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A Primer on Network Neutrality

The Internet has quickly evolved from a collection of specialized networks, primarily for electronic mail correspondence among government and academic users, to a worldwide web of networks and services providing a widely available blend of information, communications and entertainment (ICE).[1] Governments financially underwrote the construction and use of the first generation Internet, but quickly withdrew funding and management when commercial enterprises could assume the responsibility. In its second generation the Internet proliferated and diversified as a largely privatized World Wide Web offering user friendly graphical interfaces and other enhancements. The Internet has begun to evolve into a third generation that will provide users with high speed access to an ever more diverse array of ICE services.

In its third generation the Internet may become more centralized and operates as the key medium for many services that heretofore operated separately. A centralized Internet may incorporate much of the existing broadcasting, wireline and wireless telephony and video programming services. Already incumbent telephone and cable television operators offer customers a triple or quadruple play combination of these services.[2]

As the Internet becomes the key medium for most ICE services, industry observers, academics, consumer representatives and others have expressed concern whether service providers will manage their networks fairly. Advocates for network neutrality seek carrier assurance and possibly regulator-established rules to ensure that the Internet continues to operate in a nondiscriminatory manner, both in terms of how subscribers access and receive Internet transmitted services and how content and other service providers reach subscribers. Throughout the phases of its development, the Internet has benefited from prudent decisions by governments to use a light hand when regulating and safeguarding national interests. Governments correctly recognized that they could rely on the motivations of mostly private stakeholders to build the telecommunications links and to diversify the services available from the World Wide Web. But on the other hand as the Internet consolidates previously discrete ICE services, the stakes have risen in terms of whether the competitive playing field exists for consumer access to the variety of services available via the Internet, and for service provider access to consumers.

The Internet continues to evolve as it incorporates technological innovations and becomes a conduit for many services that previously traversed dedicated telecommunications networks. As the Internet begins to offer convergent services, such as Voice over the Internet Protocol (VoIP) telephone services and Internet Protocol Television (IPTV), some operators may perceive the opportunity to accrue a financial or competitive benefit by deviating from a plain vanilla, "one size fits all" Internet, characterized by nondiscriminatory, best efforts routing of traffic[3] and "all you can eat" subscriptions.

Some Internet Service Providers (ISPs) seek to diversify the Internet by prioritizing bitstreams and by offering different quality of service guarantees. To some observers this strategy constitutes harmful discrimination that violates a tradition of network neutrality in the switching, routing and transmission of Internet traffic. To others offering different levels of service provides the means for consumers and carriers to secure and pay for premium, "better than best efforts" service if so desired.

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[1] For background on how the Internet evolved from a government underwritten project to a privatized and commercialized medium, cf. Rob Frieden: Revenge of the Bellheads: How the Netheads Lost Control of the Internet, in: Telecommunications Policy, Vol. 26, No. 6, pp. 125-144, Sep./Oct. 2002; cf. also Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Larry G. Roberts, Stephen Wolff: A Brief History of the Internet, Internet Society, available at: http://www.isoc.org/internet/history/brief.shtml.

[2] "[T]raditional phone companies that are primed to offer a 'triple play' of voice, high-speed Internet access, and video services over their respective networks." Exclusive Service Contracts for Provision of Video Services in Multiple Dwelling Units and Other Real Estate Developments, Notice of Proposed Rule Making, 22 FCC Rcd. 5935, 5938 (2007). The quadruple play refers to the combination of "video, broadband Internet access, VoIP and wireless service . . .." AT&T Inc. and Bellsouth Corporation, Application for Transfer of Control, Memorandum Opinion and Order, 22 FCC Rcd. 5662, 5735 (2007).

[3] "TCP/IP routes packets anonymously on a 'first come, first served' and 'best efforts' basis. Thus, it is poorly suited to applications that are less tolerant of variations in throughput rates, such as streaming media and VoIP, and is biased against network-based security features that protect e-commerce and ward off viruses and spam." Christopher S. Yoo: Beyond Network Neutrality, in: Harvard Journal of Law & Technology, Vol. 19, Fall 2005, pp. 1, 8.

Network neutrality refers to the view that the Internet and other telecommunications and information processing networks should remain open, nondiscriminatory and largely managed by users rather than carriers. The principle supports end-to-end connectivity and the kind of access equality provided by "best efforts" network routing of traffic. Opponents of network neutrality claim the concept would impose common carrier nondiscrimination responsibilities on information service providers, create disincentives for investment in next generation network infrastructure and generate regulatory uncertainty.[1]

[1] Cf. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Policy Statement, 20 FCC Rcd. 14986 (2005) (articulating network neutrality policy objectives); Rob Frieden: Internet 3.0: Identifying Problems and Solutions to the Network Neutrality Debate, in: International Journal of Communication, Vol. 1, 2007, pp. 461 ff., available at: http://ijoc.org/ojs/index.php/ijoc/article/view/160/86; Rob Frieden: Network Neutrality or Bias? – Handicapping the Odds for a Tiered and Branded Internet, in: Hastings Communications and Entertainment Law Journal, Vol. 29, No. 2, 2007, pp. 171-216; Brett Frischmann, Barbara van Schewick: Network Neutrality and the Economics of an Information Superhighway: A Reply to Professor Yoo, in: Jurimetrics Journal, Vol. 47, No. 4, Summer 2007, pp. 383-428; Barbara van Schewick: Towards an Economic Framework for Network Neutrality Regulation, in: Journal on Telecommunications & High Technology Law, Vol. 5, Issue 2, 2007; Barbara A. Cherry: Misusing Network Neutrality to Eliminate Common Carriage Threatens Free Speech and the Postal System, in: Northern Kentucky Law Review, Vol. 33, 2006, pp. 483 ff.; Bill D. Herman: Opening Bottlenecks: On Behalf Of Mandated Network Neutrality, in: Federal Communications Law Journal, Vol. 59, Dec. 2006, pp. 103 ff.; Craig McTaggart: Was The Internet Ever Neutral?, paper presented at the 34th Research Conference on Communication, Information and Internet Policy, George Mason University School of Law, Arlington, Virginia (rev. Sep. 30, 2006), available at: http://web.si.umich.edu/tprc/papers/2006/593/mctaggart-tprc06rev.pdf; Tim Wu: Network Neutrality, Broadband Discrimination, in: Journal on Telecommunications & High Technology Law, Vol. 2, 2005, pp. 141 ff., available at: http://ssrn.com/abstract=388863; J. Gregory Sidak: A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet, in: Journal of Competition Law and Economics, Vol. 2, No. 3, 2006, pp. 349 ff.; Christopher S. Yoo: Network Neutrality and the Economics of Congestion, in: Georgetown Law Journal, Vol. 94, June 2006, pp. 1847 ff.; Adam Thierer: Are 'Dumb Pipe' Mandates Smart Public Policy? Vertical Integration, Net Neutrality, and the Network Layers Model, in: Journal on Telecommunications & High Technology Law, Vol. 3, 2005, pp. 275 ff.; Christopher S. Yoo: Beyond Network Neutrality, in: Harvard Journal of Law & Technology, Vol. 19, Fall 2005; Christopher S. Yoo: Would Mandating Broadband Network Neutrality Help or Hurt Competition? A Comment on the End-to-End Debate, in: Journal on Telecommunications & High Technology Law, Vol. 3, 2004, pp. 23 ff.; Mark A. Lemley: Lawrence Lessig: The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era, in: UCLA Law Review, Vol. 48, 2001, pp. 925 ff.

This paper will explain the different conceptualizations of network neutrality and why a debate has arisen about whether governments need to establish rules mandating nondiscrimination. The paper will identify what types of price and quality of service discrimination represent legitimate efforts to diversify Internet-mediated services and to satisfy increasingly diverse requirements of content providers and consumers. The paper concludes that while many concerns about net-

Voice over the Internet Protocol ("VoIP") offers voice communications capabilities, much like ordinary telephone service, using the packet switched Internet, for all or part of the link between call originator and call recipient. VoIP calls originating or terminating over the standard, dial up telephone network require conversion from or to the standard telephone network's architecture that creates a dedicated "circuit-switched" link, as opposed to the ad hoc, "best efforts" packet switching used in the Internet.[1]

[1] Cf. Mark C. Del Bianco: Voices Past: The Present and Future of VoIP Regulation, in: CommLaw Conspectus: Journal of Communications Law and Policy, Vol. 14, 2006, pp. 365 ff.; Robert Cannon: State Regulatory Approaches to VoIP: Policy, Implementation, and Outcome, in: Federal Communications Law Journal, Vol. 57, May 2005, pp. 479 ff.; Sunny Lu, Note, Cellco Partnership v. FCC & Vonage Holdings Corp. v. Minnesota Public Utilities Commission: VoIP's Shifting Legal and Political Landscape, in: Berkely Technology Law Journal, Vol. 20, 2005, pp. 859, 862; Chérie R. Kiser, Angela F. Collins: Regulation on the Horizon: Are Regulators Poised to Address the Status of IP Telephony?, in: CommLaw Conspectus: Journal of Communications Law and Policy, Vol.11, 2003, pp. 19 ff.; Robert M. Frieden: Dialing for Dollars: Should the FCC Regulate Internet Telephony?, in: Rutgers Computer and Technology Law Journal, Vol. 23, 1997, pp. 47-79. For technical background on how VoIP works cf. Intel, White Paper, IP Telephony Basics, available at: http://www.intel.com/network/csp/resources/white_papers/4070web.htm; Susan Spradley, Alan Stoddard: Tutorial on Technical Challenges Associated with the Evolution to VoIP, Power Point Presentation, available at: http://www.fcc.gov/oet/tutorial/9-22-03_voip-final_slides_only.ppt. Cf. also Jerry Ellig, Alastair Walling: Regulatory Status of VoIP in the Post-Brand X World, in: Santa Clara Computer and High Technology Law Journal, Vol. 23 2006, pp. 89 ff.; Amy L. Leisinger: If It Looks Like a Duck: The Need for Regulatory Parity in VoIP Telephony, in: Washburn Law Journal, Vol. 45, Spring 2006, pp. 585 ff.; Mark C. Del Bianco: Voices Past: The Present and Future of VoIP Regulation, in: CommLaw Conspectus: Journal of Communications Law and Policy, Vol. 14, 2006, pp. 365 ff.; R. Alex DuFour: Voice Over Internet Protocol: Ending Uncertainty and Promoting Innovation Through a Regulatory Framework, in: CommLaw Conspectus: Journal of Communications Law and Policy, Vol. 13, 2005, pp. 471 ff.; Stephen E. Blythe: The Regulation of Voice-Over-Internet-Protocol in the United States, the European Union, and the United Kingdom, in: Journal of High Technology Law, Vol. 5, 2005, pp. 161 ff.

work neutrality overstate the potential for harm, ISPs should offer non-neutral services in a fully transparent manner so that regulators can distinguish between actual and induced network congestion as well as other potential harm to content providers and consumers.

What is Net Neutrality?

The initial plans for the Internet and the technical protocols established for managing the networks providing services anticipated the operation of a seamless global "network of networks." This means that the original architectural design for the Internet built in an addressing system and a traffic management regime that treated all traffic equally. "Best efforts" routing refers to a design that contemplates nondiscrimination in the switching, routing and transmission of digital bitstreams. Such a one size fits all, plain vanilla topology

Rather than "broadcasting" a constant stream of all available programs, as cable does and Verizon plans to do, **IPTV** stores a potentially unlimited number of programs on a central server, which users then call up on demand. SBC will not replace the copper lines that currently run into customer premises. Instead, to make sure there is sufficient bandwidth between the neighborhood node where the optical fiber terminates and the household premise, it will upgrade the DSL equipment currently at those nodes and in households with VDSL technology. At the household, the viewer will use the IP technology to send a signal to the SBC end-office to send a particular channel or video on demand selection. That signal will be sent over the same bandwidth used for data and VoIP service. In SBC's system, a single customer line will have enough bandwidth to support up to four active television sets per household at a time, or up to two HDTV channels at a time."[1]

[1] Charles B. Goldfarb: Telecommunications Act: Competition, Innovation, and Reform, Congressional Research Service, Vol. 37, Jan. 13, 2006, available at: http://www.educause.edu/ir/library/pdf/EPO0635.pdf; cf. also Micah Schwalb: IPTV: Public Interest Pitfalls, in: Journal of High Technology Law, Vol. 5, Fall 2006, pp. 305 ff.

"The Internet is a vast network of individual computers and computer networks that communicate with each other using the same communications language, **Transmission Control Protocol/Internet Protocol (TCP/IP)**. The Internet consists of approximately more than 100 million computers around the world using TCP/IP protocols. Along with the development of TCP/IP, the open network architecture of the Internet has the following characteristics or parameters: 1. Each distinct network stands on its own with its own specific environment and user requirements, notwithstanding the use of TCP/IP to connect to other parts of the Internet. Communications are not directed in a unilateral fashion. Rather, communications are routed throughout the Internet on a best efforts basis in which some packets of information may go through one series of computer networks and other packets of information go through a different permutation or combination of computer networks, with all of these information packets eventually arriving at their intended destination. 2. Black boxes, for lack of a better term, connect the various networks; these boxes are called 'gateways' and 'routers'. The gateways and routers do not retain information but merely provide access and flow for the packets being transmitted. 3. There is no global control of the Internet."[1]

[1] Konrad L. Trope: Voice Over Internet Protocol: The Revolution in America's Telecommunications Infrastructure, in: The Computer and Internet Lawyer Journal, Vol. 22, Dec. 2005, No. 12, pp. 1,4.

helped promote widespread proliferation of networks and emphasized timely, efficient and low cost delivery of traffic. Operators participating in the creation of the Internet optimized their networks to handle traffic as quickly as possible. To achieve this goal, network managers configured their routers not to examine or meter traffic. Examining traffic might have provided the basis for prioritizing particular types or sources of traffic, and also to measure the usage by specific sources of traffic. Telecommunications network operators typically engage in such activities so that they can render accurate bills based on network usage, but Internet managers opted not to do so. Internet managers opted not to meter or prioritize traffic based on the view that the Internet could develop faster if carriers devoted all network resources to promoting connectivity and reach as opposed to dividing resources between connecting networks and metering usage.

Network neutrality advocates seek to require ISPs to continue adhering to the principle of nondiscrimination even though technological innovations in routers and other networking devices make it easier and less of a resource drain to prioritize, meter and actively manage traffic. Network neutrality advocates want ISPs to continue operating their networks without favoring any category of content provider or consumer. Network neutrality in application would require ISPs to continue routing traffic on a best efforts basis, ostensibly to foreclose the potential for the Internet to fragment and balkanize into various types of superior access arrangements, available at a premium, and a public Internet increasingly prone to real or induced congestion.

Opponents to compulsory network neutrality seek to differentiate service, in terms of quality, price and features to accommodate increasingly diverse user requirements. ISPs and some industry observers claim that compulsory network neutrality would create disincentives for ISPs to invest in next generation network upgrades, because the carriers could not recoup the investment by offering new services beyond plain vanilla Internet access. Without such flexibility, opponents of net neutrality express concern that ISPs will not risk investing the billions of dollars in network infrastructure upgrades needed to provide third generation Internet services such as broadband access via both wired and wireless networks.[4] For example, ISPs want to offer more expensive services to on-line game players, IPTV viewers and VoIP subscribers who may need prioritization of their traffic streams so that their bits arrive on time, even during network congestion. To provide this premium service, ISPs will need to identify and favor specific traffic streams.

Opponents of network neutrality oppose efforts to prevent ISPs from tiering how consumers access the Internet and how content providers reach consumers.

[4] Cf., e.g., J. Gregory Sidak: A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet, in: Journal of Competition Law and Economics, Vol. 2, Sep. 2006, pp. 349, 460; Thomas W. Hazlett: Neutering the net, in: Financial Times, FT.com Online, posted March 20, 2006, available at: http://news.ft.com/cms/s/392ad708-b837-11da-bfc5-0000779e2340.html; Testimony of J. Gregory Sidak, United States Senate, Committee on Commerce, Science and Transportation, Feb. 7, 2006, available at http://commerce.senate.gov/pdf/sidak-020706.pdf.

Digital Subscriber Links (DSL) provide Internet access via the copper wires initially used solely to provide narrowband telephone service. Telephone companies retrofit the wires to provide medium speed broadband services by expanding the available bandwidth by about 1500 kiloHertz. The FCC provides the following definition: "Digital Subscriber Line is a technology for bringing high-speed and high-bandwidth, which is directly proportional to the amount of data transmitted or received per unit time, information to homes and small businesses over ordinary copper telephone lines already installed in hundreds of millions of homes and businesses worldwide. With DSL, consumers and businesses take advantage of having a dedicated, always-on connection to the Internet. "[1]

Cable modems provide Internet access using a small portion of the bandwidth available from cable television networks. "Cable operators have invested in major improvements or system upgrades to provide cable modem service. The typical upgrade employs a hybrid fiber-coaxial (HFC) architecture. Most HFC systems utilize fiber between the cable operators' offices (the headend) and the neighborhood "nodes.' Between the nodes and the individual end-user homes, signals travel over traditional coaxial cable infrastructure. Part of the cable system, typically a 6 MHz channel, is dedicated to cable modem service. At each subscriber's home or office, a splitter and a high-speed cable modem are installed. The splitter separates signals and sends them to different cables going to the subscriber's television and computer. The cable that goes to the computer connects with a high-speed cable modem and an Ethernet card that are attached to the computer. This modem and card enable the cable system to communicate with the subscriber's computer, and vice versa."[2]

[1] Federal Communications Commission: FCC Consumer Facts, Broadband Access for Consumers, available at: http://www.fcc.gov/cgb/consumerfacts/dsl2.html.

[2] Inquiry Concerning The Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, 17 FCC Rcd. 2844, 2915 (2002).

Consumer tiering could differentiate service in terms of bitrate speeds, amount of permissible traffic carried per month and how an ISP would handle specific types of traffic, including "mission critical" content that might require special treatment, particularly when network congestion likely may occur. While consumer tiering addresses quality of service and price discrimination at the first and last kilometer, access tiering could differentiate how ISPs handle content upstream into the Internet cloud[5] that links content providers and end users.

Network neutrality advocates have expressed concern that the potential exists for ISPs to use diversifying service requirements as cover for a deliberate strategy to favor their own content and to extort additional payments from users and content providers threatened with intentionally degraded service. The worst case scenario envisioned by network neutrality advocates sees a reduction in innovation, efficiency, consumer benefits and national productivity.

Many network neutrality advocates speak and write in apocalyptic terms that allowing price and service discrimination will eviscerate the Internet and enable carriers to delay or shut out competitors and ventures unwilling or unable to pay surcharges. The head of a consumer group claims that incumbent telephone and cable companies can reshape the nation's digital destiny by branding the Internet and foreclosing much of its societal and cultural benefits.[6] On the other hand, opponents of network neutrality reject as commercially infeasible scenarios where ISPs would unreasonably discriminate or degrade service. Network neutrality opponents also note that ISPs typically qualify for a regulatory "safe harbor"[7] that largely insulates them from regulation, because they operate as information service providers and not telecommunications service providers. While the latter group incur traditional common carrier, public utility responsibilities, including the duty not to discriminate, the former group enjoys quite limited government oversight in most nations.

Opponents of network neutrality see no actual or potential problems resulting from ISPs having freedom to discriminate and diversify service. The most caustic opponents to network neutrality scoff at the notion that an ISP would deliberately degrade service to some types of subscribers. Arguably in a robustly competitive marketplace any unnecessary degradation of service would motivate subscribers to "vote with their feet" and take their business elsewhere. But in most nations, such a competitive marketplace does not exist for first kilometer wireline or wireless access. While content providers upstream from end users can readily shift Internet backbone providers, residential subscribers typically have few facilities-based carrier options. In the United States incumbent telephone and cable television companies provide over 96 percent of all broadband Internet access via Digital Subscriber Links and cable modem service respectively. Despite vehement claims by ISPs that they would never disserve a customer the number of proven instances of service degradation has increased to a point where the threat is more than a matter of speculation or anecdote.

[5] The Internet cloud refers to the vast array of interconnected networks that make up the Internet and provider users with seamless connectivity to these networks and the content available via these networks.

[6] Cf. Jeff Chester: The End of the Internet?, in: The Nation, posted Feb. 1, 2006, available at: www.thenation.com/doc/20060213/chester.

[7] A safe harbor constitutes "[a]n area or means of protection [or a] provision (as in a statute or regulation) that affords protection from liability or penalty." in: Black's Law Dictonary, 8th ed., 2004.

Network Neutrality Initiatives Conflict with the Internet's Evolution

The Internet commenced operations as a neutral, non-discriminating medium. However commercialization, technological development, increased diversity among users and proliferating service options collectively create the ability and incentive for ISPs to pursue price and service discrimination. The migration from government ownership, to government subsidization, and finally to privatization and commercialization has motivated ISPs to find new ways to generate more revenue. Technological innovations provide the means for ISPs to differentiate how it manages traffic flows, including the ability to prioritize specific bitstreams and to delay or even block delivery of "standard" traffic. As the nature and type of Internet user diversifies, ISPs seek to offer different service tiers with different prices on the basis of user requirements and intensity of need, e.g., premium rates for "power" users needing high bandwidth and timely delivery of packets.

Although no government or private forum comprehensively regulates the Internet, government and private operator decisions, primarily in North America and Europe, have had a substantial impact on the Internet's development and governance.[8] The United States government helped create the Internet through research and development support and by serving as an "anchor tenant." The decision to abandon public financing of the major US backbone network in 1995 created the opportunity for former government contractors to become Tier-1 ISP operators of the major backbone networks providing transcontinental and transoceanic links. For the most part largely unregulated private parties have the power to make sweeping decisions affecting the terms and conditions for network access. However, privatization also created an environment where absent market power, possessed individually or collectively, competition and consumer sovereignty predominate.

The industrial structure of the Internet has tracked four phases:

1. government administration, first through the United States Defense Department and later through the United States National Science Foundation and universities and research institutes throughout the world (1980s-1995);
2. privatization of government financed networks and the ascendancy of its contractors and other major local and interexchange carriers (1995-1998);
3. dotcom boom triggering irrational, excessive investment and overcapacity (1998-2001);
4. dotcom bust, market re-entrenchment and resumed growth (2001-present).

Phase 1: Active Government Stewardship

Until 1995, the United States government, through the Defense Department and later the National Science Foundation (NSF), underwrote development and maintenance of the core Internet backbone (NSFnet). National governments in other parts of the world pursued similar network projects. After incubating the Internet as a medium for traffic associated with research and education, NSF concluded that it could abandon its public financing and a commercial, privatized Internet could evolve.

NSF's 1993 public solicitation document anticipated a privatized Internet with a structure much like what we have today: a hierarchy of many small ISPs serving localities and regions, fewer inter-regional, Tier-2 ISPs and even fewer Tier-1 ISPs serving entire nations with the highest capacity backbone networks. At the outset of Internet development government contractors engineered national networks accessible primarily by government, academic and research users. With few operators, generally having the same characteristics in terms of user population, bandwidth, traffic switching capabilities, network management staffing and geographical reach, the parties could agree to simple interconnection and access arrangements. The intelligence behind Internet network routing sought to achieve efficiency and the ability to route around outages and congestion. As all the ISPs in this phase had roughly the same characteristics and traffic volumes, their routing assignments generated approximately the same financial burdens.

Internet access in this first phase sought primarily to achieve better geographical reach and more users with little regard to the cost of access and who caused an ISP to incur such costs. This promotional phase emphasized the accrual of positive networking exter-

[8] For background on the history of Internet development cf. Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel, Larry G. Roberts, Stephen Wolff: Internet Society, A Brief History of the Internet, 2003, available at: http://www.isoc.org/internet/history/brief.shtml; cf. also William B. Norton: The Evolution of the U.S. Internet Peering Ecosystem, Draft 1.1, Nov. 19, 2003, available at: http://www.equinix.com/pdf/whitepapers/PeeringEcosystem.pdf.

nalities[9] so much so that the parties did not seek to monitor traffic flows. Because few ISPs existed, each having the same characteristics and operating with government funding, the parties saw little benefit and significant cost in negotiating interconnection agreements and metering traffic.

In this first promotional phase all participating ISPs agreed to network "peering" meaning that they would provide reciprocal access to each other's subscribers in a free exchange of traffic that would take place at a few shared, "public" Network Access Points (NAPs).[10] The few ISPs operating at this time agreed to receive traffic from the other ISPs for onward delivery to the final intended destination or to another ISP in exchange for the same traffic acceptance and delivery commitment from the other ISPs. This interconnection commitment triggered no exchange of funds based on the "rough justice" expectation that an ISP would deliver roughly the same amount of traffic generated by other ISPs that it handed off for delivery by those ISPs. In the vernacular of telecommunications carriers this arrangement constituted a "bill and keep" and "sender keep all" arrangement, because each ISP retained all revenues it generated from traffic carriage regardless of whether it solely provided the transmission, or whether it handed off the traffic for carriage by other ISPs.

[9] A positive network externality exists when the cost incurred by a user of the Internet does not fully reflect the benefit derived with the addition of new users and points of communications. Cf. John Farrell, Garth Saloner: Standardization, Compatibility and Innovation, in: RAND Journal of Economics, Vol. 16, 1985, pp. 70 ff.; Michael L. Katz, Carl Shapiro: Network Externalities, Competition and Compatibility, in: American Economic Review, Vol. 75, 1985, pp. 424 ff.; cf. also Mark A. Lemley, David McGowan: Legal Implications of Network Economic Effects, in: California Law Review, Vol. 86, 1998, pp. 479 ff.

[10] For helpful background on how peering developed cf. Scott Marcus: Global Traffic Exchange among Internet Service Providers, OECD Briefing, 2001, available at: http://www.oecd.org/dataoecd/45/9/1894955.pdf; Geoff Huston: Interconnection Peering and Settlements, INET'99 presentation, available at: http://www.isoc.org/inet99/proceedings/1e/1e_1.htm; William B. Norton: Interconnection Strategies for ISPs, Document v.2.0, available at: http://pharos.equinix.com/pdf/whitepapers/ISPInterconnectionStrategies2.pdf; The Evolution of the U.S. Internet Peering Ecosystem, Draft 1.1, available at: http://pharos.equinix.com/pdf/whitepapers/PeeringEcosystem.pdf; A Business Case for ISP Peering, Draft 1.3, available at: http://pharos.equinix.com/pdf/whitepapers/Business_case.pdf; Bill Woodcock: White Paper on Transactions and Valuation Associated with Inter-Carrier Routing of Internet Protocol Traffic or BGP for Bankers, Version 0.2, available at: http://www.pch.net/resources/papers/bgp-for-bankers/BGP-for-Bankers-v02.doc; Daniel C.H. Mah: Explaining Internet Connectivity: Voluntary Interconnection Among Commercial Internet Service Providers, March 26, 2003, available at: http://tprc.org/papers/2003/181/Explaining_Internet_Connectivity_Mar26-03.DOC.pdf; Steve Gibbard: Economics of Peering, Oct. 2004, available at: http://www.pch.net/resources/papers/Gibbard-peering-economics.pdf; cf. also Network Startup Resource Network: Routing, BGP and IXP Resources, available at: http://www.nsrc.org/route-bgp-ixp.html; The North American Network Operators' Group: Peering Links, available at: http://www.nanog.org/subjects.html#P.

"In **a bill-and-keep or sender-keeps-all** arrangement, each carrier bills its own customers for the origination of traffic and does not pay the other carrier for terminating this traffic. In a settlement arrangement, on the other hand, the carrier on which the traffic originates pays the other carrier to terminate the traffic. If traffic flow between the two networks is balanced, the net settlement that each pays is zero, and therefore a bill-and-keep arrangement may be preferred because the networks do not have to incur costs to measure and track traffic or to develop billing systems. As an example, the Telecommunications Act of 1996 allows for incumbent local exchange carriers to exchange traffic with competitors using a bill-and-keep arrangement."[1]

[1] Michael Kende: The Digital Handshake: Connecting Internet Backbones, in: CommLaw Conspectus: Journal of Communications Law and Policy, Vol. 111, 2003, No. 60, pp. 45 ff. (citing 47 U.S.C. §252 (d)(2)(B)(i) (2000)). "The sharing of traffic over the interconnected networks forming the Internet on a statistical and un-metered 'settlements' (or 'bill & keep') basis was a hallmark of early federal agency involvement in the development of the Internet. This system of traffic carriage free of charge became known as 'peering.'" Barbara Esbin: Internet Over Cable: Defining the Future in Terms of the Past, F.C.C., O.P.P. Working Paper No. 30, 1998, available at 1998 WL 567433.

Phase 2: Privatization Creates a Hierarchy of Operators

NSF's glide path to privatization largely succeeded with former contractors achieving supremacy in both the ownership and operation of backbone networks and NAPs. MCI won the solicitation to take over the very high speed backbone network that previously had served NSF-sponsored research institutions including Cornell University, supercomputer centers in Pittsburgh and San Diego and several government facilities. MCI upgraded its Asynchronous Transfer Mode network from OC-3 (155 megabits per second) to OC-12 (622 megabits per second).

The NSF privatization solicitation also created four private NAPs in Chicago, operated by the Ameritech Bell Operating Company and Bellcore, the former research arm of AT&T spun-off to the divested Bell Operating Companies, metropolitan New York/Philadelphia , operated by Sprint and the San Diego Supercomputer Center and San Francisco, operated by the Bell Operating Company Pacific Telesis and BellCore, and Washington, DC, operated by Metropolitan Fiber Systems, a networking firm subsequently acquired by MCI.

With the privatization of the Internet, a hierarchical industrial structure developed. At the top of the pyramid stood a handful of Tier-1 ISPs whose network size, customer base and operational success qualified them for the direct and cost-free exchange of traffic. While peering used to predominate as the primary mode of the NSF network interconnection, the commercialization of the Internet created opportunities for market entry by more ISPs and new incentives for all ISPs to charge what the market would bear for network access. The composition of ISPs diversified in terms of available bandwidth, geographical reach, subscribership, types of available content, etc.

In light of this diversification and proliferation of ISPs, universal peering became unsustainable. ISPs not having sufficient size and importance became customers of network access provided by the Tier-1 and other ISPs. This meant that the smaller ISPs have to pay the larger Tier-1 ISPs for the privilege of accessing the Tier-1 ISPs' customers and network connections. The term transit — also borrowed from the telecommunications vernacular — refers to a negotiated business relationship whereby one ISP sells access to its customers, its network and its access to other ISP networks it has negotiated.

Most industry observers would agree that the Phase 2 Tier-1 ISP list included MCI, AT&T, Sprint, Qwest and GTE in the United States and the major national telecommunications carriers, such as British Telecom, Deutsche Telekom, KPN and France Telecom in Europe. However, even before the dotcom boom, mergers and acquisitions changed the Tier-1 ISP list. For example, Cable & Wireless purchased portions of the MCI Internet infrastructure while the merged MCI-Worldcom company maintained a major Internet presence through UUNet. Verizon merged with GTE whose ISP venture had become known as Genuity.

Clearly no ISP beneficiary of cost-free peering appreciated the demoted status of having to pay for access as a customer and reseller. Yet this demotion appeared to occur on the basis of sound business judgment made by individual Tier-1 ISPs and not on the basis of collusion or concerted refusals to deal. ISPs in Asia-Pacific and Africa have borne the greatest financial burden in having to self-provision lines to and from NAPs in North America and Europe as well as the obligation to pay for transit. However, smaller ISPs everywhere bear a similar, albeit less expensive burden as well. ISPs in North America incur less telecommunications expense in reaching a Tier-1 ISPs NAP, or Point of Presence, in light of the proliferation of such facilities and their close proximity to most ISPs. ISPs located in more remote areas have to secure at their expense the complete link to Tier-1 ISP facilities, even though once installed these two-way links provided Tier-1 ISPs with a cost-free pathway to the smaller remotely located ISP and its subscribers.

ISPs in remotely located regions objected to having to provide typically well financed Tier-1 ISPs a "free ride" for the delivery of traffic from the Tier-1 ISPs. Certainly from a telecommunications service orientation it appeared that the remotely located ISP underwrote the full cost of "return" traffic in light of the bi-directional nature of telecommunications links instead of having to pay half of such cost. However, in the context of Internet service the free ride attribution breaks down. First, the Internet seamlessly combines telecommunications bit transport with access to content. Particularly at the time of Phase Two in the Internet's development, ISP subscribers could access most of the content available via the Internet for nothing more than the cost of their ISP subscription. Put another way when an ISP pays another larger ISP for transit services, the smaller ISP acquires access to the larger ISP's subscribers and the content available from these customers as well as the customers of other ISPs with which the larger ISP peers or pays for transit. Smaller ISPs had to pay for access to and from larger ISPs in North America and Europe, but the smaller ISPs could then deliver content that their subscribers sought. Much of the most desired content resided on servers located in North America and Europe meaning that remote ISPs had to secure access to be able to deliver the content their subscribers expected to access.

Internet transit access arrangements also do not match the limited geographical scope of telecommunications transit arrangements. In telecommunications service, transit arrangements typically secure an indirect link to one carrier in one location, primarily because a small carrier might not have sufficient traffic volume to secure a direct link. In Internet service, transit arrangements typically provide access to a vast array of networks certainly not limited to one country. In its most expansive role one Internet transit payment arrangement with one major Tier-1 ISP can provide a small, remote ISP with access to the Rest of the World, because the Tier-1 ISP has secured ubiquitous access and therefore can offer (advertise in the Internet vernacular) an extensive list of routing opportunities.

Phase 3: The Dotcom Boom Stimulates Several Hundred Billion Dollars in Internet Infrastructure

The "irrational exuberance" of the dotcom bubble stimulated a gold rush mentality among investors. Undocumented and belatedly refuted claims that the Internet doubled in size on a monthly basis encouraged risk taking based on the assumption that a rising tide would raise all ships, i.e., that anyone investing at the onset of the Information Revolution would reap ample returns. Investors sank several hundred billion dollars in incumbent and new telecommunications and ISP networks such as Global Crossing, Asia Global Crossing, Level Three, Agis, PSInet, 360 Networks, Flag, Verio, Savvis, COLT, Cogent Communications, Interroute, Kingston Communications, Tiscali International Network, etc.

The resulting glut in local and long haul transmission capacity had the impact of creating substantial downward pressure on Internet transport cost and precluding any pricing discipline by Tier-1 ISPs individually or even collectively had they attempted to collude. Similarly, even before the dotcom implosion, several Tier-1 ISPs, e.g., Genuity, experienced financial distress, even as the infusion of investment helped create more aspiring Tier-1 and Tier-2 operators through acquisitions, e.g., NTT's acquisition of Verio, and greater opportunities for smaller ISPs and individual consumers to choose among hungry, possibly desperate, competitors.

Phase 4: Retrenchment and a Proliferation of Interconnection Options

The dotcom bubble continues to have an impact largely because the vast investment in transmission capacity still imposes a price ceiling until such time as demand matches capacity. While the downward trajectory of Internet transmission capacity costs has leveled off, anecdotal information proves that the burden of transit payment obligations constitutes a minor element relative to the overall cost of doing business.[11]

Even as telecommunications costs drop as a percentage of the total cost of doing business, ISPs continue to explore ways to reduce this expense, because new types of traffic trigger the need for more bandwidth. Peer-to-peer sharing of music and video files makes up a significant percentage of the growth in traffic volumes despite efforts to reduce copyright piracy. The growth in broadband access from residences and small businesses also contributes to a renewed upswing in bandwidth requirements. Likewise the growth in electronic commerce, streaming audio and video services and wireless access to the Internet all contribute to increased bandwidth requirements.

The ongoing need to upgrade infrastructure to handle increasingly bandwidth intensive applications creates a powerful financial incentive for ISPs to change the terms and conditions for service. Many ISPs initially offered an "all you can eat" unmetered service plan based on the correct perception that all but early adopters would need financial inducements to "test drive" the Internet. Now that the Internet marketplace has evolved, many ISPs see unmetered service as conferring an unnecessary windfall on high volume users to the detriment of the carrier and low volume users. ISPs perceive network neutrality initiatives as foreclosing pricing flexibility.

Wireless Network Neutrality

The network neutrality debate has focused almost exclusively on Internet access via wireline carriers. Recently the issue of wireless Internet access has surfaced in light of the growing importance of wireless services and consumer frustration with carrier tactics that disable handset functions and block access to competing services.[12] While wireless handsets generally can access Internet services, most carriers attempt to favor content they provide or secure from third parties under what critics deem a "walled garden" strategy: deliberate efforts to lock consumers into accessing and paying for favored content and services.

Just about every nation in the world has established policies that mandate the right of consumers to own their own telephone and to use any device to access any carrier, service or function provided it does not cause technical harm to the telecommunications network. Once regulators unbundled telecommunications service from devices that access network services, a robustly competitive market evolved for both devices and services. Remarkably, wireless carriers in many nations, including the United States, have managed to avoid having to comply with this open network concept. Even though consumers own their wireless handset, the carrier providing service will operate only with specific types of handsets programmed only to work with one carrier's network. Carriers justify this lock in and high fees for early termination of service because the carriers sell wireless handsets at subsi-

[11] "As a consequence of these changes, the share of costs for international connectivity for Australian ISPs has fallen from around 70% to about 10%." John Hibbard, John de Ridder, George R. Barker, Rob Frieden: International Internet Connectivity and its Impact on Australia, Final Report on an Investigation for the Department of Communication, Information Technology and the Arts, p. 4, Canberra, Australia, May 31, 2004, available at: http://www.dcita.gov.au/__data/assets/word_doc/16616/IIC_report_-_web_version.doc; cf. also Australian Competition Commission: Internet Interconnection Service, April 2003, available at: http://www.accc.gov.au/content/item.phtml?itemId=481925&nodeId=file40315c15de753&fn=Internet%20Interconnection.pdf.

[12] Cf. Tim Wu: Wireless Net Neutrality: Cellular Carterfone and Consumer Choice in Mobile Broadband, New America Foundation, Wireless Future Program, Working Paper No. 17, Feb. 2007, available at: http://www.newamerica.net/publications/policy/wireless_net_neutrality; Robert W. Hahn, Robert E. Litan, Hal J. Singer: The Economics of "Wireless Net Neutrality", AEI-Brookings Joint Center for Regulatory Studies, Related Publication 07-10, April 2007, available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=983111; and http://jcle.oxfordjournals.org/cgi/reprint/nhm015v1.pdf.

dized rates—sometimes “free”—based on a two year subscription term. Of course the value of a two year lock in period offsets the handset subsidy, particularly in light of next generation wireless networks that will offer many services in addition to voice communications. In the United States wireless carriers sell more than 60% of all wireless handsets, typically when a subscriber commences service or renews a subscription. No market for used handsets has evolved, because wireless carriers do not offer lower service rates for subscribers who bring their own phone, even though these subscribers do not tap into a handset subsidy.

Wireless network neutrality would require carriers to stop blocking the use of non-carrier affiliated handsets and locking handsets so that they only work on a single carrier network. More broadly wireless network neutrality would prohibit wireless carriers from preventing subscribers' access to the content, services, and software applications of their choosing. It also would require carriers to support an open interface so that handset manufacturers and content providers can develop equipment and services that do not have any potential for harming wireless carrier networks.

Opponents of wireless network neutrality consider the initiative unnecessary government intrusion in a robustly competitive marketplace. They claim that imposing such requirements would risk causing technical harm to wireless networks and generate such regulatory uncertainty that the carriers might refrain from investing in next generation network enhancements. Opponents claim that separating equipment from service constituted an appropriate remedy when a single wireline carrier dominated, but that such compulsory unbundling should not occur when consumers have a variety of carrier options.

Reasons Why ISPs Oppose Network Neutrality

ISPs oppose network neutrality for a number of theoretical and practical grounds. Fundamentally ISPs oppose network neutrality because it would impose or threaten to impose government regulation, or at least legitimize a role for governments to establish and enforce rules.

Most ISP managers favor hands off, laissez faire governance, coupled with the view that ISPs operate in a competitive marketplace that can self regulate. More practically ISPs fear that actual or potential involvement and intervention by government would foreclose or at least condition operational flexibility.

In most nations ISPs operate largely free of conventional telecommunications service regulation, based on the premise that they provide value-added, enhancements to telecommunication links. In the United States, ISPs qualify for an information service[13] “safe harbor” from the traditional, common carrier regulation under Title II[14] of the Communications Act, as amended.[15] Additionally US ISPs qualify for a status that exempts them from liability for carrying tortious or harmful content, in light of the actual or perceived burden such content scrutiny would impose.[16]

ISPs generally operate as private carriers often lacking legal responsibility for the content they carry. Governments granted such freedom to promote robust development of the Internet and to remove concerns for liability should subscribers use their Internet access for nefarious and illegal purposes. At the time of such grants ISPs lacked the technological wherewithal to examine the content they transmitted. Now ISPs have far greater ability to meter and examine Internet traffic. They want to exploit technological opportunities to “sniff” traffic packets and to prioritize them based on payments received, but they do not want to relinquish their exemption from regulation and liability for carrying harmful content.[17]

ISPs also want to expand their ability to diversify services and to engage in price discrimination based on the quality of service they provide end users and content providers. Network neutrality, whether imposed by law or rules established by National Regulatory Authorities, would likely impose restrictions on ISP pricing and diversification of services based on such factors as reliability, allocated bandwidth, performance during network congestion, ability to handle spikes in demand and quality of service. Some service differentiation already exists as ISPs offer their cus-

[13] Information service is defined as “the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service.” 47 U.S.C. § 153(20). “[T]he language and legislative history of [the Communications Act of 1996] indicate that the drafters . . . regarded telecommunications services and information services as mutually exclusive categories.” Federal-State Joint Board on Universal Service, Report to Congress, 13 FCC Rcd. 11501, 11522 (1998); cf. also Vonage Holdings Corp., 290 F. Supp.2d at 994, 1000 (applying the FCC's dichotomy).

[14] 47 U.S.C. §201 et seq.

[15] Common carriers, including providers of basic telecommunications services, must offer service on a nondiscriminatory basis, subject to numerous entry regulations, tariffing, and operating requirements.

[16] Section 509(c)(1) of the Communications Decency Act, codified at, 47 U.S.C. § 230(c)(1), states that “No provider or user of an interactive computer service shall be treated as the publisher or speaker of any information provided by another information content provider.”

[17] Cf. Rob Frieden: Internet Packet Sniffing and Its Impact on the Network Neutrality Debate and the Balance of Power Between Intellectual Property Creators and Consumers, Fordham Intellectual Property, Media & Entertainment Law Journal, (publication pending).

"A packet sniffer (also known as a network analyzer or protocol analyzer or, for particular types of networks, an Ethernet sniffer or wireless sniffer) is computer software or computer hardware that can intercept and log traffic passing over a digital network or part of a network. As data streams travel back and forth over the network, the sniffer captures each packet and eventually decodes and analyzes its content according to the appropriate RFC or other specifications."[1]

"Cisco® Service Control technology offers service providers the ability to classify application traffic and identify subscribers while prioritizing and optimizing network resources. Using stateful deep packet inspection, operators can optimize traffic on their networks, thereby increasing efficient use of network resources, reducing costs, and maximizing capital investment. State-of-the-art bandwidth management can be applied to network traffic on a global, subscriber, or individual flow-level hierarchy, helping ensure that operators can better manage network resource distribution."[2]

[1] Wikipedia: Packet sniffer; available at: http://en.wikipedia.org/wiki/Packet_sniffer.

[2] Cisco: Optimizing Application Traffic With Cisco Service Control Technology, Solution Overview, available at: http://www.cisco.com/en/US/products/ps6150/prod_brochure0900aecd80241955.html.

tomers different subscription rates based on bandwidth and bitrates. Additional differentiation could involve variable service quality, based on the ability to handle peak demand bursts as occurs in peer-to-peer networking, video gaming, delivery of large files and real time streaming of video programming. The ability to inspect traffic streams would make it possible for ISPs to identify priority traffic and to provide superior and preferential processing for a premium price. Most network neutrality advocates do not oppose such tiering of customers based on clearly established service differentials that parallel tiering in commercial aviation, e.g., different classes of service, and on some roadways, e.g., toll versus free lanes.

ISPs also want the ability to price discriminate upstream from end users into the Internet cloud all the way to sources of content. Such "access tiering" would offer different options for service providers, a more controversial matter, because ISPs might use network management tools to degrade standard traffic delivery even when conditions do not necessitate it to facilitate timely delivery of premium traffic. It makes perfect sense to former AT&T Chairman Ed Whitacre and other ISP executives to expect payment from all content providers every time their traffic traverses an ISP network.[18] However, unlike telephone companies which typically meter traffic and secure payment based on usage, ISPs typically do not meter traffic opting instead to negotiate peering agreements[19] that establish a reciprocal traffic carriage agreement without payment. In a peering agreement AT&T secures the lawful right to have its traffic carried free of charge by other carriers in exchange for agreeing to provide similar free access. ISPs benefit from the streamlined and uncomplicated aspects of peering agreements, but these carriers also want the opportunity to single out large volume users of their networks, e.g., Google, and attempt to extract additional direct payments despite having agreed to carry such traffic as part of their peering agreements.

The Need for Network Neutrality Rules

Little middle ground exists between net neutrality advocates and opponents, but practically speaking the Internet will continue to deviate from a one size fits all network. Accordingly one should consider net neutrality in terms of a dichotomy between types of discrimination that make economic sense and will not harm consumers and those that constitute unfair trade practices and other types of anticompetitive practices.

Opponents of network neutrality correctly state that external, non-market driven constraints on their ability to price discriminate can adversely impact their incentive to invest in broadband infrastructure and their ability to recoup that investment. ISPs have avoided common carrier responsibilities and the Internet largely functions as a product of countless interconnection arrangements flexibly negotiated and executed free of government oversight. ISPs correctly note that only in rare instances has an interconnection dispute triggered allegations of anticompetitive practices, or resulted in consumers losing access to a content source or email addressee as a result of network inaccessibility or balkanization.

[18] "Now what they would like to do is use my pipes free, but I ain't going to let them do that because we have spent this capital and we have to have a return on it. So there's going to have to be some mechanism for these people who use these pipes to pay for the portion they're using. Why should they be allowed to use my pipes? The Internet can't be free in that sense, because we and the cable companies have made an investment and for a Google or Yahoo! or Vonage or anybody to expect to use these pipes [for] free is nuts!" At SBC, It's All About "Scale and Scope," Businessweek, online extra, November 7, 2005, available at: http://www.businessweek.com/@@n34h*IUQu7KtOwgA/magazine/content/05_45/b3958092.htm.

[19] For background on the economics and logistics of peering, cf. Geoff Huston: Where's the Money? – Internet Interconnection and Financial Settlements, Jan. 2005, available at: http://www.potaroo.net/ispcol/2005-01/; Steve Gibbard: Economics of Peering, Oct. 2004, available at: http://www.pch.net/resources/papers/Gibbard-peering-economics.pdf; Daniel C.H. Mah: Explaining Internet Connectivity: Voluntary Interconnection Among Commercial Internet Service Providers, March 26, 2003, available at: http://tprc.org/papers/2003/181/Explaining_Internet_Connectivity_Mar26-03.DOC.pdf; William B. Norton: A Business Case for ISP Peering, Draft 1.3, Feb. 19, 2002, available at: http://www.equinix.com/pdf/whitepapers/Business_case.pdf; Jean-Jacques Laffont, Scott Marcus, Patrick Rey, Jean Tirole: Interconnection and Access in Telecom and the Internet, in: American Economic Review, Vol. 91, May 2001, No. 2, pp. 287-291; Bill Woodcock: White Paper on Transactions and Valuation Associated with Inter-Carrier Routing of Internet Protocol Traffic, or BGP for Bankers, Aug. 2000, available at: http://www.pch.net/resources/papers/routing-economics/pch-routing-economics.htm.

On the other hand, network neutrality advocates have identified actual instances where ISPs unilaterally have blocked traffic, to reduce subscribers' network demand, handicap a competitor, punish ventures for not agreeing to pay a surcharge and to stifle criticism about the ISP and its parent corporation.[20] Even if one were to dismiss such evidence as anecdotal or exceptional, it appears that an ISP's ability to discriminate in the switching and routing of bits matches or exceeds the ease with which employees of electric generating companies were able to create artificial congestion and false bottlenecks and thereby accrue exorbitant profits. Employees of Enron and other electric utilities engaged in a number of anticompetitive practices that caused the spot market price for electricity to skyrocket based on tactics designed to mimic a dramatic increase in demand that the electricity distribution grid could not handle.[21] If Enron employees could manipulate the market for the switching and routing of electrons, then ISP employees might engage in similar tactics when switching and routing packets. Policymakers should consider seriously the potential for harm to consumers and content providers when ISPs deviate from network neutrality.

Permissible and Impermissible Discrimination

Many types of diversification in the pricing and provisioning of Internet-mediated services make economic sense and do not violate a reasonable expectation of network neutrality. ISPs should have the conditional option of providing both end users and content providers with "better than best efforts" routing. Just as airlines offer first, business, and economy seating and car drivers have free and toll highway options, Internet consumers should have access to different Internet experiences based on bandwidth, monthly allocation of throughput and traffic prioritization during instances where real network congestion exists. ISPs should have the option of metering service, instead of offering monthly unlimited use plans that force light users to subsidize heavy users. Likewise, ISPs can opt to partition network capacity so that priority users have access to links less likely to suffer from congestion.

On the other hand both content providers and consumers have a legitimate expectation that they should not experience dropped packets and degradation in service simply for having declined to pay for a superior service tier. ISPs should not have the option to trigger delays and lost packets even in the absence of congestion. Regulators should devise network reporting requirements that require ISPs to identify the number and cause of instances where the public Internet so suffered congestion that an ISP had to drop packets and degrade service. An ISP should not partition its network in such a way as to all but guarantee that non-priority bitstreams experience lost packets and degradation of service quality even when it is possible for the ISP to avoid dropping any packets. False congestion[22] to punish, discipline or competitively outmaneuver competitors or customers refusing to pay newly imposed surcharges, appears the same as the manufacture of congestion by energy traders employed by Enron keen on artificially raising prices.

> "So Enron was also responsible for some of California's power crisis! What was then a profoundly corrupt enterprise manipulated the Golden State's power market to help create artificial shortages that would jack up prices. A particularly repellent example of this enterprise was Enron's so-called Death Star strategy, which, as a company memo put it, let Enron be paid 'for moving energy to relieve congestion without actually moving any energy or relieving any congestion.' In one case, Enron bought power in California at a capped price of $250 a megawatt hour and resold it in Oregon for $2,500. The company also "laundered" electricity to avoid federal price caps."[1]
>
> [1] Providence Journal-Bulletin, May 22, 2002, (retrieved from Lexis-Nexis Academic Universe).

Rather than threaten lawful or unlawful retaliation through delayed, degraded and dropped packets, incumbent carriers should market a superior Internet experience for high volume content generators and their customers. ISPs should offer such premium options on a fully transparent basis by disclosing all service options and by offering them to any subscriber.

Conclusions and Recommendations

Technological innovations and the convergence of services available via the Internet create the ability and incentive for ISPs to diversify services. ISPs now can examine bitstreams and prioritize traffic, a capability that can accommodate subscribers' mission critical requirements just as it can degrade service to plain vanilla subscribers even in the absence of real network congestion. Regulators need to refrain from impos-

[20] Cf., e.g., Associated Press: Comcast Admits Delaying Some Traffic, Oct. 23, 2007, available at: http://www.nytimes.com/aponline/technology/AP-Comcast-Data-Discrimination.html?_r=1&oref=slogin.

[21] "[I]n Load Shift, Enron traders submitted false energy schedules and bids to the California market to create the appearance of congestion on a transmission line. This would trigger payments attached to easing congestion and let Enron profit from its own lies when it used its transmission rights to ease the sham congestion." Mary Flood, Tom Fowler: The Fall of Enron: Ex-Trader Pleads Guilty To Schemes; Prison, Fines Likely In California Deals, The Houston Chronicle, Business, Feb. 5, 2003, p.1.

[22] ISPs surely should have the option of offering a premium peak service that would offer higher likelihood of undropped packets and timely delivery even under truly congested conditions. Cf. Christopher S. Yoo: Network Neutrality and the Economics of Congestion, Vanderbilt University Law School Law and Economics Working Paper 05-28, 2005, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=825669.

ing public interest "safeguards" that restrict legitimate quality of service diversification. However, these very same regulators need to remain vigilant against Enron-style tactics that create false congestion as the justification for degrading service to subscribers and content providers unwilling to pay for premium services. ISPs should operate in a more transparent environment where they have to disclose all premium service options and report all instances where congestion forced them to drop packets and degrade service.

The network neutrality debate highlights a particularly contentious time in ICE policy making. Stakeholders appear to have little inclination to find a middle ground, and decision makers appear to have even less. Policy making has become predominated by sponsored research, politics, campaign contributions and rhetoric. In light of an apparent disinterest for the facts it comes as no surprise that the network neutrality debate highlights opposing perceptions about the impact from changes in the next generation Internet. Regrettably no unbiased fact finding appears readily available, because the issue has triggered intense lobbying and the use of hyperbole.

Network neutrality opponents have overstated the case that competition would remedy any and all instances of illegal network bias. A fully self-regulating Internet marketplace does not exist, nor can one confidently assert that the Internet marketplace would remedy all attempts at unreasonable network bias. On the other hand the Internet has not failed to function when network operators and content providers cut exclusive and preferential deals, or when network providers offer better than best efforts routing.

For better or worse the next generation Internet will adopt many of the biased networking characteristics of current vintage cable television and third generation cellular telephony. Cable and satellite television operators enjoy substantial freedom to cut special content delivery deals, but lawful "must carry" obligations impose affirmative carriage duties, notwithstanding cable operators' non-common carrier status. Commercial mobile radio service providers retain the common carrier, telecommunications service provider status, yet they can use new broadband carriage capabilities to deliver a biased, walled garden access to video and Internet content.

Regulators should agree to examine allegations of network bias and to evaluate the complaint from a public interest template that considers whether discrimination constitutes an unfair trade practice, or a reasonable attempt at diversifying and proliferating information services.