per year in higher payments for broadband access). More realistic estimates of the elasticity of demand for broadband and of broadband prices (which would allow for some incremental margin in an unmanaged network) would result in even larger welfare losses.

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124. Clarke, *supra* note 69, at 20.

125. *FCC High-Speed Services*, *supra* note 85, at tbl.3.

126. *See*, *e.g.*, Hal R. Varian, *The Demand for Bandwidth: Evidence from the INDEX Project*, *in* BROADBAND: SHOULD WE REGULATE HIGH-SPEED INTERNET ACCESS? 57-83 (Robert W. Crandall & James H. Alleman eds., 2002) (estimating an elasticity of demand between -3.1 and -2.0); Austan Goolsbee, *The Value of Broadband and the Loss of Taxing New Technology*, 5 B.E. J. ECON. ANALYSIS & POL'Y 1505 (2006) (estimating a demand elasticity between -3.07 and -2.44); Robert W. Crandall, J. Gregory Sidak, & Hal J. Singer, *The Empirical Case Against Asymmetric Regulation of Broadband Internet Access*, 17 BERKELEY TECH. L.J. 953, 954 (2002) (estimating an elasticity of demand of -1.2); Gerald R. Faulhaber & Christiaan Hogendorn, *The Market Structure of Broadband Telecommunications*, 48 J. INDUS. ECON. 305, 326 (2000) (estimating an elasticity of demand of -1.533).

2. Consumer Losses Associated with Standardized QoS Offerings

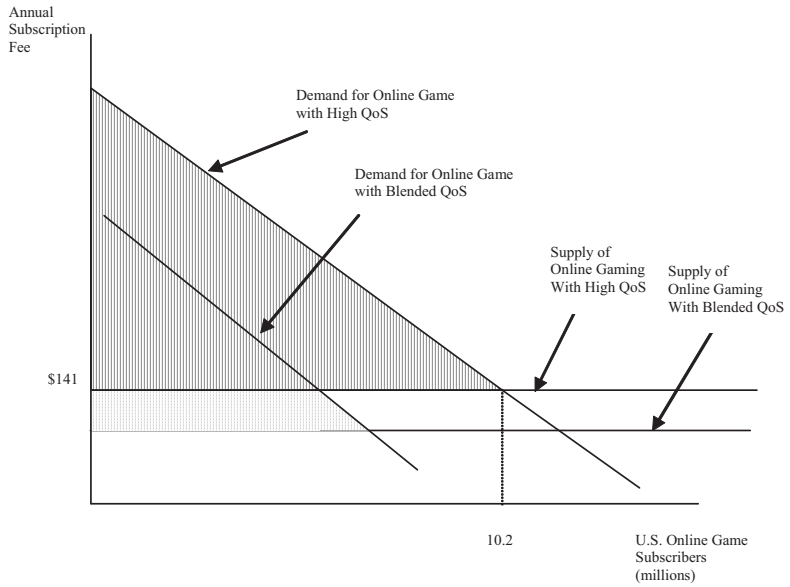
In this scenario, we posit that access providers, in an effort to comply with the non-discrimination provisions relating to QoS, embed a "blended" level of QoS as part of their standard hosting or access service for content providers. The blended level of QoS would likely be an average QoS that is superior to the QoS associated with plain hosting or access service but inferior to the QoS associated the current QoS options. Nothing in the net neutrality bills prohibits an access provider from charging more for complementary services such as access or hosting.

a. Content Providers and Their Customers Who Value Enhanced QoS Will be Forced to Settle for Something Less

The analysis of the loss in consumer welfare from a reduction in QoS is similar to the preceding analysis of the loss in consumer welfare from the elimination in QoS. Both scenarios result in an inward shift of the demand curve. Under this scenario, we posit that the demand for online games with blended QoS sits to the left of (or below) the demand for online games with enhanced QoS. Temporarily holding the supply curve constant, the effect of such a shift would be a reduction in consumer welfare, as the area of the triangle is reduced. The magnitude of the shift will depend on the extent to which online gamers are willing to tolerate a modest reduction in the quality of the game. This shift in the demand curve is depicted in Figure 2.

In addition to a shift in the demand curve, the supply curve of online video gaming could shift downwards. The supply curve can be thought of as the marginal cost of supplying online gaming. Under the status quo, online game producers such as Sony and Blizzard incur a marginal cost for acquiring a high level of QoS from access providers. Under the scenario contemplated here, however, content providers that previously acquired a high level of QoS would incur a lower marginal cost for acquiring a blended level of QoS, as *all* content providers—not just those that value QoS—would be required to share in the access provider's cost of providing blended QoS. Holding the demand curve constant, a downward shift in the supply of a product increases consumer welfare, as the size of the triangle increases. Because both the demand curve and the supply curve are affected by a reduction in QoS, one must balance the decrease in welfare from reduced demand (depicted by the vertical lines above the demand curve for blended QoS) against the increase in welfare from lower costs (depicted by the dotted area above the supply of online gaming with blended QoS).

FIGURE 2: CONSUMER WELFARE LOSS OF ONLINE GAMERS ASSOCIATED WITH BLENDED QOS OFFERING



Although the net welfare effect on online gamers is ambiguous in theory, it is reasonable to believe that the demand effect will likely exceed the supply effect, thereby resulting in a net reduction in welfare. With respect to the demand effect, online video gamers could be especially sensitive to even a slight degradation in the experience of the game. Most websites are free. To persuade a user to pay $25 per month for an online interactive game requires an exceptionally superior offering. For this reason, we expect the demand effect could be large. By contrast, it is not clear whether online game providers would pass on a large portion of the cost savings to their subscribers; only firms in perfectly competitive industries pass on 100 percent of the cost savings to consumers. Moreover, access providers would attempt to recover the cost of providing blended QoS service through higher prices of complementary products. Hence, the total cost of providing online gaming, including the cost of access and hosting services, will not decline as dramatically as the direct cost of QoS. For these reasons, we expect the supply effect could be small. On net, online gamers will likely be worse off, but by not as much as they would be if access providers were to withdraw QoS entirely (the first scenario).

b. Content Providers and Their Customers Who Do Not Value Enhanced QoS Will be Forced to Purchase Something They Do Not Value

Not all content providers value QoS. Indeed, as of September 2006, most websites did not produce QoS-needy applications. For example, real-time applications such as online gaming and VoIP are relatively recent offerings. (The 56 percent increase in Akamai's revenues from the second quarter 2005 to the second quarter 2006 implies that QoS-needy applications are growing and could one day represent a significant portion of total Internet traffic.[127]) In a world where every content provider must acquire some QoS, content providers who do not value those services will be unambiguously worse off. Because access providers could not charge explicitly for QoS under the current net neutrality bills, the fees would likely be imposed on complementary services purchased by content providers such as access and hosting.

To make this point concrete, consider a content provider that currently purchases hosting service from an access provider for $100 per month but declines the QoS option, which was priced at an additional $50 per month. Assume that ten percent of the access provider's customers chose the bundled hosting offering (hosting plus QoS) for $150 before the imposition of net neutrality. The average price per customer is thus $105 (equal to 0.9 x $100 + 0.1 x $150). Under a net neutrality regime, the price of the QoS option would be set to zero (by law) and the price of hosting service would increase to $105 if the access provider sought to preserve the average revenue per customer. Hence, the content provider that originally opted against QoS now incurs an additional charge of $5 per month for blended QoS. Faced with this higher incremental cost, the content provider would likely try to pass on a portion of this cost increase to its customers.

In summary, blended QoS would likely harm end-users of content providers that require enhanced QoS (by reducing the quality of QoS-needy applications), and it would unambiguously harm end-users of content provider that do not value QoS (by increasing the price of an unnecessary component). Indeed, it is hard to identify *any* constituency that would prefer a one-size-fits-all solution for QoS. (Indeed, this begs the question as to why Google and some other content providers are seeking such restrictions. We believe the most plausible explanation is that Google's most lucrative application—namely, online search—does not depend on high QoS to perform properly. As a result, Google would prefer to erect barriers to entry in QoS-needy content submarkets, even if

127. *Akamai Second Quarter Results, supra* note 61.

those barriers applied to itself.[128]) One class of content providers that could be better off would have a willingness to pay for enhanced QoS just below the current price for QoS. To use the simple example above, assume this particular content provider values high QoS at $45 per month (slightly below the market price of $50) but values blended QoS at $15 per month (slightly more than the incremental cost of the blended offering). Hence, under the blended QoS offering, this content provider earns incremental surplus of $10 (equal to $15 less $5). Public policy should not favor one class of content providers over the content providers at the ends of the distribution that either do not value QoS at all or value QoS highly.

B. Innovation Effects: Content Providers Will Divert Resources Away from QoS-Needy Applications and Towards Non-QoS-Needy Applications

How would a content provider that was developing QoS-needy content react to an access provider's attempts to comply with the non-discrimination provisions relating to QoS? Under either reaction posited above, withdrawal or blended QoS, high QoS would no longer be available to content providers that were developing QoS-needy applications. Hence, the net neutrality bills would effectively eliminate a market. Content providers interested in designing and producing QoS-needy content would have no means of providing that content, at least not in an acceptable manner. Accordingly, they will divert their resources and creative energies to other applications that do not require high QoS.

The analysis above, describing the reduction in consumer surplus flowing from a reduction in demand for QoS-needy applications, is broadly applicable across not just presently existing content, but also content still under development. Consider current efforts by Apple to deliver streaming video for Internet users. On September 13, 2006, Apple announced a device due in early 2007 called iTV that will display movies, television shows, and other videos purchased over the Internet on television sets.[129] The iTV device will connect directly to a user's television set, and it will access audio and video files stored on a user's computer through a common Wi-Fi.[130] Movies will take 30 minutes to download from Apple's iTunes Store.[131] Although current video clips

128. For other possible explanations for Google's seemingly non-self-serving strategy, including a coordinated refusal to deal among content providers, *see* Sidak, *supra* note 40, at 456-58.

129. Nick Wingfield & Merissa Marr, *Apple Computer Aims to Take Over Your Living-Room TV*, WALL ST. J., Sept. 13, 2006, at B1.

130. *Id.*

131. *Id.*

may not require high QoS (guaranteed throughput may be required for streaming video), as online video takes on a more interactive nature, it is not much of a stretch to envision how Apple or some other video provider would demand high QoS from access providers. By eliminating the market for QoS-needy applications entirely, net neutrality legislation would reduce consumer surplus not just for current QoS-needy applications, like online gaming, but also for applications not yet existing and that will never be developed in a world where there is no mechanism to deliver the relevant QoS-needy content.

C. Implications for U.S. Broadband Leadership

Proponents of net neutrality argue that imposing non-discrimination requirements in the provision of QoS will increase broadband penetration rates in the United States, thereby making the U.S. more competitive with other countries.[132] In particular, they argue that "robust competition in other nations' networks have made the debate over nondiscrimination (or Network Neutrality) moot in these countries," and that "any temptations to distort the content market are undercut by competition between multiple broadband providers."[133] They point out that, presumably as a result of deregulatory policies at the federal level, the United States has fallen to 16th place in the International Telecommunications Union's ("ITU") broadband penetration rankings and has fallen to 12th place in the penetration measures from the Organization for Economic Cooperation and Development ("OECD").[134]

Importantly, the authors note a strong correlation between broadband penetration rates and broadband prices.[135] Based on this result, they suggest that mandatory unbundling at cost-based prices would reduce prices and thereby stimulate broadband penetration:

> [t]he best broadband offerings in many of the countries shown above do not come from the traditional telecom incumbents, but from competitors who have entered historically monopolistic markets. This new competition was made possible by good public policy—specifically the successful implementation of 'open-access' or 'unbundling' requirements.[136]

Empirical research demonstrates that open access policies, after properly

132. *See, e.g.*, S. DERRICK TUCKER, FREE PRESS, CONSUMERS UNION & CONSUMER FED'N OF AM., BROADBAND REALITY CHECK II 5 (2006), *available at* http://www.freepress.net/docs/bbrc2-final.pdf.

133. *Id.* at 16.

134. *Id.* at 8.

135. *Id.* at 17.

136. *Id.* at 17.

controlling for other factors that influence broadband penetration, do not positively contribute to broadband penetration in a significant way.[137] In a cross-sectional regression of broadband penetration on several unbundling variables, Scott Wallsten of the AEI-Brookings Joint Center found that (1) the incremental effect of local loop unbundling ("LLU") on penetration is ambiguous, (2) the incremental effect of bitstream access on penetration is positive, but is not always statistically significant, and (3) the incremental effect of subloop unbundling on penetration is negative and statistically significant under all specifications.[138] Instead, Wallsten finds that population density (it is easier to connect broadband users if they live closer together), GDP per capita, country-specific factors, and time factors are more important in explaining variations in broadband penetration.[139] To the extent that mandatory unbundling fails to lower broadband prices—perhaps resellers fails to pass on to consumers any of the difference between the retail price and the regulated access price—mandatory unbundling cannot increase broadband penetration.

Because the demand for broadband access is sensitive to the price of broadband access, broadband prices are critical in driving broadband penetration. The relevant question, however, is how net neutrality provisions would affect the price for broadband access. Setting aside the issue of whether competition for U.S. broadband customers is sufficiently intense so as to render the issue "moot," proponents of net neutrality fail to provide the link between "temptations to distort the content market" with tiered QoS offerings and higher access prices. For at least two reasons, we believe that net neutrality legislation would *increase* the price of broadband access, and thereby decrease broadband penetration in the United States. First, the cost per customer of an unmanaged network would be prohibitively expensive. Clarke estimates that to the extent that consumer demand for more bandwidth-intensive applications continues to rise, the cost per customer of an unmanaged network will increase dramatically. These cost increases would be passed onto consumers in the form of higher broadband access prices. Second, access providers could use incremental revenues from content providers to partially subsidize the price of access for end-users.[140] Google, a wireless broadband access provider, is using this pricing strategy in Mountain View, California.[141]

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137. Scott J. Wallsten, *Broadband and Unbundling Regulations in OECD Countries* 1 (AEI-Brookings Joint Ctr. for Regulatory Studies, Working Paper No. 06-16, 2006), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=906865.

138. *Id.*

139. *Id.* at tbls.1, 2.

140. *See* Sidak, *supra* note 40.

141. John Markoff, *Google Says It Has No Plans for National Wi-Fi Service*, N.Y.

Finally, it bears emphasis that broadband penetration rates (while important) should not be the *sole* consideration in shaping broadband policy in the United States. If the objective of the U.S. government were exclusively to maximize broadband penetration, as opposed to maximizing static and dynamic efficiency, then the "optimal" policy would be to mandate unbundling to competitors at $0 per month, which would be tantamount to nationalizing all broadband infrastructure in the United States. Clearly, such a policy would be blatantly inconsistent with maximizing static and dynamic efficiency. In addition to broadband penetration rates, U.S. competitiveness in broadband services will ultimately depend on innovation by both access providers and content providers. Net neutrality would undermine the incentive of access providers and content providers to invest in new technologies. By limiting ancillary revenue streams for access providers, net neutrality would undermine an access provider's incentives to expand and enhance their networks. By mandating non-discrimination in the supply of QoS, content providers will be less inclined to take risks on QoS-needy applications. The rest of the world looks to the United States for creative content. Net neutrality would force them to look elsewhere.

TIMES, Aug. 16, 2006, at C7.