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# THE DIGITAL HANDSHAKE: CONNECTING INTERNET BACKBONES

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## I. INTRODUCTION

The Internet is not a monolithic, uniform network; rather, it is a network of networks, owned and operated by different companies, including Internet backbone providers. Internet backbones deliver data traffic to and from their customers; often this traffic comes from, or travels to, customers of another backbone. Currently, there are no domestic or international industry-specific regulations that govern how Internet backbone providers interconnect to exchange traffic, unlike other network services, such as long distance voice services, for which interconnection is regulated.<sup>1</sup> Rather, Internet backbone providers adopt and pursue their own interconnection policies, governed only by ordinary laws of contract and property, overseen by antitrust rules. This paper examines the interconnection policies between Internet backbone providers that have evolved in place of industry-specific regulations in order to examine the impact of these policies on the markets for Internet services.

In order to provide end users with universal connectivity, Internet backbones must interconnect with one another to exchange traffic destined for each others' end users. Interconnection agreements between Internet backbone providers are reached through commercial negotiations in

a "handshake" environment. Internet backbones interconnect under two different arrangements: peering or transit. In a peering arrangement, backbones agree to exchange traffic with each other at no cost. The backbones only exchange traffic that is destined for each other's end users, not the end users of a third party. In a transit arrangement, on the other hand, one backbone pays another backbone for interconnection. In exchange for this payment, the transit supplier provides a connection to all end users on the Internet.

The interconnection policies that have evolved in place of industry-specific regulations are examined here in order to determine the impact of these policies on the markets for Internet services. In the past several years, a number of parties have questioned whether larger backbone providers are able to gain or exploit market power through the terms of interconnection that they offer to smaller existing and new backbone providers. In the future, backbones may attempt to differentiate themselves by offering certain new services only to their own customers. As a result, the concern is that the Internet may "balkanize," with competing backbones not interconnecting to provide all services. This paper demonstrates how, in the absence of a dominant backbone, market

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author, and do not necessarily represent the views of the Analysys Consulting Limited, the FCC, the Chairman, any Commissioners or other FCC staff.

<sup>1</sup> For purposes of this paper, "industry-specific regulations" are defined to be rules, applied by an expert agency, that govern the behavior of companies in a particular industry. These regulations supplement the antitrust laws and ordinary common law rules that apply to all industries in the United States. In general, industry-specific regulations correct for market failures that antitrust laws and ordinary common law cannot resolve or prevent. In this paper, an "unregulated industry" is one that is not subject to any industry-specific regulations.

forces encourage interconnection between backbones and thereby protect consumers from any anti-competitive behavior on the part of backbone providers. While it is likely that market forces, in combination with antitrust and competition policies, can guarantee that no dominant backbone emerges, if a dominant backbone provider should emerge through unforeseen circumstances, regulation may be necessary, as it has been in other network industries such as telephony.

Section two of this paper examines the history of Internet interconnection and describes current interconnection policies between Internet backbones. Section three examines several current and potential pressures on the domestic system of interconnection, showing how backbones may attempt to differentiate themselves from their competitors in the future by not interconnecting at all to exchange traffic flowing from innovative new services. The conclusion, in Section four, shows how competition, governed by antitrust laws and competition enforcement that can prevent the emergence of a dominant firm, can act to restrain the actions of larger backbones in place of any industry-specific regulations, such as interconnection obligations.

## II. BACKGROUND

### A. Introduction

Interconnection arrangements enable each Internet user to communicate with every other Internet user.<sup>2</sup> For simplicity, this paper focuses on the interactions between four groups of Internet participants: end users, content providers, Internet service providers ("ISPs") and Internet backbone providers ("backbones"). Using the In-

ternet, end users communicate with each other, access information from content providers, such as the Wall Street Journal Interactive Edition,<sup>3</sup> and purchase products or services from e-commerce vendors, such as Amazon.com.<sup>4</sup> End users access the Internet via ISPs such as America Online ("AOL")<sup>5</sup> or EarthLink, Inc.<sup>6</sup> Small business and residential end users generally use modems to connect to their ISP over standard telephone lines, while larger businesses and content providers generally have dedicated access to their ISP over leased lines.<sup>7</sup> ISPs are generally connected to other ISPs through Internet backbone providers such as UUNET and PSINet.<sup>8</sup> Backbones own or lease national or international high-speed fiber optic networks that are connected by routers, which the backbones use to deliver traffic to and from their ISP customers.<sup>9</sup> Many backbones also are vertically integrated, functioning as ISPs by selling Internet access directly to end users, as well as having ISPs as customers.<sup>10</sup>

Each backbone provider essentially forms its own network that enables all its connected end users and content providers to communicate with one another.<sup>11</sup> End users, however, are generally not interested in communicating just with end users and content providers connected to the same backbone provider; rather, they want to be able to communicate with a wide variety of end users and content providers, regardless of the backbone provider.<sup>12</sup> In order to provide end users with such universal connectivity, backbones must interconnect with one another to exchange traffic destined for each others' end users.<sup>13</sup> Interconnection makes the Internet the "network of networks" that it is today. As a result of widespread interconnection, end users currently have

<sup>2</sup> For further discussion of the structure of the Internet, see FCC, OPP Working Paper, DIGITAL TORNADO: THE INTERNET AND TELECOMMUNICATIONS POLICY (authored by Kevin Werbach) 10-12 [hereinafter DIGITAL TORNADO]; see also JEAN-JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS 268-272 (2000); J. SCOTT MARCUS, DESIGNING WIDE AREA NETWORKS AND INTERNETWORKS: A PRACTICAL GUIDE 274-289 (1999) [hereinafter MARCUS].

<sup>3</sup> See Wall Street Journal Interactive Edition, at <http://public.wsj.com/home.html>.

<sup>4</sup> See Amazon.com, at <http://www.amazon.com>.

<sup>5</sup> See America Online, at <http://www.aol.com>.

<sup>6</sup> See EarthLink, Inc., at <http://www.earthlink.net>.

<sup>7</sup> A "leased line" is an access line rented for the exclusive use of the customer; with dedicated access to an ISP, the customer can be logged on to the Internet twenty-four hours a

day. New broadband access technologies, such as xDSL and cable modems, increasingly are replacing traditional dial-up modems, enabling residential and small business customers to receive the same high-speed, "always-on" access to the Internet enjoyed by dedicated access customers.

<sup>8</sup> See PRESTON GRALLA, HOW THE INTERNET WORKS 5-7 (Millennium ed. 1999).

<sup>9</sup> *Id.*

<sup>10</sup> INTERMEDIA COMMUNICATIONS, TO PEER OR NOT TO PEER: THE INTERMEDIA BUSINESS INTERNET PERSPECTIVE, at <http://www.intermedia.com/products/businessinternet/whitepapers/bis-peering.html> [hereinafter INTERMEDIA WHITE PAPER].

<sup>11</sup> *Id.*

<sup>12</sup> *Id.*

<sup>13</sup> *Id.*

an implicit expectation of universal connectivity whenever they log on to the Internet, regardless of which ISP they choose. ISPs are therefore in the business of selling access to the entire Internet to their end-user customers.<sup>14</sup> ISPs purchase this universal access from Internet backbones.<sup>15</sup> The driving force behind the need for backbones to deliver access to the whole Internet to customers is what is known in economics literature as *network externalities*.

## B. Network Externalities

Network externalities arise when the value, or utility, that a consumer derives from a product or service increases as a function of the number of other consumers of the same or compatible products or services.<sup>16</sup> They are called network externalities because they generally arise for networks whose purpose it is to enable each user to communicate with other users; as a result, by definition, the more users there are, the more valuable the network.<sup>17</sup> These benefits are externalities because a user, when deciding whether to join a network (or which network to join), only takes into account the private benefits that the network will bring her and will not consider the fact that her joining this network increases the benefit of the network for other users.<sup>18</sup>

Network externalities can be direct or indirect. Network externalities are direct for networks that consumers use to communicate with one another; the more consumers that use the network, the more valuable the network is for each consumer.<sup>19</sup> The phone system is a classic example of a system providing direct network externalities. The only benefit of such a system comes from access to the network of users. Network externalities

are indirect for systems that require both hardware and software in order to provide benefits.<sup>20</sup> As more consumers buy hardware, more hardware-compatible software will be produced, making this hardware more valuable to users.<sup>21</sup> A classic example is the compact disc system; as more consumers purchased compact disc players, music companies increased the variety of compact discs available, making the players more valuable to their owners.<sup>22</sup> These network externalities are indirect because consumers do not purchase the systems to communicate directly with others, yet they benefit indirectly from the adoption decision of other consumers.

One unique characteristic of the Internet is that it offers both direct and indirect network externalities. Users of applications such as e-mail and Internet telephony derive direct network externalities from the system: the more Internet users there are, the more valuable the Internet is for such communications. Users of applications such as the World Wide Web derive indirect network externalities from the system: the more Internet users there are, the more Web content will be developed, which makes the Internet even more valuable for its users. The ability to provide direct and indirect network externalities to customers provides an almost overpowering incentive for Internet backbones to cooperate with one another by interconnecting their networks.

## C. Peering and Transit

During the early development of the Internet, there was only one backbone, and, therefore, interconnection between backbones was not an issue.<sup>23</sup> In 1986, the National Science Foundation ("NSF") funded the NSFNET, a 56-kilobit per sec-

<sup>14</sup> *Id.*

<sup>15</sup> See FCC, OPP, THE FCC AND THE UNREGULATION OF THE INTERNET (authored by Jason Oxman) (1999) [hereinafter Oxman] (discussing generally the deregulation trend of the Internet).

<sup>16</sup> See generally Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSP. 93 (1994); Nicholas Economides, *The Economics of Networks*, 14 INT'L J. INDUS. ORG. 673 (1996) [hereinafter Economides].

<sup>17</sup> Metcalfe's law, which states that the value of a network grows in proportion to the square of the number of users of the network, is a specific expression of network externalities. See HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 447-48 (14th ed. 1998) [hereinafter NEWTON]; see also, Economides, *supra* note 16.

<sup>18</sup> Oxman, *supra* note 15, at 13.

<sup>19</sup> See generally Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV., 424 (1985) [hereinafter Katz & Shapiro].

<sup>20</sup> See generally Jeffrey Church & Neil Gandal, *Network Effects, Software Provision, and Standardization*, 40 J. INDUS. ECON. 85 (1992).

<sup>21</sup> See Oz SHY, INDUSTRIAL ORGANIZATION: THEORY AND APPLICATIONS 254 (1996).

<sup>22</sup> For an empirical description of the interplay between compact disc hardware sales and the availability of compact discs, see Neil Gandal, Michael Kende, & Rafael Rob, *The Dynamics of Technological Adoption in Hardware/Software Systems: The Case of Compact Disc Players*, 31 RAND J. ECON. 43 (2000).

<sup>23</sup> See DIGITAL TORNADO, *supra* note 2, at 13-16 (giving a brief history of the Internet); see also Robert H'obbes' Zakon, *Hobbes' Internet Timeline v4.1*, at <http://www.isoc.org/guest/>

ond (“Kbps”) network created to enable long-distance access to five supercomputer centers across the country.<sup>24</sup> In 1987, a partnership of Merit Network, Inc., IBM and MCI began to manage the NSFNET, which became a T-1 network<sup>25</sup> connecting thirteen sites in 1988.<sup>26</sup> The issue of interconnection arose only when a number of commercial backbones came into being and eventually supplanted the NSFNET.<sup>27</sup>

At the time that commercial networks began appearing, general commercial activity on the NSFNET was prohibited by an Acceptable Use Policy,<sup>28</sup> thereby preventing these commercial networks from exchanging traffic with one another using the NSFNET as the backbone.<sup>29</sup> This roadblock was circumvented in 1991, when a number of commercial backbone operators including PSINet, UUNET and CerfNET established the Commercial Internet Exchange (“CIX”).<sup>30</sup> CIX consisted of a router, housed in Santa Clara, California, that was set up for the purpose of interconnecting these commercial backbones and enabling them to exchange their end users’ traffic.<sup>31</sup> In 1993, the NSF decided to leave the management of the backbone entirely to competing commercial backbones.<sup>32</sup> In order to facilitate the growth of overlapping competing backbones, the NSF designed a system of geographically dispersed Network Access Points (“NAPs”) similar to CIX, each consisting of a shared switch or local area network (“LAN”) used to exchange traffic.<sup>33</sup> The four original NAPs were in San Francisco (operated by PacBell), Chicago (BellCore and Ameritech), New York (SprintLink) and Washington, D.C. (MFS).<sup>34</sup> Backbones could choose to interconnect with one another at any or all of these NAPs.<sup>35</sup> In 1995, this network of commercial backbones and NAPs permanently replaced the NSFNET.<sup>36</sup>

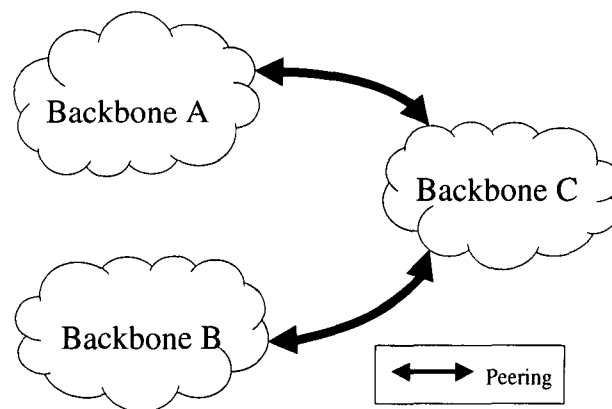


Figure 1: Peering

The interconnection of commercial backbones is not subject to any industry-specific regulations. The NSF did not establish any interconnection rules at the NAPs, and interconnection between Internet backbone providers is not currently regulated by the Federal Communications Commission (“FCC” or “the Commission”) or any other government agency.<sup>37</sup> Instead, the backbones are self-regulated through interconnection arrangements evolved from the informal interactions that characterized the Internet at the time the NSF was running the backbone. The commercial backbones developed a system of interconnection known as peering.<sup>38</sup> Peering has a number of distinctive characteristics. First, peering partners only exchange traffic that originates with the customer of one backbone and terminates with the customer of the other peered backbone. In Figure 1, customers of backbones A and C can trade traffic as a result of a peering relationship between the backbones, as can the customers of backbones B and C, which also have a peering arrangement. As part of a peering arrangement, however, a backbone would not act as an intermediary—it would accept the traffic of one peering partner

zakon/Internet/History/HIT.html [hereinafter Zakon].

<sup>24</sup> NATIONAL SCIENCE FOUNDATION, NIFTY 50-THE INTERNET, at [http://www.nsf.gov/od/lpa/nsf50/nsfoutreach/htm/n50\\_z2/pages\\_z3/28\\_pg.htm](http://www.nsf.gov/od/lpa/nsf50/nsfoutreach/htm/n50_z2/pages_z3/28_pg.htm).

<sup>25</sup> A T-1 network carries 1.544 megabits of data per second (“Mbps”).

<sup>26</sup> DIGITAL TORNADO, *supra* note 2, at 13.

<sup>27</sup> See JANET ABBATE, INVENTING THE INTERNET 191-200 (1999) [hereinafter ABBATE].

<sup>28</sup> NATIONAL SCIENCE FOUNDATION, ACCEPTABLE USE POLICIES FOR NSFNET PROGRAM BACKBONE NETWORK SERVICES, at <http://www.interact.nsf.gov/cise/html.nsf/Pages/2D8273FAFF1E362D85256683006645CF>.

<sup>29</sup> *Id.*

<sup>30</sup> ABBATE, *supra* note 27, at 198.

<sup>31</sup> *Id.*

<sup>32</sup> NATIONAL SCIENCE FOUNDATION, NSF AND THE INTERNET: AN OVERVIEW, at <http://www.nsf.gov/od/lpa/news/media/backgr1.htm> [hereinafter NSF AND THE INTERNET].

<sup>33</sup> *Id.*

<sup>34</sup> MARCUS, *supra* note 2, at 277.

<sup>35</sup> *Id.* at 276.

<sup>36</sup> *Id.*

<sup>37</sup> See generally Oxman, *supra* note 15 (discussing the FCC’s role in the Internet).

<sup>38</sup> INTERMEDIA WHITE PAPER, *supra* note 10 (defining peering as “the arrangement between two Internet service providers to connect their networks, so that the customers of one can communicate with those of the other”).

and transit this traffic to another peering partner.<sup>39</sup> Thus, referring back to Figure 1, backbone C will not accept traffic from backbone A destined for backbone B. The second distinctive characteristic of peering is that peering partners exchange traffic on a settlements-free basis.<sup>40</sup> The only costs that backbones incur to peer are that each partner pays for its own equipment and the transmission capacity needed for the two peers to meet at each peering point.

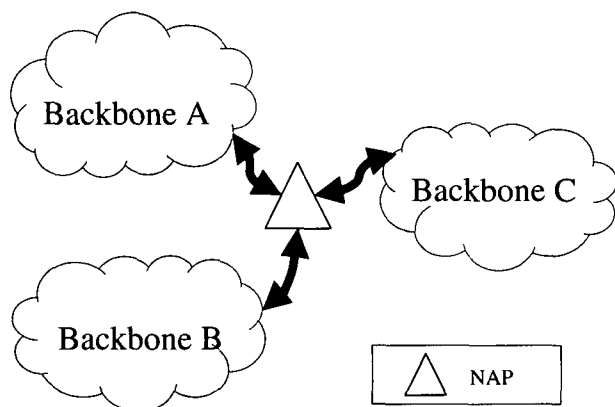


Figure 2: Hot-Potato Routing

Additional characteristics of peering relate to the routing of information from one backbone to another. Peering partners generally meet in a number of geographically dispersed locations.<sup>41</sup> In order to decide where to pass traffic from one backbone to another in a consistent and fair manner, they have adopted what is known as “hot-potato routing,” whereby a backbone will pass traffic to another backbone at the earliest point of exchange.<sup>42</sup> As an example, in Figure 2, backbones A and B are interconnected on the West and East Coasts. When a customer of ISP X on the East Coast requests a web page from a site connected to ISP Y on the West Coast, backbone A passes this request to backbone B on the East Coast, and backbone B carries this request to the West Coast. Likewise, the responding web page is routed from backbone B to backbone A on the West Coast, and backbone A is responsible for carrying the re-

sponse to the customer of ISP X on the East Coast. A final characteristic of peering is that recipients of traffic only promise to undertake “best efforts” when terminating traffic, rather than guaranteeing any level of performance in delivering packets received from peering partners.<sup>43</sup>

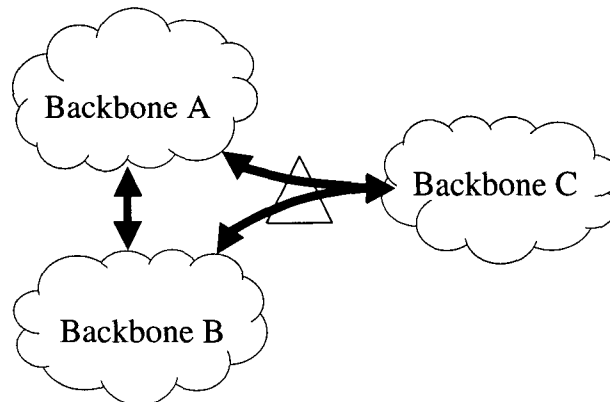


Figure 3: Network Access Point

The original system of peering has evolved over time. Initially, most exchange of traffic under peering arrangements took place at the NAPs, as it was efficient for each backbone to interconnect with as many backbones as possible at the same location, as shown in the example in Figure 3.<sup>44</sup> The rapid growth in Internet traffic soon caused the NAPs to become congested, however, which led to delayed and dropped packets.<sup>45</sup> For instance, Intermedia Business Solutions asserts that at one point packet loss at the Washington, D.C. NAP reached up to 20 percent.<sup>46</sup> As a result, a number of new NAPs have appeared to reduce the amount of traffic flowing through the original NAPs. For example, MFS, now owned by WorldCom, operates a number of NAPs known as Metropolitan Area Exchanges (“MAEs”), including one of the original NAPs, the Washington, D.C. NAP known as MAE-East, as well as MAE-West in San Jose and other MAEs in Los Angeles, Dallas and Chicago.<sup>47</sup>

Another result of the increased congestion at the NAPs has been that many backbones began to

<sup>39</sup> See, e.g., INTERMEDIA WHITE PAPER, *supra* note 10, at <http://www.intermedia.com> (providing a definition of peering).

<sup>40</sup> This is similar to bill-and-keep or sender-keeps-all arrangements. See *infra* note 60.

<sup>41</sup> INTERMEDIA WHITE PAPER, *supra* note 10.

<sup>42</sup> See MARCUS, *supra* note 2, at 283-285.

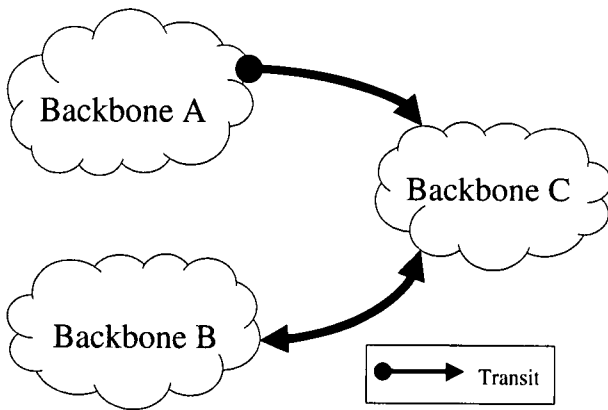
<sup>43</sup> See DIGITAL TORNADO, *supra* note 2, at 17-18.

<sup>44</sup> MARCUS, *supra* note 2, at 280-282.

<sup>45</sup> A packet is “the unit of data that is routed between an origin and a destination on the Internet.” Whatis.com, at [http://whatis.techtarget.com/definition/0,289893,sid9\\_gci212736,00.html](http://whatis.techtarget.com/definition/0,289893,sid9_gci212736,00.html) (last modified Jul. 31, 2001).

<sup>46</sup> INTERMEDIA WHITE PAPER, *supra* note 10.

<sup>47</sup> See WORLDCOM, INTEROPERABILITY, at [http://www.worldcom.com/govt/federal\\_solutions/resource\\_guide/re-dacted\\_contract/vol1\\_tech/section2/2\\_1-17.pdf](http://www.worldcom.com/govt/federal_solutions/resource_guide/re-dacted_contract/vol1_tech/section2/2_1-17.pdf).



**Figure 4: Private Peering**

interconnect directly with one another.<sup>48</sup> This system has come to be known as *private peering*, as opposed to the public peering that takes place at the NAPs. In Figure 4, backbones A and B have established a private peering connection through which they bypass the NAP when exchanging traffic for each other – they both only use the NAP when exchanging traffic with backbone C.<sup>49</sup> This system developed partly in response to congestion at the NAPs, yet it may often be more cost-effective for the backbones.<sup>50</sup> For instance, if backbones were to interconnect only at the NAPs, traffic that originated and terminated in the same city but on different backbones would have to travel to a NAP in a different city or even a different country for exchange.<sup>51</sup> With private peering, in contrast, the traffic can be exchanged within the same city, thereby alleviating the strain on the NAPs. At one point it was estimated that 80 percent of Internet traffic was exchanged via private peering.<sup>52</sup> There are recent indications, however,

that as NAPs begin to switch to Asynchronous Transfer Mode (“ATM”)<sup>53</sup> and other advanced switch technologies, the NAPs will be able to provide higher quality services and may regain their former attraction as efficient meeting points for peering partners.<sup>54</sup> Unless specified, discussions of peering below refer to both public and private peering.

Because each bilateral peering arrangement only allows backbones to exchange traffic destined for each others’ customers, backbones need a significant number of peering arrangements in order to gain access to the full Internet. UUNET, for instance, claims to “peer with 75 other ISPs globally.”<sup>55</sup> As discussed below, there are few backbones that rely solely on private or public peering to meet their interconnection needs. The alternative to peering is a transit arrangement between backbones, in which one backbone pays another backbone to deliver traffic between its customers and the customers of other backbones.

Transit and peering are differentiated in two main ways. First, in a transit arrangement, one backbone pays another backbone for interconnection and therefore becomes a wholesale customer of the other backbone.<sup>56</sup> Second, unlike in a peering relationship, with transit, the backbone selling the transit services will route traffic from the transit customer to its peering partners.<sup>57</sup> In Figure 5, backbone A is a transit customer of backbone C; thus, the customers of backbone A have access both to the customers of backbone C as well as to the customers of all peering partners of backbone C, such as backbone B. If backbone A

<sup>48</sup> See MARCUS, *supra* note 2, at 280-282.

<sup>49</sup> Private peering may take place in the same physical location as the NAP. If two carriers wishing to peer privately already have transport going to a NAP, they may simply bypass the NAP’s switches and interconnect directly at the same location. INTERMEDIA WHITE PAPER, *supra* note 10.

<sup>50</sup> For instance, Intermedia states that its “dual peering policy,” combining open public peering with private peering, “will create a win-win solution for everyone and a better management approach to the Internet.” INTERMEDIA WHITE PAPER, *supra* note 10.

<sup>51</sup> For example, prior to the establishment of a NAP in Rome backbones often exchanged domestic Italian Internet traffic in the United States. Sam Paltridge, *Internet Traffic Exchange: Developments and Policy*, 22-23, at <http://oecd.org/pdf/M000014000?M000014288.pdf> (Apr. 1, 1998) (This document was prepared for the Organisation for Economic Co-operation and Development’s Committee for Information, Computer and Communications Policy.).

<sup>52</sup> Michael Gaddis, Chief Technical Officer of SAVVIS Communications, gave this estimate. Randy Barrett, *ISP Sur-*

*vival Guide*, at <http://www.intweek.com> (Dec. 7, 1998).

<sup>53</sup> ATM is a “high bandwidth, low-delay, connection oriented, packet-like switching and multiplexing technique.” NEWTON, *supra* note 17, at 67-69.

<sup>54</sup> See MARCUS, *supra* note 2, at 278. Marcus states that “in 1998, MCI WorldCom upgraded its MAE facilities . . . to offer modern ATM switches as a high-capacity alternative to the FDDI/gigaswitch architecture.” *Id.* See also Letter from Attorneys for MCI WorldCom and Sprint to Magalie Roman Salas, Secretary, FCC, Attach. at 20-21 (Jan. 14, 2000) (filed in Application for Consent to the Transfer of Control of Licenses from Sprint Corporation to MCI WorldCom, Inc., CC-Docket 99-333) [hereinafter MCI WorldCom Sprint *Ex Parte*] (“In short, the deployment of ATM switches has expanded the capability of NAPs to handle the demand for public peering by increasing the number of ports as well as the capacity available at NAPs.”).

<sup>55</sup> MCI WorldCom Sprint *Ex Parte*, *supra* note 35, Attach. at 20, n.48.

<sup>56</sup> See generally, MARCUS, *supra* note 2.

<sup>57</sup> *Id.*

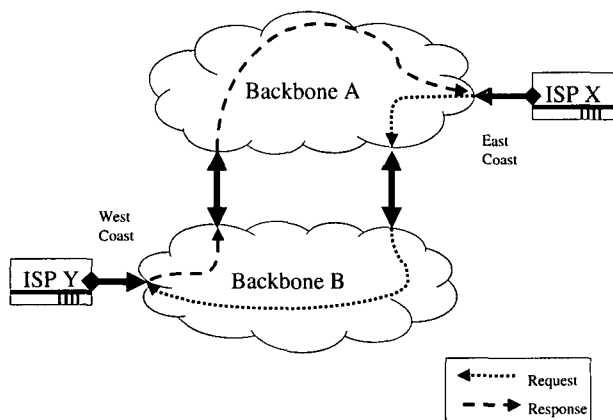


Figure 5: Transit

and backbone C were peering partners, as in Figure 1, backbone C would not accept traffic from backbone A that was destined for backbone B.

Many backbones have adopted a hybrid approach to interconnection, peering with a number of backbones and paying for transit from one or more backbones in order to have access to the backbone of the transit supplier as well as the peering partners of the transit supplier.<sup>58</sup> Those few large backbones that interconnect solely by peering, and do not need to purchase transit from any other backbones, will be referred to here as *top-tier backbones*. Because of the non-disclosure agreements that cover interconnection between backbones, it is difficult to state with accuracy the number of top-tier backbones. According to one industry participant, there are five: Cable & Wireless, WorldCom, Sprint, AT&T and Genuity (formerly GTE Internetworking).<sup>59</sup>

It is useful to compare Internet interconnection arrangements of peering and transit with more fa-

miliar, traditional telephony interconnection arrangements. The practice of peering is similar to the practice of bill-and-keep or sender-keeps-all arrangements in telephony.<sup>60</sup> Transit arrangements between Internet backbones are somewhat similar to resale arrangements between, for instance, long distance carriers; the Internet backbone providing transit service acts as the wholesaler, and the backbone buying transit acts as the reseller of Internet backbone services. There are notable differences in the way Internet and telephony arrangements are regulated. The interconnection between Internet backbones is not governed by industry-specific regulations,<sup>61</sup> while the interconnection of traditional telephone carriers is currently regulated both domestically and internationally.<sup>62</sup> Furthermore, unlike telephony, there is no difference between domestic and international Internet interconnection arrangements; backbones treat each other the same regardless of the country of origin or location of customer base.<sup>63</sup>

There is no accepted convention that governs when two backbones will or should decide to peer with one another, nor is it an easy matter to devise one. The term "peer" suggests equality,<sup>64</sup> and one convention could be that backbones of equal size would peer. However, there are many measures of backbone size, such as geographic spread, capacity, traffic volume or number of customers. It is unlikely that two backbones will be similar along many or all dimensions. One may have fewer, but larger, customers than the other, another may reach into Europe or Asia, and so forth. The ques-

<sup>58</sup> Economides, *supra* note 16.

<sup>59</sup> MARCUS, *supra* note 2, at 280. Marcus is the Chief Technology Officer of Genuity. Genuity was formerly GTE Internetworking. In order to comply with Section 271 of the Telecommunications Act of 1996, and thereby obtain Commission approval to merge with Bell Atlantic, GTE agreed to sell most of its equity in Genuity to the public through an initial public offering. Press Release, GTE, Bell Atlantic and GTE Chairmen Praise FCC Merger Approval (June 16, 2000). In addition, according to Marcus, "somewhere between six and perhaps thirty other ISPs could also be viewed as backbone ISPs." Marcus states that "the ability to reach all Internet destinations without the need for a transit relationship . . . is a strong indicator that an ISP should be viewed as a backbone ISP." MARCUS, *supra* note 2, at 279. This is similar to the definition used in this paper of a top-tier backbone.

<sup>60</sup> 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. 47 U.S.C. §252 (d)(2)(B)(i) (2000). See also *infra* note 184.

<sup>61</sup> See *infra* Section II. D.

<sup>62</sup> See generally Communications Act of 1934, as amended by the Telecommunications Act of 1996, 47 U.S.C. §251 (2000).

<sup>63</sup> See, e.g., *infra* Section II. C.

<sup>64</sup> The definition of peer is "one that is of the same or equal standing (as in law, rank, quality, age, ability) with another: EQUAL." WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1665 (1986).

tion then becomes, how the backbones weigh one variable against another. Given the complexity of such judgments, it may be best to use a definition of equality proposed by one industry participant—that companies will peer when they perceive equal benefit from peering based on their own subjective terms, rather than any objective terms.<sup>65</sup> In sum, peering agreements are the result of commercial negotiations; each backbone bases its decisions on whether, how and where to peer by weighing the benefits and costs of entering into a particular interconnection agreement with another backbone. Currently, there are no industry-specific regulations governing interconnection that Internet backbone providers must weigh as part of the costs in their decision to peer.

#### D. The Backbone as an Unregulated Service

The Federal Communications Commission maintains a policy to “focus on sustaining competitive communications markets and protecting the public interest where markets fail to do so.”<sup>66</sup> As an example of this policy, for many years the FCC has recognized a categorical distinction between regulated telecommunications services and unregulated computer-based services.<sup>67</sup> To understand why Internet backbone services are, and should continue to be, treated as unregulated computer-based services, it is important to highlight two basic policies. First, it is important to understand the basis for the regulation of network industries. For the telecommunications network, like the railroad and the telegraph before it, to grow into a healthy and vibrant universally available network, striking a “common carrier” bargain with telephone com-

panies was a beneficial government intervention.<sup>68</sup> In addition, given the economies of scale<sup>69</sup> inherent in the construction of the telecommunications network, natural monopoly regulation was necessary to ensure reasonable price and quality levels.<sup>70</sup> Second, it is important to understand why certain services are not regulated as common carrier services. Soon after their introduction, the FCC determined that the computer-based services market would remain competitive, and therefore should not be regulated, so long as an essential input to such services – telecommunications capability – was available to providers of such services on a nondiscriminatory basis.<sup>71</sup> Thus it was not necessary to impose common carrier regulations on the users of those telecommunications services as well as the providers.<sup>72</sup> The following is a brief overview of relevant domestic telecommunications regulations.<sup>73</sup>

##### 1. Common Carrier Regulation

The traditional rationale for regulating network industries, such as telecommunications, was the almost overwhelming economies of scale in the provision of such services.<sup>74</sup> Economic theory and practice suggests that a natural monopolist is likely to arise in such industries; this is considered efficient to the extent that duplicative facilities are not installed.<sup>75</sup> However, without competitors, a natural monopoly can harm consumers in a variety of ways, which fall generally into three categories: (1) the monopolist can directly raise retail prices and/or reduce retail service quality; (2) the monopolist can leverage market power into related markets that would otherwise be competi-

<sup>65</sup> Geoff Huston, *Interconnection, Peering and Settlements*, 3-4, at <http://www.telstra.net/gih/peerdocs/peer.html> (Jan. 1999); see also MARCUS, *supra* note 2, at 279 (“Over time, it came to be recognized that peers need not be similar in size; rather, what was important was that there be comparable value in the traffic exchanged.”).

<sup>66</sup> FEDERAL COMMUNICATIONS COMMISSION, A NEW FCC FOR THE 21ST CENTURY, *Draft Strategic Plan*, 3 (August 1999), [http://www.fcc.gov/21st\\_century](http://www.fcc.gov/21st_century) (Aug. 1999).

<sup>67</sup> See, e.g. Oxman, *supra* note 15.

<sup>68</sup> *Id.*

<sup>69</sup> See *infra* note 74.

<sup>70</sup> Economides, *supra* note 16, at 11.

<sup>71</sup> Oxman, *supra* note 15, at 9.

<sup>72</sup> *Id.* at 9 (stating, “[t]hus, data processing services were ‘unregulated’ from the outset, permitting the data industry to develop innovative services exempt from the numerous common carrier requirements of Title II of the Communications Act”).

<sup>73</sup> See also GERALD R. BROCK, TELECOMMUNICATIONS POLICY FOR THE INFORMATION AGE: FROM MONOPOLY TO COMPETITION (1994) [hereinafter BROCK]; INGO VOGELSANG & BRIDGER M. MITCHELL, TELECOMMUNICATIONS COMPETITION: THE LAST TEN MILES (1997) [hereinafter VOGELSANG & MITCHELL].

<sup>74</sup> Economies of scale arise when the cost per unit of providing service decreases as output increases. ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 223 (4th ed. 1995) [hereinafter PINDYCK & RUBINFELD]. In wireline telephony, it was felt that the cost of having one company serve a particular area was historically much lower than having two or more companies with partial or full overbuilds of each others’ networks. VOGELSANG & MITCHELL, *supra* note 73, at 51-55. Lately, new technologies have altered the traditional cost structures in a number of network industries such as telephony, which enabled the pro-competitive, deregulatory provisions of the Telecommunications Act of 1996.

<sup>75</sup> See PINDYCK & RUBINFELD, *supra* note 74, at 352-358.



tive;<sup>76</sup> and (3) the monopolist can deny access to its network and thus bar entry into its core markets.<sup>77</sup>

Governments worldwide traditionally chose to operate or regulate natural monopolies in order to benefit from the efficiencies inherent in having a single provider, while not incurring the corresponding harms that the natural monopolies could inflict on consumers.<sup>78</sup> In the United States, certain telecommunications providers have been subject to natural monopoly regulation;<sup>79</sup> this meant a government grant of monopoly (the monopoly granted to local telephone companies, for example, was lifted by Congress in 1996), along with rate and service quality regulation. In addition, all telecommunications providers, even those not subject to natural monopoly regulation, are regulated as common carriers, as described below. It should be noted that the goals of regulation are similar to those of antitrust policy—both seek to protect consumers from firms with market power. Indeed, in the United States, federal antitrust actions have had at least as great an impact on telecommunications as federal regulations.<sup>80</sup> Broadly speaking, in the United States, regulatory approaches have been used to control firms' actions while taking the market structure as given; antitrust policy has been used to control firms' actions by acting on the market structure itself, such as by reviewing mergers that would increase market concentration, inducing a divestiture aimed at reducing concentration or preventing firms from taking actions that cripple market mechanisms.<sup>81</sup> For the public, the combinational use of both approaches benefited the construction of a nation-

wide telecommunications network while ensuring affordable access to all users.

Government involvement in the nascent telephone market began at the turn of the 20th century. Even before the passage of the Communications Act in 1934, the Supreme Court ruled that telegraph companies had a duty – arising out of the common law – to serve all customers in a non-discriminatory manner as a common carrier.<sup>82</sup> In addition, thirty-four states determined that mandating interconnection obligations was the best way to resolve disputes that had arisen between 1894 and 1906 between the Bell System, the largest telephone company at the time, and smaller independent telephone companies.<sup>83</sup> It was not until 1910 that the Mann-Elkins Act extended the jurisdiction of the Interstate Commerce Commission to include telephone companies.<sup>84</sup> In 1913, in response to a threatened antitrust case, AT&T entered into an agreement, known as the Kingsbury Commitment, to interconnect with independent local telephone companies for long distance calls.<sup>85</sup> In 1934, Congress established the Federal Communications Commission to regulate telecommunications common carriers.<sup>86</sup>

Today, pursuant to the Communications Act, as amended, communications common carriers must offer service on demand to the public at large without unreasonable discrimination; in exchange, there is protection from certain types of liability.<sup>87</sup> Common carriers with market power are subject to additional regulations that restrict rates and govern service quality levels.<sup>88</sup> In order to prevent common carriers with market power from leveraging this market power into related

<sup>76</sup> For instance, local wireline services are necessary inputs in the provision of wireless and long distance services; a carrier with market power over local services could leverage this market power into these related markets.

<sup>77</sup> Economides, *supra* note 16, at 11-13.

<sup>78</sup> *Id.*

<sup>79</sup> *Id.*

<sup>80</sup> VOGELSANG & MITCHELL, *supra* note 73, at 63-64.

<sup>81</sup> In telecommunications, the FCC, the federal agency charged with regulating interstate communications by wire and radio, has authority pursuant to the Communications Act of 1934 to determine whether transactions involving the transfer of certain licenses or authorizations serve the public interest. See *In re Applications of Ameritech Corp., Transferor, and SBC Communications Inc., Transferee, For Consent to Transfer Control of Corporations Holding Commission Licenses and Lines Pursuant to Sections 214 and 310(d) of the Communications Act and Parts 5, 22, 24, 25, 63, 90, 95 and 101 of the Commission's Rules, Memorandum Opinion and*

*Order*, 14 FCC Rcd. 14712, paras. 46-54 (1999). The Commission also shares concurrent antitrust jurisdiction with the Department of Justice ("DOJ") under the Clayton Act to review mergers between common carriers. *Id.* at para. 53.

<sup>82</sup> See *Western Union Tel. Co. v. Call Publishing Co.*, 181 U.S. 92, 99-104 (1901).

<sup>83</sup> Zakon, *supra* note 23.

<sup>84</sup> Mann-Elkins Act, Pub. L. No. 61-218, 36 Stat. 539 (1910).

<sup>85</sup> See VOGELSANG & MITCHELL, *supra* note 73, at 64.

<sup>86</sup> The Communications Act of 1934, the FCC's enabling statute, created the Commission "for the purpose of regulating interstate and foreign commerce in communication by wire and radio." 47 U.S.C. §151 (2000). The Communications Act defines a common carrier as "any person engaged as a common carrier for hire." 47 U.S.C. §153(h) (2000).

<sup>87</sup> *Richman Bros. Records v. FCC*, 124 F.3d 1302 (D.C. 1997).

<sup>88</sup> *Id.*

competitive markets, including long distance and the manufacture of consumer premise equipment ("CPE"), there has been a wide range of regulations, including outright divestiture and prohibition on entering these related markets.<sup>89</sup> As competition is introduced into formerly monopolized telecommunications markets such as local telephony, regulation is nevertheless required in order to encourage the incumbent monopolist to open its network fully to potential entrants.

Over the years, technological advances have altered the cost structure upon which natural monopoly regulation rested.<sup>90</sup> The regulatory response in the United States has been to relax regulation in markets where competition has eliminated the need for regulation, while protecting these markets from firms with market power in related segments of the industry.<sup>91</sup> As an example, after upstarts such as MCI demonstrated that competition was possible in the provision of long distance services, an antitrust case brought by the Department of Justice ("DOJ") culminated in the breakup of the Bell System into AT&T, providing long distance services in a competitive market, and the seven Regional Bell Operating Companies ("RBOCs"), providing local services in exclusive regions.<sup>92</sup> The RBOCs were prohibited from entering long distance markets in order to prevent discrimination towards unaffiliated long distance carriers that led to the breakup of the Bell System in the first place.<sup>93</sup> Recently, as competition became possible in local markets, Congress passed the Telecommunications Act of 1996 ("1996 Act"),<sup>94</sup> requiring incumbent Local Exchange Carriers ("LECs"), such as the RBOCs and GTE, to open their local markets to competition

by a variety of means.<sup>95</sup> These requirements are crucial to the development of a competitive telecommunications network, and the Federal Communications Commission rules implementing these requirements will be relaxed as competition renders them unnecessary.<sup>96</sup>

In summary, telecommunications providers are subject to common carrier regulations that ensure nondiscriminatory access to end users. Together with antitrust enforcement, these regulations also serve to protect against anti-competitive behavior by telecommunications providers with market power. In markets where competition can act in place of regulation as the means to protect consumers from the exercise of market power, the Commission has long chosen to abstain from imposing regulation. For this reason, providers of services that combine telecommunications with computer services are not regulated as common carriers.

## 2. *Basic versus Enhanced Services*

For more than thirty years, the Commission has sought to avoid imposing unnecessary common carrier regulation on providers of computer services that rely on the nation's telecommunications infrastructure for transmission of those services but do not themselves provide telecommunications services to the public. The absence of market power in the computer services industry led the Commission to conclude that imposing common carrier regulation was unnecessary and might discourage innovation and distort the nascent data marketplace.<sup>97</sup> The Commission instead focused on ensuring that the providers of the un-

<sup>89</sup> VOGELSANG & MITCHELL, *supra* note 73, at 61-62.

<sup>90</sup> For instance, microwave technology made it possible for MCI to compete with AT&T in long distance. See BROCK, *supra* note 73, at 111-115.

<sup>91</sup> See, e.g., *In re* Policy and Rules Concerning Rates for Competitive Common Carrier Services and Facilities Authorizations Therefore, *First Report and Order*, 85 F.C.C.2d 1, para. 54 (1980) ("Application of current regulatory procedures to non-dominant carriers imposes unnecessary and counterproductive regulatory constraints upon a marketplace that can satisfy consumer demand efficiently without government intervention."). See also *In re* Motion of AT&T Corp. to be Reclassified as a Non-dominant Carrier, *Order*, 11 FCC Rcd. 3271 (1995) (determining that AT&T should be declared non-dominant).

<sup>92</sup> *United States v. American Tel. & Tel. Co.*, 552 F. Supp. 131 (D.D.C. 1982). See also, VOGELSANG & MITCHELL, *supra* note 73, at 67-69; BROCK, *supra* note 73, at Ch. 9.

<sup>93</sup> *United States v. American Tel. & Tel. Co.*, 552 F. Supp.

131 (D.D.C. 1982).

<sup>94</sup> Pub. L. No. 104-104, 110 Stat. 56 (1996).

<sup>95</sup> The 1996 Act provides for three types of competition: facilities-based competition, competition using network elements unbundled (leased) from the incumbent at cost-based rates and competition reselling the incumbent's service. See 47 U.S.C. §251 (2000). To ensure that the customers of the competitors remain plugged into the network, section 251 of the 1996 Act requires that incumbent LECs offer nondiscriminatory interconnection terms and conditions to competitors. See 47 U.S.C. §251 (2000). Absent such a requirement, incumbents would be able to deny competitors access to their monopoly networks.

<sup>96</sup> Upon a showing that local markets are open to competition, the RBOCs are granted authority to enter the market for long distance services, pursuant to section 271 of the 1996 Act. 47 U.S.C. §271 (2000).

<sup>97</sup> See generally Oxman, *supra* note 15.

derlying telecommunications services made these services available on a non-discriminatory basis and did not themselves leverage their market power into the provision of these complementary computer services.<sup>98</sup> As a result, the competitive enhanced services market was able to flourish without onerous regulations impeding its growth.

In 1966, the Commission opened the *Computer Inquiry* proceeding that explored the regulatory and policy issues raised by the nascent interdependence of computer and communication technologies.<sup>99</sup> In announcing the inquiry, the Commission foreshadowed the incredible attributes of computer networks that would make the Internet such a valuable tool.

The modern day electronic computer is capable of being programmed to furnish a wide variety of services, including the processing of all kinds of data and the gathering, storage forwarding and retrieval of information – technical, statistical, medical, cultural, among numerous other classes. With its huge capacity and versatility, the computer is capable of providing its services to a multiplicity of users at locations remote from the computer. Effective use of the computer is, therefore, becoming increasingly dependent upon communication common carrier facilities and services by which the computers and the user are given instantaneous access to each other.<sup>100</sup>

In the early 1970s, the Commission determined that there were “no natural or economic barriers to free entry into the market for [computer] services.”<sup>101</sup> The Commission therefore decided that the policies and objectives of the Communications Act would best be served by allowing computer services to operate in an environment free from industry-specific regulation.<sup>102</sup> In addition, the Commission devised rules that require com-

mon carriers to grant nondiscriminatory access to their networks to enhanced service providers.<sup>103</sup> Mandating such nondiscrimination, the Commission concluded, was necessary because the computer-based service industry “cannot survive, much less develop further, except through reliance upon and use of communications facilities and services.”<sup>104</sup>

In order to facilitate the implementation of its computer services policy, the Commission created the categories of “basic” and “enhanced” services.<sup>105</sup> The basic services category denotes common carrier services subject to Title II of the Communications Act.<sup>106</sup> The enhanced services category denotes those services offered over common carrier transmission facilities used in interstate communications, which employ computer processing applications that act on the format, content, code, protocol or similar aspects of the subscriber’s transmitted information; provide the subscriber additional, different or restructured information; or involve subscriber interaction with stored information.<sup>107</sup>

Thus, a basic service is a communications pathway, like a telephone line, while an enhanced service is a computer-enhanced offering that operates via that communications pathway. Present day examples of unregulated enhanced services include voicemail services, gateway services, electronic publishing and Internet services. In these markets, competition between firms rather than any industry-specific regulations ensures that consumers enjoy low prices and increased growth in innovative services on the Internet.

## E. Growth of the Internet Industry

In the past five years, the Internet has exper-

<sup>98</sup> *Id.*

<sup>99</sup> *Id.* at 8.

<sup>100</sup> *In re Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, Notice of Inquiry*, 7 F.C.C.2d 11, para. 1 (1966).

<sup>101</sup> *In re Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, Tentative Decision*, 28 F.C.C.2d 291, para. 18 (1970).

<sup>102</sup> Oxman, *supra* note 15, at 9.

<sup>103</sup> *In re MTS and WATS Market Share, Memorandum Opinion and Order*, 97 F.C.C.2d 682, 711-722 (1985).

<sup>104</sup> *In re Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, Final Decision and Order*, 28 F.C.C.2d 267,

para. 7 (1971).

<sup>105</sup> The 1996 Act introduced new provisions referring to “telecommunications service” and “information service.” For definitions of these services, see 47 U.S.C. §§153(46), 153(20) (2000), respectively. The Commission has concluded that these definitions correspond to the categories of basic and enhanced services, respectively. For a general discussion, see *In re Federal-State Joint Board on Universal Service, Report to Congress*, 13 FCC Rcd. 11501 (1998).

<sup>106</sup> Basic services are defined as a common carrier offering of a pure “transmission capacity for the movement of information.” *In re Amendment of Section 64.702 of the Commission’s Rules and Regulations (Second Computer Inquiry), Final Decision*, 77 F.C.C.2d 384, para. 5 (1980) [hereinafter *Second Computer Inquiry*].

<sup>107</sup> 47 C.F.R. §64.702(a) (2001).

experienced unprecedented growth rates.<sup>108</sup> The market for Internet backbone services has grown since privatization in 1995 into a market with a multitude of competing providers.<sup>109</sup> According to *Boardwatch* magazine, the number of Internet backbone providers rose steadily in the late 90's to reach forty-two national backbones by 1999.<sup>110</sup> *Boardwatch* defines a national backbone to be one "maintaining a hub city in at least five different states, spanning both coasts, and peering at the major NAPs."<sup>111</sup> The list of national backbones includes the top-tier backbones that only peer with other backbones, as well as other smaller national backbones that peer with some backbones and purchase transit from others. Due to the non-disclosure agreements covering contracts between backbones, it is impossible to know the exact breakdown between the number of top-tier backbones and other national backbones, although there are suggestions that there are five top-tier backbones.<sup>112</sup>

The list of national backbones includes a number of backbones that pre-date the privatization of the Internet, as well as a number of newer players that have entered partly on the strength of their new fiber facilities.<sup>113</sup> Many of the older backbones have been swept into the merger wave that transformed the general communications industry and, combined with their merger partners, remain among the largest backbones. WorldCom now owns UUNET and ANS Communications, two of the earliest backbones, along with GridNet, Unicom-Pipex, InNet, NL Net and Metrix Interlink.<sup>114</sup> WorldCom also owns MFS, which runs the

NAPs known as MAEs, including one of the original NAPs, MAE East.<sup>115</sup> According to the Department of Justice, UUNET is now "by far the largest provider of Internet backbone services in the world, whether measured by traffic or revenues."<sup>116</sup> In 1997, GTE Internetworking, since renamed Genuity, purchased BBN, the developer of a precursor to the modern day Internet, and was then spun off as a separate public corporation.<sup>117</sup> AT&T's role in the backbone market has grown with its purchases of CERFnet, another early backbone, along with IBM's Global Network business.<sup>118</sup> Cable & Wireless entered the ranks of the largest backbones when it purchased MCI's Internet backbone, which was divested during the MCI WorldCom merger proceeding.<sup>119</sup> Finally, PSINet, an early backbone that has remained independent, also remains among the list of the larger backbones, although PSINet recently filed for Chapter 11 Bankruptcy protection.<sup>120</sup>

The increase in the number of backbones has been facilitated by the recent dramatic increases in the availability of fiber optic capacity. Not only have the fiber networks owned by the incumbent carriers—AT&T, Sprint and MCI WorldCom—all grown in recent years, a more significant increase in capacity comes from four entrants—Qwest, Broadwing (formerly IXC), Williams and Level 3—that have built or are building nationwide fiber optic networks.<sup>121</sup> Not only are these four companies themselves national Internet backbones, but also a number of other backbones have in turn bought or leased capacity from them. For instance, PSINet purchased sixteen fibers cov-

<sup>108</sup> Larry Press, *The State of the Internet: Growth and Gaps*, at [http://www.isoc.org/isoc/conferences/inet/00/cdproceedings/8e/8e\\_4htm](http://www.isoc.org/isoc/conferences/inet/00/cdproceedings/8e/8e_4htm) (June 30, 2000).

<sup>109</sup> The analysis contained in this paper is based solely on publicly available information. As in most markets, information about Internet backbone prices and costs is proprietary. In addition, information about the nature of relationships between Internet backbone providers is protected by non-disclosure agreements. The effects of these non-disclosure agreements on this analysis are described below.

<sup>110</sup> In 1999, *Boardwatch* actually listed forty-three national backbones; however, for purposes of this paper we count as one backbone the two backbones listed as owned by MCI WorldCom—Advanced Networks and UUNET. In addition, *Boardwatch* does not include in its list five other national backbones, Williams Communications, Bell Canada/Bell Nexxia, Network Two, ITC DeltaCom and RoadRunner, because these backbones would not release their prices. For consistency with *Boardwatch's* previous lists, these backbones are not accounted for here. *Boardwatch Magazine's Directory of Internet Service Providers*, 5 (11th ed. 1999).

<sup>111</sup> *Boardwatch Magazine Directory of Internet Service Providers*, 27 (9th ed. 1997).

<sup>112</sup> See *infra* at note 59.

<sup>113</sup> See *Boardwatch Magazine's Directory of Internet Service Providers* (11th ed. 1999) (providing a complete list and description of national backbone providers).

<sup>114</sup> See Complaint at 6, *US v. WorldCom, Inc. and Sprint Corp.* (D.D.C. 2000) [hereinafter DOJ WorldCom Sprint Complaint].

<sup>115</sup> WORLDCOM, INC., 1996 ANNUAL REPORT 28 (1997).

<sup>116</sup> *Id.* at 4-5.

<sup>117</sup> See *infra* at note 59.

<sup>118</sup> AT&T Business, "Twenty-first Century Networking," at [http://www.ipservices.att.com/realstories/databriefs/features/30\\_21c.cfm](http://www.ipservices.att.com/realstories/databriefs/features/30_21c.cfm).

<sup>119</sup> See *infra* note 131.

<sup>120</sup> *PSINet Files for Chapter 11*, REUTERS NEWSWIRE, JUNE 1, 2001.

<sup>121</sup> IXC Communications merged with Cincinnati Bell to become Broadwing Inc.

ering 14,000 miles from the former IXC Communications.<sup>122</sup> The development of dense wavelength division multiplexing ("DWDM") technologies, which divide each strand of fiber into multiple channels, is further increasing the availability of fiber capacity by multiplying the capacity of existing and new networks.<sup>123</sup> Entry into the backbone market is facilitated by this increasing availability of fiber capacity from a growing number of providers.

The growth in private Internet backbones has coincided with the introduction of the World Wide Web, which has popularized the Internet for millions of consumers. The result is a virtuous cycle that is typical of industries characterized by network externalities. In this case, users, drawn to the Internet by applications such as the World Wide Web, encourage the creation of more Web content, which in turn encourages additional users to log on to the Internet.<sup>124</sup> New users, and new providers of content, require Internet access, encouraging the creation of more ISPs, which in turn encourages the entry of more Internet backbone providers and fiber providers to transport the additional data. These ISPs compete to attract new users and content providers in a continuation of the virtuous cycle that has led to the unprecedented growth level that characterizes the Internet.

In recognition of the role of regulatory abstention in the development of the Internet, the 1996 Act states "[t]he Internet . . . [has] flourished, to the benefit of all Americans, with a minimum of government regulation."<sup>125</sup> Yet, the commercial backbone market is relatively young, and industry observers are questioning whether the government can, or should, maintain a fully hands-off approach to backbone providers.<sup>126</sup> Competition, hand-in-hand with antitrust laws and competition enforcement, will act to restrain any anti-competitive actions in place of industry-specific regulations.

### III. INTERCONNECTION ISSUES

There have been a number of allegations, dis-

cussed below, that the entire system of interconnection between backbones is at risk due to the actions of several larger backbones. At least one industry observer argued that the emerging system of private peering enables the larger backbones to act in an anti-competitive manner by excluding smaller backbones from private peering arrangements and then raising prices.<sup>127</sup> Universal connectivity is the norm today, but as new real-time services begin to be offered over the Internet, there are fears that backbones may choose to differentiate themselves by not interconnecting for purposes of offering these new services. However, there is hardly any possible market failure in the Internet backbone market that could not be governed adequately by existing antitrust laws.

#### A. Internet Backbone Market Power Issues

##### 1. Background

Internet backbone providers face conflicting incentives. On one hand, they have an incentive to cooperate with one another in order to provide their customers with access to the full range of Internet users and content. On the other hand, these same backbones have an incentive to compete with one another for both retail and wholesale customers. The need for backbone *A* to interconnect with backbone *B* in order to provide its customers access to backbone *B*'s customers creates what might be termed a *competitive network externality*; this interconnection also enables backbone *B* to provide its customers access to backbone *A*'s customers. As long as *A* and *B* are of approximately equal size, there is a strong incentive for them to cooperate with one another in spite of competitive network externalities; if either unilaterally stops interconnecting, it has no guarantees that it will benefit from such an action. This situation seems to characterize the early days of the commercial Internet, when a number of backbones were relatively similar in size and readily agreed to peer with one another. Recently, however, there have been allegations that as certain backbones grew they began to engage in uncoop-

competitive free market that presently exists for the Internet." *Id.* at (b)(2).

<sup>122</sup> See *infra* Section III. A. 1.

<sup>123</sup> *With Series of Deals, PSINet seeks to become 'Super Carrier'*, COMMUNICATIONS DAILY, Oct. 20, 1999.

<sup>124</sup> NEWTON, *supra* note 17, at 247.

<sup>125</sup> See *infra* Section II. B.

<sup>126</sup> 47 U.S.C. §230 (a)(4) (2000). Furthermore, "[it] is the policy of the United States to preserve the vibrant and

<sup>127</sup> Jack Rickard, *Yet Another Unique Moment in Time. Peering Redux - Back to the Future and the Essentials of a Competitive Internet*, EDITOR'S NOTES, BOARDWATCH MAGAZINE, May 1998.

erative, if not anti-competitive, practices.<sup>128</sup>

In early 1997, UUNET, followed by several other large backbones, attempted to end peering with a number of smaller backbones and instead charge them for transit.<sup>129</sup> In another example, GTE Internetworking, since renamed Genuity, announced that it would no longer privately peer with Exodus Communications, as did PSINet more recently.<sup>130</sup> When WorldCom, which had purchased UUNET and several other backbones, announced a merger agreement with MCI, there was concern that the combined backbone would become the dominant backbone with the ability to exercise market power against smaller competitors in a variety of ways.<sup>131</sup> In particular, merger opponents argued that the merged firm would refuse to peer with smaller backbones.<sup>132</sup> These concerns were echoed in the recent MCI WorldCom/Sprint merger proceeding.<sup>133</sup> During this proceeding, Level 3 argued that Sprint was refusing to peer with it, a refusal that "cannot be explained by competitive market forces."<sup>134</sup> Likewise, when Exodus was refused peering by PSINet, Adam Wegner, General Counsel for Exodus stated that "[Exodus] view[s] [PSINet's] action as anti-competitive."<sup>135</sup>

<sup>128</sup> For instance, Level 3's Chairman, James Crowe, claimed that MCI and WorldCom's refusal to peer with Level 3 constituted "monopolistic behavior." Joan Engebretson, *Level 3: Whiner or Visionary*, TELEPHONY MAGAZINE, May 25, 1998, at 7 [hereinafter Engebretson]; see also John J. Keller, *Level 3 Assails the WorldCom-MCI Deal*, WALL ST. J., May 20, 1998, at B10.

<sup>129</sup> Because interconnection agreements are generally confidential due to the widespread use of non-disclosure agreements, it is not commonly known whether this attempt was successful. See Engebretson, *supra* note 128, at 7.

<sup>130</sup> Kate Gerwig, *Service Providers Still in Peering Dither*, INTERNETWEEK, Aug. 27, 1998, at <http://www.internetwk.com/news0898/news082798-2.htm> [hereinafter Gerwig]; Martin Kady II, *Peer Pressure: Dissolution of PSINet, Exodus Network-Sharing Agreement May be Sign of Things to Come*, WASH. BUS. J., June 2, 2000, at 1 [hereinafter Kady].

<sup>131</sup> See *In re Application of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications Corporation to WorldCom, Inc.*, *Memorandum Opinion and Order*, 13 FCC Rcd. 18025, 18103-18115, paras. 142-156 (1998) [hereinafter MCI/WorldCom Order]. In order to satisfy antitrust concerns regarding increased concentration in the Internet backbone market, MCI sold its Internet assets to Cable & Wireless. See Press Release, European Commission, Commission Clears WorldCom and MCI Merger Subject to Conditions (July 8, 1998) [hereinafter European Commission MCI WorldCom Press Release]; Press Release, Department of Justice, Justice Department Clears WorldCom/MCI Merger After MCI Agrees to Sell its Internet Business (July 15, 1998) [hereinafter DOJ MCI WorldCom Press Release]; MCI/WorldCom Order, 13 FCC Rcd at

Notwithstanding Exodus' views, a backbone's refusal to peer with another backbone may not be anti-competitive. Anti-competitive is defined to mean the ability of a firm (or firms) to maintain prices profitably above the level that would otherwise result from a competitive market. The search for anti-competitive actions focuses on actions that harm consumers, but do not necessarily harm competitors, for actions that harm competitors may not in fact harm consumers.<sup>136</sup> For instance, a merger may increase the efficiency of a firm and result in lower retail prices. While this may harm competitors, if many rivals remain in the market the merger is not anti-competitive, because lower prices benefit consumers. If a market failure is found to lead to anti-competitive actions on the part of one or more Internet backbone providers, a determination must then be made whether anti-trust laws would provide a sufficient remedy or if industry-specific regulation is required.

The effect of a backbone's refusal to peer with another backbone depends on the degree of competition in the backbone market. In a competitive market, a backbone may refuse to peer with a smaller rival for legitimate, rather than anti-competitive, reasons.<sup>137</sup> Nevertheless, backbones that

18109-18115, paras. 151-156. The Federal Communications Commission did conclude, however, that "peering is likely to remain an issue that warrants monitoring." *Id.* at 18115, para. 155.

<sup>132</sup> For instance, Level 3 argued that both MCI and WorldCom were refusing to peer with Level 3 and that the merger would increase the merger partners' incentives to discriminate against rivals seeking to interconnect. See Letter from Terrence J. Ferguson, Senior Vice President and General Counsel, Level 3 Communications, to Magalie Roman Salas, Secretary, FCC, Attach. (May 29, 1998) (filed in *In re Application of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications Corporation to WorldCom, Inc.*) [hereinafter Level 3 May 29, 1998 *Ex Parte*].

<sup>133</sup> DOJ WorldCom Sprint Complaint, *supra* note 114, at 14-21.

<sup>134</sup> Reply Comments of Level 3 Communications to the Application for Consent to the Transfer of Control of Licenses from Sprint Corporation to MCI WorldCom, Inc. in CC-Docket No. 99-333, at 11 (March 20, 2000).

<sup>135</sup> Kady, *supra* note 130, at 3.

<sup>136</sup> See, e.g., *Continental T.V., Inc. v. GTE Sylvania Inc.*, 433 U.S. 36, 59 (1977).

<sup>137</sup> Here we focus on reasons to deny peering that have their roots in economic considerations. Peering may also be denied for technical reasons, as a peer could be exposed to significant harms resulting from errors on the part of peering partners. A backbone with little technical competence may find willing peering partners scarce for technical reasons alone.

have been denied peering can enter the backbone market, because competition among the larger top-tier backbones gives them an incentive to provide transit arrangements to smaller backbones in place of peering. If, on the other hand, there was a dominant backbone, the dominant backbone might be able to disadvantage actual or potential rivals in an anti-competitive manner by, for instance, not peering or not providing transit to smaller backbones.

## 2. Analysis

### a. Competitive Backbone Market

An important determinant of the competitiveness of any market is whether new firms can enter the market and smaller firms can expand, thereby constraining any potential exercise of market power by the existing larger firms.<sup>138</sup> In order to enter or expand, Internet backbones need to interconnect with existing backbones in order to enable their customers to exchange traffic with the customers of existing firms, and they need access to fiber capacity to carry this traffic.<sup>139</sup> Much of the current debate focuses on the effects of one backbone refusing to peer with another backbone. Nevertheless, in a competitive backbone market, there may be a number of legitimate reasons, as discussed below, for one backbone to refuse to peer with another backbone. Therefore, such a refusal may not constitute a barrier to entering the backbone market. As long as transit arrangements are available on a competitive basis, smaller backbones can enter and ensure that the backbone market remains competitive.

One reason a backbone may refuse to peer is

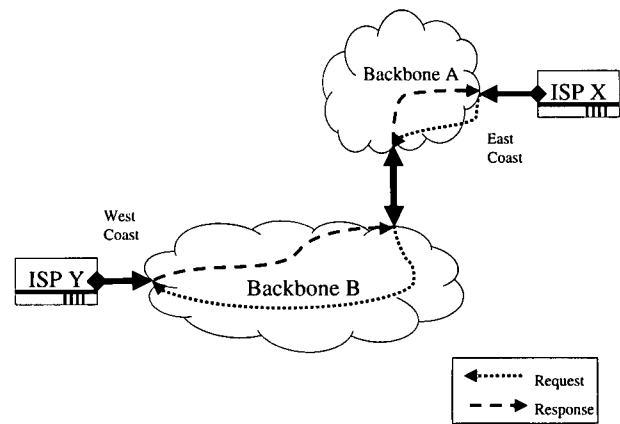


Figure 6: Example of Free Riding

that peering would enable the other backbone to free ride on its infrastructure investments. Figure 6 illustrates this situation. In the figure, backbone *B*, a national backbone, has a presence on both coasts. Backbone *A*, in contrast, is a regional backbone with a presence only on the East Coast. If the two backbones peered on the East Coast, when a customer of backbone *A* requests a web page from a customer of backbone *B* whose server is on the West Coast, then backbone *B* would carry the request from the East Coast to the West Coast and also carry the response back to the East Coast. The national backbone may thus refuse to peer on the grounds that it would otherwise bear the expense for a national infrastructure from which the regional carrier could then benefit at no cost. As a result of such considerations, a number of backbones require that peering partners be willing and able to interconnect at a number of geographically diverse locations.<sup>140</sup> This consideration seems to have motivated UUNET's decision

<sup>138</sup> UNITED STATES DEPARTMENT OF JUSTICE & FEDERAL TRADE COMMISSION, HORIZONTAL MERGER GUIDELINES, at [http://www.usdoj.gov/atr/public/guidelines/horiz\\_book/hmg1.html](http://www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html) (Apr. 8, 1997).

<sup>139</sup> As described above, fiber capacity is readily available, and thus this Section will focus on the ability of smaller Internet backbones to interconnect with larger ones.

<sup>140</sup> For instance, UUNET's North American Peering Policy states, among other things, that "[t]he Requester [of peering] shall operate [certain] facilities in at least 50% of the geographic region in which the WorldCom Internet Network with which it desires to interconnect operates such facilities" and that "in the United States, at a minimum, the Requester must have the ability to meet WorldCom's Internet Network at an East Coast location, a West Coast location, and at least two Midwest locations." WORLD COM, WORLD COM POLICY FOR SETTLEMENT-FREE INTERCONNECTION WITH INTERNET NETWORKS, at <http://www.uu.net/peering> (Jan. 2001) [hereinafter WORLD COM PEERING POLICY]. Sprint's Bi-Lateral Peering Policy contains a similar provision, stating that peering partners must be able to support peering arrangements "at 4 geographically diverse domestic U.S. locations." Letter from Michael G. Jones, Counsel, Sprint, to Magalie R. Salas, Secretary, FCC, Attach., (April 13, 2000) filed in Application for Consent to the Transfer of Control of Licenses from Sprint Corporation to MCI WorldCom, Inc. [hereinafter Sprint Peering Policy]. Finally, Genuity recently published its Internet Interconnect Guidelines. Press Release, Genuity, Genuity Announces Public Posting of Interconnect Guidelines, (Sept. 8, 2000). One of the criteria for public peering with Genuity is a presence at three or more Shared Interconnection Points (NAPs) where Genuity has a presence, two of which must be MAE-East and MAE-West. GENUITY, INTERNET INTERCONNECTION GUIDELINES FOR GENUITY, at <http://www.genuity.com/infrastructure/interconnection.htm> [hereinafter GENUITY INTERCONNECTION GUIDELINES].

to change its peering policy in 1997.<sup>141</sup>

Another reason for refusal results from the "hot-potato routing" that characterizes peering arrangements, which may also lead to actual or perceived free-riding, as a result of the specialized backbones providing service mainly to one type of customer, such as content providers. This situation can be illustrated by referring back to Figure 2. Suppose that ISP *Y*, a customer of backbone *B*, provides service mainly to content providers, while ISP *X*, a customer of backbone *A*, provides service mainly to end users. Given hot-potato routing, when an end user customer of ISP *X* requests content that is hosted by ISP *Y*, backbone *B* will carry the request from the East Coast to the West Coast, while backbone *A* would carry the requested content back from the West Coast. As a rule, content such as Web pages involve more bits of data than the corresponding requests for the content. Therefore, backbones such as *A* that carry the Web pages would transport more traffic than would backbones such as *B* that carry the requests for these Web pages. Backbones may thus refuse to peer with backbones hosting a high proportion of content providers on the grounds that they are bearing the expense for more capacity than the backbone that is actually hosting the content that utilizes this capacity.<sup>142</sup> This consideration may have motivated GTE Internetworking (now Genuity) and PSINet to refuse to peer with Exodus, a company that provides network services to content providers.<sup>143</sup>

The preceding paragraphs show that, in order to prevent free-riding, a large backbone may refuse to peer with a smaller backbone. In a compet-

itive market, these refusals may not have any anti-competitive intent or effect; indeed, such refusals may in fact have a pro-competitive result. A smaller backbone, denied peering on the grounds of free-riding, may then have an incentive to invest in infrastructure and compete for a varied mix of new customers in order to qualify for peering – resulting in an increased number of competing national backbone providers. As discussed below, this is only possible if the denied smaller backbone is able to enter the market with a transit relationship.

A more ambiguous example of free-riding arises when a backbone is refused peering because it has a small customer base. There are indications that a backbone may refuse to peer with a smaller backbone based on the amount of traffic generated by the smaller backbone. For instance, the published peering policies of UUNET, Sprint and Genuity all contain a requirement that a peering candidate be able to exchange a certain minimum amount of data at the beginning of the peering relationship.<sup>144</sup> An MCI spokesperson was quoted as saying that, for this reason, Level 3 was denied peering by MCI.<sup>145</sup> One justification given by the larger backbones is that it is difficult and costly to allocate necessary resources to potential peers with low current volumes that may or may not grow rapidly in the future. Nevertheless, this requirement may place backbones with low volumes in a Catch-22 situation; without a large number of customers generating traffic volume, it is not possible to negotiate peering arrangements with the large backbones; yet without peering, it may be difficult to gain the large number of cus-

<sup>141</sup> At the time, the president and CEO of UUNET, John Sidgmore, argued that "a few years ago all ISPs were generally the same size and used each other's infrastructures to a more or less equal extent. . . that situation no longer exists and consequently there are many cases where peering is not appropriate." Press Release, UUNET, UUNET Details Peering Strategy, at <http://www.us.uu.net/press/1997/peering.shtml> (May 12, 1997) [hereinafter UUNET May 12, 1997 Press Release].

<sup>142</sup> UUNET, for one, argues that companies that provide "web server farm" services and request peering with UUNET are "seeking to use UUNET's network for free, after UUNET has spent hundreds of millions of dollars to create its infrastructure." *Id.*

<sup>143</sup> John Curran, then Chief Technical Officer of GTE Internetworking, was quoted as saying that the traffic exchange with Exodus was "'wildly asymmetrical,'" and that as a result Exodus was getting a free ride from GTE Internetworking. Gerwig, *supra* note 130. Genuity now specifically states in its Internet Interconnection Guidelines that

one of the criteria for traffic exchange with Genuity is, "[f]or domestic ISPs, roughly balanced traffic." GENUITY INTERCONNECTION GUIDELINES, *supra* note 140. Similarly, Bob Leahy, Vice President of Marketing for PSINet, stated of Exodus that "[w]e were tired of carrying their load. They are a pure hosting play. What makes them meritorious to get free peering?" Kady, *supra* note 130.

<sup>144</sup> WorldCom expects that "the aggregate amount of traffic exchanged in each direction over all interconnection links between the Requester and the WorldCom Internet Network . . . shall equal or exceed 150 Mbps of traffic [in the United States]." WORLDCOM PEERING POLICY, *supra* note 140. Sprint's peering policy has a provision that the "average monthly traffic exchange between Sprint and the peering network must be justifiable." Sprint Peering Policy, *supra* note 140. One of the criteria for traffic exchange with Genuity is a "minimum Internet traffic exchange of 1 Mbps with Autonomous System 1." GENUITY INTERCONNECTION GUIDELINES, *supra* note 140.

<sup>145</sup> Engbretson, *supra* note 128.



tomers necessary to generate the traffic volume to qualify for peering. In order to determine whether the latter statement is valid, one must examine the implications for smaller backbones of not being able to peer with larger backbones.

It is important to differentiate between larger backbones refusing to *interconnect* with smaller backbones, versus the larger backbones only refusing to *peer* with smaller backbones. Instead of peering with the smaller backbones, the larger backbones may offer them a transit arrangement.<sup>146</sup> For instance, if backbone *A* is refused peering by backbone *B*, then backbone *A* could use a transit arrangement in order for its customers to have access to backbone *B*'s customers. Backbone *A* could take transit directly from backbone *B*, or it could become a transit customer of a third backbone *C* that is interconnected with backbone *B*, as in Figure 5.

Having denied peering to smaller backbones, one might question whether the larger top-tier backbones providing transit would refuse to either provide transit to smaller backbones or simply increase the cost of transit in order to squeeze out the smaller rivals. There are two reasons that this would be unlikely in a competitive backbone market. The first reason is unique to the Internet. In negotiating peering, one important bargaining chip is the number of customers to which a backbone provides access; this includes the number of transit customers. Therefore, backbones will compete with each other to win transit customers to use as leverage when negotiating peering relationships with other backbones. The second reason is traditional. The large backbones will compete for the transit business of smaller backbones in order to increase their revenues, which will keep transit prices down. In a growing market like the Internet market, in particular, one would not expect it to be profitable for a competitive backbone to raise prices and thereby restrict sales and growth in sales. Therefore, in a competitive backbone market, no backbone provider is likely to find it

profitable to use a price squeeze to disadvantage smaller rivals.

As a transit customer, it may be possible for a smaller backbone provider to grow and later qualify to peer with backbones that initially refused peering, including the transit supplier. Although a smaller backbone may prefer peering rather than being a paying transit customer either for quality or cost reasons, in a competitive market, a smaller backbone that only interconnects via a transit arrangement might not be at a competitive disadvantage.

Because transit does not involve the same service as peering, refusing peering in favor of transit is not simply a means of charging for a service that is otherwise provided free of charge. In a transit relationship, one backbone must pay another for access to the Internet. For instance, at the time that UUNET changed its peering policy in 1997, it announced that wholesale connectivity started at \$2,000 per month for a T-1 connection and \$6,000 for a fractional T-3 connection.<sup>147</sup> Transit customers receive benefits in return for these payments. When backbones pay for transit they benefit from the infrastructure investments of national or global backbones without having to make or utilize their own investments. In addition, as noted above, transit gives a backbone access to the entire Internet, not just to the customers of the peering partner. In order to provide transit customers with access to the entire Internet, the transit provider must either maintain peering arrangements with a number of other backbones or must pay for transit from yet another backbone. In other words, a backbone providing transit services is providing access to a greater array of end users and content than it would as a peer, thereby incurring correspondingly higher costs that are recuperated in the transit payments. In a competitive backbone market, transit prices should reflect costs and should not put entering backbones at a competitive disadvantage.

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<sup>146</sup> See, e.g., Rob Frieden, *Without Public Peer: The Potential Regulatory and Universal Service Consequences of Internet Balkanization*, 3 VA. J.L. & TECH., 1522, para. 16 (1998) [hereinafter Frieden].

<sup>147</sup> UUNET May 12, 1997 Press Release, *supra* note 141. A T-1 connection is a digital transmission link with a capacity of 1.544 Mbps. A fractional T-3 connection is a portion of a T-3 (44.7364 Mbps) digital transmission link. Letter from

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Terrence J. Ferguson, Senior Vice President and General Counsel, Level 3 Communications, to Michelle Carey, Common Carrier Bureau, FCC (August 7, 1998) (filed in Application of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications Corporation to WorldCom, Inc. [hereinafter Level 3 Aug. 7, 1998 *Ex Parte*]).

In terms of the quality of transit, Level 3 has suggested that, as a transit customer of another backbone, it would depend on the supplying backbone for delivery of IP traffic, at the very least placing Level 3 at a marketing disadvantage.<sup>148</sup> This view was affirmed in the DOJ Complaint in the MCI WorldCom/Sprint merger proceeding.<sup>149</sup> Nevertheless, at least one backbone, SAVVIS, initially relied only on transit connections and not peering and was very competitive in terms of quality.<sup>150</sup> Quality may improve with transit, at least compared with public peering at a NAP, because a transit connection may avoid the congestion of passing through a NAP to get access to a backbone. According to an executive at Digex, a Web-hosting company that used to own its own backbone, “[w]ith free peering, the level of service is not as good. It costs more [to pay for access], but the quality of service is better.”<sup>151</sup> In sum, there is evidence that paying for transit does not put a transit customer at an insurmountable disadvantage from a quality point of view.

In conclusion, the presence of a large number of top-tier backbones can prevent any anti-competitive actions. In a competitive backbone market, no large backbone would unilaterally end peering with another, as it has no guarantee that it would benefit from such an action. Furthermore, there would be no insurmountable barrier to entry or growth of smaller backbones. Larger top-tier backbones would continue to compete to provide transit services to smaller backbones. These smaller backbones would be able to resell these services to their own customers and would not seem to face any barrier to acquiring either the infrastructure or customer base that could enable them eventually to join the ranks of the larger backbones and qualify for peering. Actual, as well as potential, entry by new backbones would

act to constrain the actions of larger incumbent backbones, keeping prices at competitive levels.

b. *Backbone Market with a Dominant Firm*

If, on the other hand, a single backbone were dominant, it would be able to harm the public interest by engaging in a number of anti-competitive actions. As discussed above, it appears unlikely that a firm may organically grow to become dominant. Instead, the route to such dominance would likely be achieved by consolidation between backbone providers or by achieving market power over a key bottleneck input, such as transmission facilities. The issue of consolidation was at the heart of the debate surrounding WorldCom’s acquisition of MCI and, later, MCI WorldCom’s acquisition of Sprint.<sup>152</sup> A number of potential anti-competitive harms were raised by commentators in the MCI/WorldCom merger proceeding and identified in the Commission’s *MCI/WorldCom Order*.<sup>153</sup>

A dominant backbone could harm the public interest in a number of ways. First, by definition, a dominant firm has the unilateral ability to profitably raise and sustain retail prices above competitive levels. In addition, a dominant backbone would have both the ability and the incentive to stop cooperating with smaller backbones. Failure to cooperate could take a number of forms, including refusing to interconnect at all, executing a price squeeze, or degrading the quality of interconnection by not upgrading the capacity of connections with smaller backbones.

A dominant backbone could also abuse market power by refusing to interconnect with smaller backbones. The network externalities literature has shown that, in general, a larger network has less of an incentive to become compatible or in-

<sup>148</sup> Level 3 May 29, 1998 Ex Parte, *supra* note 132, at 4.

<sup>149</sup> DOJ WorldCom Sprint Complaint, *supra* note 114, at 13.

<sup>150</sup> Doug Mohny, *SAVVIS Shifts Gears and Ownership*, BOARDWATCH, at <http://boardwatch.internet.on/mag/99/apr/bwm66.html> (Apr. 1999). In 1997, SAVVIS Internet was rated the highest quality backbone provider by Keynote Systems. Jack Rickard, *Editor’s Notes*, BOARDWATCH MAGAZINE (May 1998). At the time, SAVVIS created private NAPs, bought transit from the largest backbones and did not peer at all, though Rickard notes that this is expensive.

<sup>151</sup> Kady, *supra* note 130, at 3 (quoting Bobby Patrick, Vice President of Strategy at Digex).

<sup>152</sup> The issue of backbone consolidation during the MCI/WorldCom merger proceeding was resolved when MCI

divested its Internet business to Cable & Wireless. *See infra* note 131. Later, because of the backbone consolidation, as well as other concerns, both the European Commission and the Department of Justice acted to block the MCI WorldCom/Sprint merger. *See* Press Release, Department of Justice, Justice Department Sues to Block WorldCom’s Acquisition of Sprint (June 27, 2000); Press Release, European Commission, Commission Prohibits Merger Between MCI WorldCom and Sprint (June 28, 2000) [hereinafter European Commission WorldCom Sprint Press Release].

<sup>153</sup> MCI/WorldCom Order, 13 FCC Rcd. paras. 149-150. Similar issues were raised by the Department of Justice in the course of the MCI WorldCom Sprint proceeding. *See* DOJ WorldCom Sprint Complaint, *supra* note 114, at n.165.

terconnect with a smaller network, as customers of the smaller network have more to gain from being able to communicate with customers of the larger network than vice versa.<sup>154</sup> In the context of the Internet, if a dominant backbone refused to interconnect with a smaller one, the customers of the smaller backbone would have an incentive to switch to the larger network in order to enjoy the network externalities associated with the larger backbone's customer base. Although customers of the dominant backbone would also lose access to the smaller network's customer base, they are unlikely to respond by switching to the smaller network. As a result, the smaller backbone would be positioned poorly to compete for customers, reinforcing the dominance of the largest backbone. It is noteworthy that the advantage of dominant networks also characterizes local telephony, where incumbent LECs must be compelled by statute to interconnect with smaller competitive LECs.<sup>155</sup>

A dominant backbone could also exercise market power by executing a price squeeze on those smaller backbones with which it interconnects. In a price squeeze situation, a vertically integrated firm with market power over an essential upstream input raises the price of this input to rivals competing in downstream retail markets.<sup>156</sup> The increased cost of this essential input forces downstream rivals to raise their retail prices.<sup>157</sup> The vertically integrated firm is then in a position to undercut the downstream rivals in retail markets and thereby increase market share and profits.<sup>158</sup> In the backbone example, interconnection is the essential input that smaller backbones must have from the dominant backbone in order to compete with the dominant backbone to sell backbone services to ISPs or directly to end users. Dominant backbones can refuse to peer with smaller backbones and also raise the price of transit services charged to those same backbones. This will weaken existing rivals and also prevent the entry of new backbones. As a result, the dominant back-

bone can raise downstream prices and increase profits.

A dominant backbone also might engage in non-price discrimination against rival backbones by degrading interconnections with rivals in order to win their customers.<sup>159</sup> This could most easily be done by "slow rolling" necessary increases in the capacity of the trunks used to interconnect with other backbones. Such capacity increases are a regular necessity to keep pace with the rapid growth in demand for Internet services. Under this scheme, a backbone, *A*, may degrade a connection with a smaller backbone, *B*. As *B*'s customers begin to feel the effects of this degradation when communicating with customers of backbone *A*, they may switch to backbone *A* in order to improve connections with customers of backbone *A*. It should be noted that, with two-way interconnections, the customers of backbone *A* would also be affected by this degradation when they attempt to communicate with the customers of backbone *B*. For this reason, *A* must be significantly larger than *B* so that its customers are relatively less adversely affected than the customers of *B* are and do not themselves switch.<sup>160</sup> In order to limit further the effects of non-price discrimination on its own customers, backbone *A* would engage in what it called "serial degradation" and target only one smaller backbone at a time.<sup>161</sup>

Thus, if a backbone were to become dominant, it could act in an anti-competitive fashion. Such a backbone market would share many characteristics with other network industries that traditionally warranted regulation, and it might then be in the public interest to apply similar regulations to the backbone market. However, at this time, as long as there are a number of competing top-tier backbone providers, entry by smaller backbones into the market is possible. In that case, there would be no need for any change in the current unregulated status of the Internet. Although competition between backbone providers is unregulated, consumers nevertheless benefit from the

<sup>154</sup> Katz & Shapiro, *supra* note 19; Jacques Cremer et al., *Connectivity in the Commercial Internet* (May 1999) (mimeographed material) [hereinafter Cremer et al.].

<sup>155</sup> See 47 U.S.C. §251 (2000).

<sup>156</sup> Martin K. Perry, *Vertical Integration: Determinants and Effects*, in *HANDBOOK OF INDUSTRIAL ORGANIZATION* 193 (Richard Schmalensee & Robert Willig, eds., 1992).

<sup>157</sup> *Id.*

<sup>158</sup> *Id.*

<sup>159</sup> See Cremer et al., *supra* note 154. These authors advised GTE on the non-price discrimination issue during the MCI WorldCom proceeding and formalized their analysis in that paper.

<sup>160</sup> GTE and its experts note that in a situation in which there is no dominant backbone, there would be no incentive for any backbone to attempt a serial degradation strategy in order to become dominant. See *id.* at Section 6.

<sup>161</sup> See Cremer et al., *supra* note 154.

same protections afforded consumers of all products and services. Existing antitrust policies, as applied in the MCI/WorldCom and MCI WorldCom/Sprint merger proceedings by the Department of Justice and the European Commission, along with the Federal Communication Commission's application of the public interest standard in the MCI/WorldCom case, can prevent the emergence of a dominant backbone in an otherwise competitive market.<sup>162</sup>

### 3. Consumer Protection in the Backbone Market

This paper has already discussed the underpinnings of the industry-specific regulation of network industries. When the underlying cost structure of an industry does not support competition, it may be in the public interest to regulate the prices and services offered by the resulting natural monopoly. Where competition is possible, regulation may be relaxed or eliminated to the extent that market forces can govern prices and services in place of regulations. Even where competition is possible, however, it is not guaranteed. As a result, antitrust laws have been enacted to protect consumers from anti-competitive behavior by a firm (or firms) that seeks to acquire or exploit market power.<sup>163</sup> The antitrust laws apply to the Internet backbone as they do to every other product and service market, and indeed they already have been invoked in the cases of the MCI/WorldCom and MCI WorldCom/Sprint mergers.<sup>164</sup> Many of the above arguments about the potential actions of a dominant backbone were raised during these merger proceedings.<sup>165</sup> These proceedings showed that the combined efforts of the European Commission and the Department of Justice, enforcing relevant antitrust statutes, as well as the Commission itself, upholding the pub-

lic interest standard, could prevent an increase in the concentration of the backbone market that could threaten consumer welfare.<sup>166</sup>

In the MCI/WorldCom merger proceeding, MCI divested its Internet business to Cable & Wireless in order to eliminate any overlap between MCI and WorldCom in the Internet backbone market and thereby satisfied concerns expressed by the Department of Justice and the European Union.<sup>167</sup> Parties argued at the time, however, that the degree to which MCI's Internet business was integrated with its other business units might complicate such a divestiture, in comparison with the divestiture of a stand-alone business unit such as WorldCom's UUNET backbone.<sup>168</sup> All relevant agencies approved the transaction based on their conclusion that the terms of the divestiture contract adequately addressed any potential complications arising from the divestiture of an integrated unit such as MCI's Internet business.<sup>169</sup> Since the divestiture, however, Cable & Wireless filed suit against MCI, claiming that MCI breached the divestiture contract by not transferring its complete Internet business;<sup>170</sup> according to Mike McTighe, Chief Executive Officer of Global Operations for Cable & Wireless, "MCI WorldCom's material breaches of the [divestiture] Undertakings threaten to impair Cable & Wireless's competitiveness."<sup>171</sup> This suit, which was settled, shows that the details of a divestiture may be important.<sup>172</sup> A complete divestiture of a business unit by one of the merging firms may mean that the market share of the merged entity does not change as a result of the merger. However, the competitive landscape may nevertheless change if the divested unit is harmed as a result of the divestiture and, therefore, poses less of a competitive constraint to the merged firm.<sup>173</sup>

In addition to this horizontal concentration in

<sup>162</sup> See MCI/WorldCom Order, 13 FCC Rcd. paras. 8-14.

<sup>163</sup> See STEPHEN MARTIN, *INDUSTRIAL ECONOMICS: ECONOMIC ANALYSIS AND PUBLIC POLICY* 45-50 (2nd ed. 1994).

<sup>164</sup> See DOJ MCI WorldCom Press Release, *supra* note 131.

<sup>165</sup> See, e.g., DOJ WorldCom Sprint Complaint, *supra* note 114, at 9-21.

<sup>166</sup> See *infra* at note 81.

<sup>167</sup> See *infra* at note 131.

<sup>168</sup> See *C&W Seen Urging EU to be Tough on MCI, Sprint Buy*, REUTERS ENGLISH NEWS SERVICE, Nov. 29, 1999; see also MCI/WorldCom Order, 13 FCC Rcd. paras. 151-56.

<sup>169</sup> MCI/WorldCom Order, 13 FCC Rcd. Paras. 151-156.; See also European Union MCI/WorldCom Press Release, *supra* note 131; DOJ MCI WorldCom Press Release, *supra*

note 131.

<sup>170</sup> *Hearing on Telecommunication Mergers Before the Senate Committee on Commerce, Science and Transportation*, 106th Cong. (1999) (statement of Mike McTighe, Chief Executive Officer, Global Operations, Cable & Wireless) [hereinafter McTighe testimony]; see also Denise Pappalardo, *Did Cable & Wireless Get the Shaft?*, NETWORK WORLD, April 5, 1999 [hereinafter Pappalardo].

<sup>171</sup> See McTighe testimony, *supra* note 170.

<sup>172</sup> Press Release, Cable & Wireless, MCI WorldCom and Cable & Wireless Reach Agreement over Internet Dispute (Mar. 1, 2000) ("MCI WorldCom has agreed to pay Cable & Wireless \$200 million in full and final settlement of the disputes.")

<sup>173</sup> In the recent MCI WorldCom/Sprint merger pro-

the backbone market, vertical integration could also lead to market power. Backbones may vertically integrate upstream into the market for the telecommunications inputs that underlie the services that backbones provide. Indeed, many backbones, such as WorldCom and Sprint, are already vertically integrated, owning their own fiber optic networks.<sup>174</sup> Because telecommunications transport capacity is readily available today from a wide variety of providers, including the vertically integrated backbones themselves, vertical integration itself is unlikely to create a barrier to entry. As with mergers of backbones, antitrust laws and merger policy should prevent undue consolidation of the telecommunications transport market that could lead the remaining telecommunications providers to engage in anti-competitive actions in the downstream Internet backbone market. In addition, existing common carrier regulations prevent vertically integrated telecommunications carriers from refusing to provide any necessary upstream telecommunications services sought by competing backbone providers.<sup>175</sup>

There also may be concern about downstream relationships between backbones and the Internet Service Providers for whom backbone services are a vital input. In addition to vertical integration, backbone providers could enter into exclusive dealing arrangements with ISPs, such that the backbone provider would provide only one ISP with its services. Likewise, backbones that already are vertically integrated with ISPs could choose not to provide backbone services to unaffiliated ISPs. In the growing Internet market such an exclusionary arrangement is unlikely, however, because backbones have incentives to increase the number of customers that they have as bargaining chips in peering negotiations.<sup>176</sup> In addition, given the availability of telecommunications inputs and transit arrangements, the possibilities of entry into either the ISP market or the backbone market could not be foreclosed by such a vertical arrangement.

Thus, the lack of industry-specific regulation of Internet backbones does not expose consumers to

economic risks that are different than those faced by consumers of other non-network products and services. Internet markets are subject to the same antitrust regulations that act to govern other industries in the event that competition is no longer able to provide customers with just and reasonable prices and quality levels.

The sections above show how, in a competitive environment without a dominant firm, interconnection, either by transit or peering, will be available to existing and new backbones. While consolidation is the most obvious means for a backbone to become dominant, as discussed above, there are other means by which a backbone could grow to become dominant. For example, one way is for a provider to leverage market power over last-mile access to end users into market power in the backbone market – an important issue that is best left to an analysis of the market for last-mile access. In another scenario, a new or existing backbone could develop a proprietary technology that makes it either more efficient or more attractive to end-user customers. If this technology is a new service, for example, the backbone may choose not to interconnect with other backbones for the provision of this new service. As customers switch to this backbone in order to benefit from the new service, the backbone may grow to become dominant.

If a dominant backbone provider were to emerge, this backbone provider could engage in a variety of anti-competitive actions, as described above, that would ultimately harm consumers. In this case, industry-specific regulation of the dominant backbone provider may be in the public interest. Other network industries such as telephony also have warranted industry-specific regulation, and the resulting regulations may provide a template for the regulations that could be imposed on a dominant backbone provider. Such regulations could include, for instance, interconnection obligations that would govern the peering and transit relationships offered by the dominant backbone provider. Any regulation of the Internet backbone market would represent a signifi-

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ceeding, the European Commission found the merging parties' proposal to divest Sprint's Internet business insufficient, concluding that the divested business would not "become a strong, viable competitor to prevent the merged WorldCom/Sprint from dominating Internet backbone." European Commission WorldCom Sprint Press Release, *supra* note 152. The European Commission noted that it explicitly took into ac-

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count the issues raised by Cable & Wireless after its purchase of MCI's Internet assets. *Id.*

<sup>174</sup> See FCC, CCB, FIBER DEPLOYMENT UPDATE END OF YEAR 1998 14 (staff report authored by Jonathan M. Kraushaar) (1999).

<sup>175</sup> 47 U.S.C. §202 (2000).

<sup>176</sup> See *infra* at Section III.A.2.a.

cant shift in the unregulated status quo under which the Internet industry has grown at unprecedented rates and, therefore, would require a corresponding significant shift in the competitiveness of the market.

## B. Internet Balkanization Issues

Although it is unlikely that any backbone will become dominant and act anti-competitively, some would argue that today's environment of universal connectivity among backbones may be unstable in the long run. Internet backbones may attempt to differentiate themselves from each other by offering certain new or existing services only to their own customers in order to raise retail prices and help attract new customers. As a result, the Internet may "balkanize," with competing backbones not interconnecting to provide all services.<sup>177</sup> This may resemble the early days of telephony, when all local companies were not interconnected.<sup>178</sup>

The dynamic nature of the Internet means that today's market structure and relationships likely will change. New services are continually being made available over the Internet. Many of these services, including Internet telephony and videoconferencing, are real-time applications that are sensitive to any delays in transmission.<sup>179</sup> As a result, quality of service ("QoS") is becoming a critical issue for backbones and ISPs. Two backbones establish high-quality interconnections over which they could guarantee QoS levels to their customers wishing to communicate in real-time with customers of the other backbone,<sup>180</sup> based on the economics behind a decision to interconnect to guarantee QoS, while assuming that any technical barriers to such interconnection could be overcome.<sup>181</sup> Backbones face a number of private economic considerations in making such interconnection decisions. Any private decision by one or more backbones not to interconnect to guarantee QoS levels for new services may also have public consequences, however, as consumers of one backbone may not be able to use these new ser-

vices to communicate with consumers of another backbone. There are strong market forces that would lead firms to interconnect in order to exchange traffic originating from these new services. If such interconnection does not materialize, proponents of any industry-specific interconnection regulation should nevertheless show why the lack of such interconnection justifies regulatory intervention.

The decision to interconnect for the provision of QoS services would appear to be relatively similar to the one that backbones currently make when deciding whether to peer with one another. The backbones each calculate whether the benefits of interconnecting with one or more other backbones would outweigh the costs. The benefits of interconnecting to exchange traffic flow from increasing the network of customers with whom one can communicate helps attract new users and encourages usage from existing users. The cost comes from a competitive network externality, as defined above; one backbone's decision to interconnect with another backbone makes the other backbone more attractive to customers. The widespread interconnection available today in the form of either peering or transit agreements indicates that currently the benefits of interconnection outweigh any costs.

There is, however, a difference between current interconnection arrangements and new interconnection arrangements for the exchange of QoS traffic. The Internet services that interconnection enables today, such as e-mail and Web access, already are universally available, and no one backbone or ISP could differentiate itself based on its unique provision of these services. Universal connectivity, however, is a legacy of the cooperative spirit that characterized the Internet in its early days. In the commercial spirit that pervades the Internet today, backbones and ISPs may view the new services that rely on QoS as a means to differentiate themselves from their competitors. A firm that introduces these new services may be less willing to share the ability to provide these services with competitors, as such sharing may reduce the

<sup>177</sup> See Frieden, *supra* note 146. Professor Frieden raises issues similar to the ones dealt with in this paper, with a focus on the effects of such balkanization on universal access to the Internet, notably in rural areas.

<sup>178</sup> See *infra* note 185.

<sup>179</sup> See, e.g., THE NEW MCGRAW-HILL TELECOM FACTBOOK 266 (Joseph A. Pecar & David A. Garbin, eds., 2nd ed. 2000).

<sup>180</sup> See also Michael Kende & Douglas C. Sicker, *Slice and Dice: The Fragmentation of the Internet* (2000) (unpublished manuscript).

<sup>181</sup> See FCC, THE INTERNET INTERCONNECTION CONUNDRUM (working paper authored by Douglas C. Slicker, Joshua Mindel & Cameron Cooper) (2000).

ability of the firm to charge a premium to its own customers. For instance, UUNET announced a Service Level Agreement ("SLA") that guarantees, among other things, the delivery speed (latency) of customers' traffic on its own network.<sup>182</sup> Because this guarantee does not extend to traffic that leaves UUNET's network, this encourages customers to keep traffic on-net.<sup>183</sup>

Even if backbones agree in principle to interconnect in order to be able to offer new services that require QoS guarantees, they may face practical difficulties in reaching a final interconnection agreement. Aside from disagreements over the terms of interconnection, it is possible that the backbones or their ISP customers must support compatible versions of a particular new service in order to be able to exchange traffic that originates with one backbone's end user and terminates with another backbone's end user. Before committing to a particular standard for this service, backbones may wish to wait for an industry-wide standard to emerge. This presents a coordination problem that may be difficult to resolve—in particular, if any firms have developed their own proprietary standards that they wish to see adopted as the industry-wide standard. In this situation, in spite of the fact that backbones would be willing to interconnect to exchange QoS traffic, the end result may be the same as if they were not willing to interconnect – end users would not be able to communicate across backbones using certain services.

Another potential issue relating to interconnection for QoS services is that it may exacerbate current congestion, and therefore it may be difficult to guarantee QoS across backbones. Assuming that interconnection for QoS traffic is implemented under the current settlement-free peering system, backbones will not be paid to terminate QoS traffic. As a result, receiving backbones will have little or no economic incentive to increase capacity to terminate this traffic. QoS traffic that traverses networks may thus face conges-

tion and would be unlikely to provide satisfactory quality. Of course, similar problems exist today with the current peering system, as described above, leading to the current congestion, but given the high data volume characterizing such services, the problem may be worsened. In order to provide the proper economic incentives to be able to guarantee to customers that they can deliver QoS traffic across networks, backbones may have to implement a traffic-sensitive settlement system for such traffic.<sup>184</sup>

If backbones are unable to overcome the economic, administrative and technical hurdles to interconnect to exchange traffic flowing from new services requiring QoS, then the Internet faces the risk of balkanization. Backbones only would provide certain new services for use among their own customers. The result would be that network externalities, once taken for granted, would suddenly play a major role for consumers of Internet services. In the current environment of universal connectivity, consumers who simply want to send and receive e-mail and surf on the Web can choose any retail provider without worrying about the choices of other consumers or content providers. If the Internet balkanizes over the offering of new services, consumers would need to be aware of the choices of those with whom they wish to communicate when making their own choice of Internet provider. For instance, a consumer who wishes to view real-time streaming video may need to be sure that the provider is connected to the same backbone to ensure high quality viewing. Likewise, a business that wishes to use the Internet for videoconferencing must make sure that all relevant branches, customers and suppliers are connected to the same backbone. Thus, any balkanization of the Internet would result in a classic example of network externalities; the specific backbone choice of each consumer would influence the choices of other consumers.

As a result of any balkanization of the Internet with respect to the provision of new services, cus-

<sup>182</sup> See UUNET.com, at <http://www1.worldcom.com/uunet/>.

<sup>183</sup> *Id.*

<sup>184</sup> Settlements are payments from a carrier that originates traffic to another carrier for terminating this traffic. See Henry Ergas & Paul Paterson, *International Telecommunications Settlement Arrangements; An Unsustainable Inheritance?*, TELECOMM. POL'Y, Feb. 1991, at 29. A form of settlement exists in international telephony today. *Id.* A settlement system

for the Internet would enable backbones to recoup the costs associated with terminating QoS traffic that originated on other backbones, giving backbones the proper incentive to invest in the capacity necessary to guarantee the timely delivery of this traffic. See, e.g., Maria Farnon & Scott Huddle, *Settlement Systems for the Internet*, in COORDINATING THE INTERNET 377-403 (Brian Kahin & James H. Keller eds., 1997). However, the technical and administrative costs of implementing such a system on the Internet are formidable. *Id.*

tomers wishing to communicate with a wide variety of others may end up subscribing to competing backbones, unless customers can coordinate on the choice of one backbone. This would raise the specter of the early days of telephony, when competing telephone companies refused to interconnect, resulting in many businesses and even some homes owning more than one telephone, corresponding to multiple local telephone company subscriptions.<sup>185</sup> As with the telephone system before it, any Internet balkanization may lead to calls for some form of interconnection regulation for backbones. Such regulations are unlikely to be necessary.

It is important to reiterate that network industries such as telephony, water and electricity have historically been regulated based on their cost structure to prevent a natural monopoly from exploiting customers. Such network industries are not generally regulated solely to provide customers the demand-side network externalities described above.<sup>186</sup> To impose interconnection regulations on Internet backbone providers in order to increase the benefits from network externalities for new services would represent a break from regulatory tradition.

There are many examples of products like the Internet that provide both direct and indirect network externalities that are not subject to industry-specific regulations.<sup>187</sup> For instance, almost every consumer electronics product consists of a hardware/software system with indirect network externalities. The usefulness of compact disc players, personal computers, web browsers and videocassette recorders depends to a great degree, if not totally, on the availability of compatible "software." The greater the number of users of the relevant "hardware," the more software will be available. Likewise, fax machines and e-mail involve direct communications between end users

with corresponding direct network externalities. In all of these cases, the market set the adopted standards or ensured that various companies' products were compatible with one another without any government intervention.

The marketplace has been quite successful at choosing standards that allow the products and services of different companies to be compatible with one another. Often, this is accomplished by a standards battle, such as the one waged between Betamax and VHS for the videocassette recorder standard.<sup>188</sup> In other cases, one firm may create an adapter that enables its products to be compatible with the products of another firm.<sup>189</sup> Another factor leading to compatibility is that firms in nascent industries have an incentive to cooperate on setting common standards that will enable the industry to grow so that later they can compete with one another over larger slices of the growing pie.<sup>190</sup>

In some cases, notably the personal computer market, more than one standard emerges, at least in part in response to consumer demand, as Apple is widely seen as meeting the demands of a niche market, while the IBM (Intel/Windows) standard meets the more general needs of the mass market.<sup>191</sup> It is worth noting here that it has been Internet protocols and applications, such as Web browsers and the Java language, that have served to meet the demands of users of IBM and Apple's respective platforms to interact seamlessly with one another.<sup>192</sup> A final example of a standard emerging as a result of marketplace forces is the Internet itself. The protocols at the heart of the Internet, TCP/IP, only relatively recently became the dominant standard for networking, at the expense of a number of proprietary and non-proprietary standards including SNA, DecNet and X.25.<sup>193</sup>

Although the marketplace is remarkably suc-

<sup>185</sup> As an example of this phenomenon, in 1910, Louisville, Kentucky was served by two local telephone companies—the Bell-licensed Cumberland Telephone and the independent Home Telephone Company. See MILTON L. MUELLER, JR., UNIVERSAL SERVICE: COMPETITION, INTERCONNECTION, AND MONOPOLY IN THE MAKING OF THE AMERICAN TELEPHONE SYSTEM 82 (1997). More than 75% of the large businesses and 9% of homes in Louisville subscribed to both services. *Id.*

<sup>186</sup> For instance, the 1913 Kingsbury Commitment, in which AT&T agreed to interconnect with independent local firms to provide long distance services, was made in response to a threatened antitrust suit, rather than calls to enable universal access for customers. See *infra* note 85.

<sup>187</sup> See *infra* Section II.D.1.

<sup>188</sup> See JAMES LARDNER, FAST FORWARD: HOLLYWOOD, THE JAPANESE, AND VCR WARS (1987) [hereinafter LARDNER].

<sup>189</sup> See OZ SHY, THE ECONOMICS OF NETWORK INDUSTRIES 17-18 (2001) [hereinafter SHY].

<sup>190</sup> See ADAM M. BRANDENBURGER & BARRY J. NALEBUFF, CO-OPERATION (1996).

<sup>191</sup> See SHY, *supra* note 189, at 28.

<sup>192</sup> See *infra* note 193.

<sup>193</sup> Transmission Control Protocol ("TCP") and Internet Protocol ("IP") together form a "networking protocol that provides communication across interconnected networks, between computers with diverse hardware architectures and various operating systems." NEWTON, *supra* note 17, at 708.



cessful at generating compatible standards, it would be a mistake to conclude that this process is costless for consumers or firms. Purchasers of Sony's Betamax VCRs found it impossible to rent or buy movies after the VHS standard won the standards battle, while Sony was forced to concede and begin selling its competitors' standard.<sup>194</sup> The government could theoretically have chosen a standard, thereby avoiding these costs. Nevertheless, in the United States, consumers and firms rarely, if ever, call for government intervention in these cases.

The marketplace is the preferred means for setting compatible standards in most industries and for most products for a variety of reasons. First, an open marketplace for standards leads to healthy competition for the rewards of owning a standard, and often "second-mover" standards are able to overcome an industry leader by embodying their standards in better products or more creative marketing of these products.<sup>195</sup> Second, as described above, innovators such as Apple Computer may target new products at niche markets, with consumers benefiting from the resulting variety. Such variety and innovation may not occur if a standard is chosen by non-market means. Therefore, while the marketplace may increase short-run costs involved with adopting new standards, the long-run marketplace benefits of competition and innovation are likely to more than make up for any short-run costs.

The marketplace should provide solutions to many, if not all, of the challenges that arise in the provision of current and new Internet services. Consumers, with expectations of universal connectivity and basic compatibility, are likely to demand that backbones essentially set standards for the provision of QoS services by agreeing to interconnect to provide these services. Backbones, in turn, may see that it is in their interest to interconnect in order to enable the market for QoS

services to grow. If firms limit offerings of new QoS services to their own customers, other marketplace solutions are available that may ensure that consumers can remain connected to the full Internet. For instance, if two backbones are unable to coordinate an interconnection agreement enabling interconnection for QoS services, consumers may simply interconnect to more than one backbone, a practice known as multihoming, or turn to firms such as InterNAP that connect with all major backbones, enabling their customers to communicate directly with the customers of all major backbones without themselves multihoming. Marketplace demands and market-driven innovations may alleviate the costs of any Internet balkanization, if not preventing it altogether, in more efficient ways than would the imposition of any interconnection regulations on the Internet.

In summary, if one or more backbones choose not to interconnect with other backbones for the provision of new services in the future, this is likely to be a temporary phase. This phase would end as a result of market forces that would induce backbones to interconnect, while at the same time, compelling pioneering providers to step into the breach to provide interconnection services for end users. Nevertheless, during this phase there may be calls to implement some form of interconnection regulation. Such intervention would be relatively unique, as there is little precedent for the regulation of networks such as the Internet where there are low entry barriers on the cost side. In addition, regulatory intervention would be a notable shift in United States policy.<sup>196</sup> As a result, any calls to intervene in the Internet market would require a correspondingly high burden of proof.

Some are calling for regulatory intervention in the interactions between backbones because (1) the lack of interconnection would lead to market power, with adverse effects on consumers;<sup>197</sup> and

<sup>194</sup> See LARDNER, *supra* note 188.

<sup>195</sup> For instance, VHS was able to overcome the Betamax lead to become the industry standard by providing longer recording times, among other things. Indeed, some attribute the initial advantage of VHS in the United States to the decision by its manufacturer to make tapes long enough to record a full American football game.

<sup>196</sup> The 1996 Act states that it is the policy of the United States to "preserve the vibrant and competitive free market that presently exists for interactive computer services, unfettered by Federal or State regulation." 47 U.S.C. §230 (b)(2) (2000).

<sup>197</sup> It is often argued that in markets with network externalities, lack of interconnection or compatibility will lead to "tipping," as consumers quickly converge on one standard in order to enjoy the benefits of being compatible with the largest possible installed base of the product. According to Stan J. Liebowitz and Stephen E. Margolis, "tipping occurs when a product subject to increasing returns [network externalities] generates sufficient momentum in market share that its domination of the market becomes inevitable." STAN J. LIEBOWITZ & STEPHEN E. MARGOLIS, WINNERS, LOSERS & MICROSOFT: COMPETITION AND ANTITRUST IN HIGH TECHNOLOGY 138 (1999). After studying a number of software markets in

(2) regardless of whether market power develops, interconnection between Internet backbones, enabling seamless communication between all Internet users, is in the public interest. However, an antitrust approach, rather than an ongoing regulatory approach, is the appropriate solution to protect consumers from any potential adverse effects of market power. In addition, the benefits and the costs of mandating interconnection and their balancing have not been shown. The benefits stem from the network externalities that backbones will be able to deliver to end user customers; the costs of mandated interconnection could include a lowered incentive to innovate in providing new services, less variety of new services, and any regulatory costs incurred by firms and the regulatory agency. Finally, the realities of mandated interconnection have not been addressed—who determines the terms of interconnection, the principles governing these terms of interconnection and how these terms should be enforced. Given the complicated nature of interactions between backbones, intervention may be complex; however, as described above, it is likely to be unnecessary as long as competition governs the interactions between backbones.

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which Microsoft participates, the authors conclude that there is no evidence of tipping in these markets. *Id.* at 228-229.

#### IV. CONCLUSION

In the past several years, a number of Internet backbones have questioned whether the commercial interconnection negotiations between backbone providers can yield fair outcomes for all parties. In addition, backbones may attempt in the future to differentiate themselves from their competitors by not interconnecting to provide certain new services. As a result, there may increasingly be calls to impose interconnection obligations on Internet backbone providers. Outcomes of a competitive Internet backbone market can differ from the network industries characterized by market power that historically warranted interconnection regulations. In addition, antitrust and competition protections can prevent any anti-competitive consolidation among Internet backbone providers. In sum, any traditional telecommunications regulation of Internet backbone interconnection is made unnecessary by a competitive backbone market, a conclusion that is consistent with section 230 of the 1996 Act.<sup>198</sup>

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<sup>198</sup> See *infra* note 125.