

# 18

FRANÇOIS BAR  
STEPHEN S. COHEN  
PETER COWHEY  
J. BRADFORD DELONG  
MICHAEL KLEEMAN  
JOHN ZYSMAN

## *The Next-Generation Internet: Promoting Innovation and User-Experimentation*

A THIRD-GENERATION INTERNET is rapidly emerging in which broadband, always-on access no longer remains the privilege of business users, but becomes available to all. This emerging infrastructure promises to create profoundly new possibilities for e-commerce: it will support the creation of new content marketplaces, enable the invention of new communication applications and services, broaden the reach of corporate networking to off-site locations and employees' homes. The current round of Internet reinvention, like previous rounds, ought to be driven by the cumulative creativity of multiple users, service providers, and equipment makers leveraging this new broadband platform to develop and implement their ideas. However, this will require a freedom of access to the residential broadband network for users, programmers, application creators, and the myriad companies selling Internet services. Limiting access to the third-generation Internet platform can only stunt this innovative process.

The Internet's success to date owes much to its open end-to-end architecture.<sup>1</sup> Applications reside in the end-nodes of the network (that is, computers connected to the network) rather than in its core. Thus the information superhighway has no single control point. Network ownership is no longer required to control network configuration and evolution, to

1. Saltzer, Reed, and Clark (1981).

unleash innovation and profits. As a result, the creation of an open network, applications, and end-to-end commerce services was the prime force behind the success of the Internet even as the Internet's new logic has forced a revolution in telecom networks and policy.

Over the coming decade residential broadband services providing "always-on" access will drive e-commerce development. The question is whether market forces will suffice to ensure the open access environment that has prevailed on telecom-based infrastructure for the first two generations. The struggle to ensure "open access" on the broadband Internet is thus a battle to shape not merely the cable or telecom industries but the very forms of network-based commerce, community, and creativity. Yet the cable industry has been skeptical of creating an "open access" model for its network. The cable network, which did not participate in the first Internet generation, retained a broadcast model in which ownership of the physical network itself has been the key to programming control and profits. As cable moved from "broadcast" to "broadband," policymakers were thus faced with an important choice. Should the open access requirements developed in the telecom world for previous-generation Internet be extended to the new cable broadband access infrastructures, or would competition among third-generation access networks serve as a substitute for open access and continue to sustain wide-ranging innovation?

The early broadband debate focused on issues of customer choice and investment incentives as well as arguments about the proper level of policymaking, federal or local. While these are important issues, a critical dimension has been missing from this discussion: the impact that the resulting architecture will have on shaping the very nature of the third-generation Internet and its innovation dynamics. The U.S. government has an urgent responsibility to ensure open access over residential broadband Internet in order to drive an innovative developmental trajectory. The government's responses to the recent merger of AOL with Time Warner have begun to address this problem much more constructively. Contrary to critics of excessive government intervention,<sup>2</sup> we believe that some initiatives to encourage open access were essential. There is no assurance that the current measures will be adequate, although the government

2. See, for example, James V. DeLong, "AOL & Time Warner: Meet the New Broadband Access Regulatory Authority (Formerly Known as the FTC)," Competitive Enterprise Institute, Washington, December 15, 2000.

is right to try for light-touch regulation in such a technologically dynamic market.

We have structured our analysis of residential broadband regulation in three main stages. First, we recount how past FCC policy, with its steady promotion of open access to the telecommunication infrastructure, made the Internet possible. We emphasize that the third generation is a distinct market, and as in the past, the practices concerning its network architecture are vital for competition and innovation. Second, we analyze the state of competition in the delivery of broadband access infrastructure at the inception of the merger. Our conclusion is that competition has suffered severe restrictions, which offer a poor substitute for open access. Third, we examine the repercussions of the FCC's decision on the AOL–Time Warner merger, investigate the positions taken by competitors in the cable market (especially AT&T), and analyze the impact of open access for innovation. Finally, we conclude with suggestions about the possible implementation of such a regulatory policy, drawing on regulation policy in Britain, Canada, and the EU.

### **Network Openness, Internet Evolution, and User-Driven Innovation**

Since its emergence about thirty years ago, the Internet has undergone constant transformation. We distinguish three successive generations. From the late 1960s to the early 1990s, the first-generation Internet was a network and social engineering prototype of interest to military and research organizations.<sup>3</sup> From the early 1990s until the commercial availability of broadband access around 1997, the second-generation Internet saw the mass adoption and commercialization of narrowband access, largely through dial-up modems providing intermittent, low-bandwidth connections. We have now entered a third phase of the Internet's history, when a critical mass of users is beginning to experience “always-on” high-speed access to the Internet from the home. Beyond the radical jump in transfer speeds, the functions to which a full-time connected broadband network can be turned and the ways it can be used represent a drastic change that will distinguish the “always-on” broadband Internet from its intermittent, narrowband precursor.

3. Hart, Bar, and Reed (1992).

In 1990, at the dawn of the second phase of the Internet revolution, nobody had quite envisioned the web or the influence it would have. Similarly today, no one can tell how the third phase will unfold, but one thing is already obvious: narrowband access will no more provide access to the services and functions of the broadband world than the monochrome, text-only computer displays in use throughout the Internet's first phase could have done justice to the second-phase web. If our analysis of the first two phases teaches us one thing, it is that the applications and services that will blossom during the third phase will come as a surprise. They will emerge through experimentation by users<sup>4</sup> and through competition among those providing users with the necessary tools. Experimentation will include broadband content, tele-work, music, movies, video, interactive games, and multimedia extensions of Internet telephony and instant messaging—some forms of which a monopolist provider (or an owner of massive libraries of copyrighted content) might prefer to inhibit. Some important innovations may involve interaction between web functions and conventional broadcast programming over broadband networks or the integration of programming and interactive communication within digital set-top boxes. A market and network structure that continues to promote extensive competition throughout the Internet is therefore clearly required.

### *Network Openness and Internet Success*

America's remarkable success in promoting the Internet revolution owes a major debt to determined regulatory action that encouraged all aspects of network openness and interconnection.<sup>5</sup> Throughout the first two phases of the Internet's evolution, a large variety of service and content providers could share existing infrastructure: the basic phone network. America Online and other Internet service providers, not the Regional Bell Operating Companies, popularized mass subscriptions to the Internet. Personal computers, the Netscape browser, and Cisco, not AT&T, drove the architecture of data networking and the web. All these innovations were possible because the Federal Communications Commission decided in the 1960s that the emerging world of data networking should not be treated like telecom services. Therefore it exempted all forms of computer net-

4. Napster, Gnutella, Scour, and the like offer good illustrations of users' innovative energy in the emerging broadband environment. See Kuptz (2000).

5. Oxman (1999).

working from much of telecom's regulatory baggage, including fees to fund various cross-subsidies for telephone services, and it prevented telephone companies from dictating the architecture of data networks.

Policy intervention, not "unregulation," forced network incumbents with market power (and the incentive to use it) to open their networks to these new entrants.<sup>6</sup> Promoting ever greater openness of the U.S. telecommunications infrastructure has been a significant theme of U.S. regulatory policy and an important factor in the Internet's success.<sup>7</sup> In today's policy language, the FCC chose to foster cost-based access to unbundled "network elements," the functional elements of the network, rather than to regulate end services. Whereas data services regulation would have frozen experimentation, this policy allowed a variety of actors to take basic network building blocks and combine them in diverse and unpredictable ways. Forty years of regulatory decisions taken by the FCC have progressively opened the phone network and shifted the impetus for telecommunications innovation from incumbent carriers to network users, alternative equipment suppliers, and new entrants.<sup>8</sup> Crucially, they protected the competitive space for new entrants to develop into viable commercial firms against entrenched incumbents by mandating interconnection to essential facilities and constraining the incumbents' use of market power.<sup>9</sup> These decisions in turn fostered user-driven innovation by giving leading-edge users—like financial services and energy and manufacturing firms—broader access to enhanced facilities and communication capabilities.

6. For specific details on these policies, see Bar and others (2000).

7. Oxman (1999).

8. Policies and proceedings like the *Specialized Common Carrier*, *Carterfone*, *Execunet* and *Open Skies* decisions, and the *First and Second Computer Inquiries*, permitted new entry into equipment, network, and service provision.

9. "Established carriers with exchange facilities should, upon request, permit interconnection or leased channel arrangements on reasonable terms and conditions to be negotiated with the new carriers, and also afford their customers the option of obtaining local distribution service under reasonable terms set forth in the tariff schedules of the local carrier." Moreover, "where a carrier has monopoly control over essential facilities we will not condone any policy or practice whereby such carrier would discriminate in favor of an affiliated carrier or show favoritism among competitors." See Federal Communications Commission, 29 F.C.C.2d 870 (1971), para. 157. See also "In the Matter of Use of the Carterfone Device in Message Toll Telephone Service," Docket 16942, 13 F.C.C.2d 420 (June 26, 1968); *MCI v. FCC* (Execunet I), 561 F.2d 365 (D.D.C. 1977), cert. denied, 434 U.S. 1041 (1978); *MCI v. FCC* (Execunet II), 580 F.2d 590 (D.D.C.), cert. denied, 439 U.S. 980 (1978); *Computer I*, 28 F.C.C.2d 267 (1971); *Computer II*, 77 F.C.C.2d 384 (1980); *Computer III: Notice of Proposed Rulemaking*, F.C.C. 85-397 (August 16, 1985).

A critical group of innovations involved “network performance features.” Examples of such features include higher speed connections, variable bandwidth, error rate correction, tailored data services, and a diverse and growing array of network management, configuration, and billing capabilities. None of these were necessary to provide plain old telephone service, and they were therefore largely unavailable from dominant carriers. As it unfolded, the FCC’s open network policy contributed to the development of these features and made them broadly available to network users and competitive service providers alike. More recently, the FCC policy of openness has moved to further enhance user-driven innovation and to broaden the possibilities for extended user choice by enabling deeper access into the incumbent local network. This created the necessary preconditions for the success of Digital Subscriber Lines (DSL) and the rapid funding by the public markets of numerous competitors to the Incumbent Local Exchange Carriers (ILECs) for high-speed data services. Throughout this history, the monopoly owners of the communications infrastructure strongly resisted opening their network to other service providers. Yet policy persistence paid off, gradually forcing open access to the infrastructure resources the incumbents monopolized. This was the key to the flourishing of a dynamic communications market and the emergence of the Internet. Consistently throughout this history, the FCC rejected claims that networks had to be closed to generate enough investment incentives.<sup>10</sup> In each case, the innovative development of the industry with new uses and new suppliers would have suffered had it been forced to develop in a “closed access” environment. Network openness has in fact radically stimulated the use of incumbents’ telecom assets such as second lines.

Indeed, U.S. policy has moved gradually and consistently, though not always intentionally and still incompletely, toward support of the new user-driven innovation paradigm. This steady policy set in motion and sustained a virtuous cycle of cumulative, user-driven innovation, new services, and infrastructure development, increasing network usage—with evident economic benefits for the U.S. economy.<sup>11</sup> Perhaps the most dramatic single example is the emergence and evolution of the World Wide Web, driven almost entirely by Internet users who pioneered all of its applications.

10. For example, the FCC consistently argued that long-run incremental cost (LRIC) allowed the sharing of network functions on terms that provided for a competitive return on capital. The furious debate over LRIC for unbundled network elements had this discussion as a critical feature.

11. Bar and Borrus (1997).

The World Wide Web in turn facilitated a new surge of innovation that has ushered in Internet-based e-commerce. Furthermore, in an unexpected collateral benefit, the virtuous circle of policy and market innovation came to be recognized by the rest of the world as the right template for network competition and the growth of the Internet. It thus gave the United States a voice in global policy that went far beyond its political and market power.

This network openness and the user-driven innovation it encouraged were a distinct departure from the prevailing supply-centric, provider-dominated, traditional network model. In that traditional model, a dominant carrier or broadcaster offered a limited menu of service options to subscribers; experimentation was limited to small-scale trials with the options circumscribed and dictated by the supplier. By contrast, open access to the network led to rich experimentation by many actors whose ideas had previously been excluded from shaping network evolution. It is a safe bet that few people, back in the days of 300-baud modems, ever thought that 28.8K data communications would flow over ordinary voice phone lines. Even speeds of 9600 bits per second were seen as reachable only with expensive, cleaned, better-than-voice lines—ISDN or some similar special service. Diversity of experimentation and competition on an increasingly open network was key, since nobody could foresee what would eventually emerge as successful applications. Openness allowed many paths to be explored, not only those that phone companies, the infrastructure's monopoly owners, would have favored. Absent policy-mandated openness, the Regional Bell Operating Companies (RBOCs) and monopoly franchise CATV networks would certainly have explored only the paths of direct benefit to them. It is doubtful that without such policy-mandated openness the Internet revolution would have occurred.

Throughout this process, the most successful innovation paths challenged the very core of the phone monopoly business as well as the industry's technology and business assumptions. Yet as the Internet ushered in the "creative destruction" of the old network model, it led to deeper economic change and greater business opportunities than anyone could have envisioned.

*Who Ought to Shape the Internet's Third Phase?  
Assessing Competitive Provision of Broadband Access*

As we enter this third phase of Internet evolution, the widespread diffusion and adoption of broadband technologies, we face again a similar situation.

Locally, one provider—the monopoly cable franchise, with significant market power in key market segments, broadband interactive multichannel video service to homes,<sup>12</sup> and broadband Internet access to homes outside the DSL circle—finds itself in a position to prevent open access to the Internet. Nationally, the dominant cable firms have slowly accepted limited access policies. Based on the history of telecoms sketched above, this should not come as a surprise. The question is obvious. The successful policy trend of the past thirty years has been to force competition and ensure open access to the incumbent infrastructure when there are significant problems pertaining to market power. Why, now, reverse that successful policy?

As stated, there is both a local and national dimension to cable's power in the market for Internet access. At the local level, cable providers have substantial market power in the broadband access and broadband service provision, because the cable franchisee, whether it be AT&T, Time Warner, or anyone else, typically has a local monopoly over the cable infrastructure.<sup>13</sup> As a result of recent acquisitions, two firms, AT&T and Time Warner, now control the majority of the U.S. cable television infrastructure. These vast corporations now have substantial market power over large sections of the present and future broadband Internet and consequently find themselves in a position to have a profound impact on the Internet's third phase. This share gives them significant influence—well beyond the sheer market power indicated by the number of homes passed by a cable system in which they have an ownership stake. Indeed, it allows the companies to coordinate the activities of many local monopolists and shape the overall network architecture and standards. The cable operators' current strategies lead them to integrate vertically with Internet service providers (ISPs): AT&T with Excite@Home, Time Warner with AOL. Even if the cable providers let in only one or a few additional ISP partners, there may be insufficient conditions for vigorous competition. In addition, the cable owners will decide which additional ISP(s) they let in and may prefer to pick the least threatening to their own strategy. While it is important to be

12. We do not focus in this piece on interactive television over broadband, although it loomed large in the FTC's reasoning about the AOL–Time Warner merger, because cable has no monopoly on broadband television services. See Owen (1999).

13. Local franchises, moreover, come up for renegotiations only episodically or with a change of ownership, further reinforcing cable's local monopoly power. A limited number of regions in America have two systems, but they are very much anomalies.

sensitive to the costs of regulation, a sound policy has to go beyond ensuring access to one or two rivals to the integrated ISP.

Clearly, all telecom industry players recognize the importance of this turning point. They have undertaken massive efforts to upgrade existing local telephone and cable infrastructures and to develop new broadband wireless access. In that respect, the current competitive situation is different from the previous generations, where there clearly was no alternative to Ma Bell's dominant access infrastructure. Yet this does not mean that broadband provision is fully competitive or competitive enough for access not to be an issue: deployment patterns, different regulatory heritage, lead-time of cable, and switching costs result in cable dominance over broadband delivery infrastructure in the short to medium term. Cable providers, which have monopoly franchises in most markets, are achieving substantial market power over broadband Internet access.

In our analysis, the relevant market for this policy discussion is the residential broadband access, distinct from narrowband dial-up access. We distinguish broadband access from narrowband and residential access from commercial. Regarding the differences in bandwidth, it should be noted that although there is overlap between the services, broadband is much more than a faster version of the old narrowband Internet. Rather, it enables previously impossible bandwidth-intensive services like broadcast quality video streaming and IP-based videoconferencing. Therefore, the relevant market for our analysis is the market for broadband access, separate from the overall Internet access market. The FCC at first rejected the distinction between broadband and narrowband access but has accepted it during the course of the AOL–Time Warner hearings, recognizing that narrowband technologies are not true substitutes for broadband.

A further distinction about relevant market rests on the classes of end-users, where the FCC's traditional distinction between residential and business markets makes sense. "Always-on" broadband access allows home networks to be permanently connected to the Internet, with access appliances or screens in several rooms. What really distinguishes this phase is the final convergence of TV and PC, of entertainment, education, and work at home: the seamless linking of the home into the larger electronic community. The architecture of the integration point, whether a digital set-top box, a new DSL consumer device, or a home wireless hub, will determine which industry players participate in creating these applications and shaping their character. Sustained development of this next generation of applications will require a critical mass of broadband-enabled users. Closing off key segments

of the broadband infrastructure to a monopoly provider or a cartel of dominant providers would inevitably choke off the very innovation that has created value from today's Internet. Thus the residential broadband access market is relevant not only in terms of the economic analysis of market power but also in terms of its broader policy importance.

This section argues, first, that in the first five years of the twenty-first century, cable has the ability and incentive to exercise market power in regard to a very significant part of the residential broadband access.<sup>14</sup> Second, even when residential consumers have a choice of broadband access provider, significant switching costs blunt competitive dynamics, reinforcing cable's lead. This lead is likely to endure through the near term, marking the first five years of broadband access deployment. This initial period is particularly critical because patterns get set early.

### *The Deployment of Broadband Access Alternatives*

The pace of broadband access infrastructure deployment is picking up dramatically. Both CATV operators and ILECs are working hard to upgrade their networks so they can offer broadband Internet access. In addition, a number of wireless technologies are now emerging as broadband alternatives, ranging from "wireless cable" approaches, such as Multichannel Multipoint Distribution Services (MMDS) and Local Multipoint Distribution Services (LMDS), to "High Data Rate" (HDR), Satellite (Tachyon, Spaceway, Teledesic), or "fiberless optics" (Terabeam). Yet the availability of "last mile" competitive broadband network infrastructure for residential customers remains limited. For all practical purposes, cable and DSL are currently the only broadband options available in the residential market, and cable has a substantial lead over DSL, as the FTC decision on Time Warner conceded. For example, the FCC reported June 30, 2000, figures showing 2.2 million cable subscribers versus just under one million DSL subscribers.<sup>15</sup> While more data must be gathered, we can reasonably accept the most conservative industry estimates, reflecting a 2-1 lead for cable.<sup>16</sup>

14. This chapter focuses on access to broadband Internet services rather than cable provision of interactive TV. While the latter is an important sector of possible cable monopoly, we concentrate on the provision of more flexible Internet services where more fundamental end-to-end innovation will occur.

15. See FCC news releases, 2000.

16. An extensive array of data about cable's early lead over DSL is available in Bar and others (2000).

Predictions about the future of broadband access competition are more dispersed, although most reports agree that cable's lead probably will endure through 2003. There is much evidence to support predictions that cable will continue to dominate. In particular, only 23 percent of U.S. households are within 12,000 feet of an upgraded central office, without Digital Loop Carrier (DLC), and therefore can technically receive DSL service, while 52 percent of U.S. households are passed by upgraded two-way cable plants that can technically deliver broadband access.<sup>17</sup> Ironically, ILECs are handicapped by their recent upgrades because the DLC equipment they deployed to connect new suburbs make these lines unfit for DSL and will have to be replaced—at a substantial cost. By contrast, cable companies have aggressively deployed digital video services to compete with Direct Broadcast, reaping substantial revenues from that deployment. That investment brings them ever closer to offering broadband data services. While there are certainly additional costs to make digital cable interactive, less than 5–8 percent of the total bandwidth on a digital cable system is used for high-speed data services; the rest remains available for profitable digital video services. Holding a franchise monopoly for cable TV thus creates a solid foundation for cable to enter the market for broadband access.

Overall national figures, whether market share or addressability, provide a misleading picture of the competitive situation. Indeed, in the short to medium term, broadband cable and DSL deployments are taking place along two distinct paths with relatively limited overlap. The cable modem path generally covers only residential areas and clearly dominates in many suburbs.<sup>18</sup> While it is to be expected that eventually most homes will have a choice between two broadband wires, cable and DSL, in the near term most will have only one option, and in most cases that option will be cable.<sup>19</sup>

In its staff report on broadband deployment, the FCC's Cable Services Bureau noted that in addition to these wired approaches, a number of

17. McKinsey and Bernstein (2000, p. 9).

18. Les Freed, *PC Magazine*, March 9, 1999, p. 172.

19. It should also be noted that a few U.S. cities, notably Palo Alto, California, and Dunwoody, Georgia, have undertaken fiber-to-the-home trials. At this point, however, these remain pricey (Palo Alto's costs \$1,200 for the connection fee and \$92 a month for 10 Mbps service, or twice those rates for 100Mbps), and their availability is likely to remain quite limited in the near term. See Hecht (2000) and "Fiber to the Home (FTTH) Trial" ([www.city.palo-alto.ca.us/utilities/fth/index.html](http://www.city.palo-alto.ca.us/utilities/fth/index.html) [March 2001])

broadband wireless technologies will be offered within a few years.<sup>20</sup> Sprint plans to deploy one such technology, Multichannel Multipoint Distribution Services, in eighty-three U.S. markets before 2003, offering data rates and prices roughly similar to today's cable modem and DSL solutions.<sup>21</sup> Like cable, MMDS is a shared solution (in fact, the technology started out as a "wireless-cable" approach to deliver CATV programming). In addition, it suffers from technical limitations, such as the requirement for line-of-sight connections and susceptibility to bad weather. Others in this general category are a variety of "wireless competitive local exchange carriers (CLECs)."<sup>22</sup> However, analysts see MMDS and fixed wireless as niche plays, estimating they will take respectively 8 percent and 7 percent of the broadband access market by 2004, primarily in areas where neither cable nor DSL is available.<sup>23</sup> Also on the horizon is an array of other high bandwidth wireless technologies; for example, Qualcomm's High Data Rate (HDR) wireless technology is expected to offer up to 2.4 Mbps, but it is several years away from extensive commercial deployment.<sup>24</sup>

In summary, the competitive landscape that emerges from current technology deployment and announcements is one in which until 2004, cable and DSL will jointly dominate the provision of residential broadband access. This timeframe provides a useful horizon: by then, broadband residential access will have been available for about five years, a period roughly comparable to the existence of second-generation Internet.<sup>25</sup> Throughout the period, all indications are that cable will enjoy the lead—a vast initial head start, progressively decreasing to rough parity over the five-year period, assuming that ILECs carry through the substantial network upgrades required. In addition, national market share numbers will likely overstate the amount of real competition between cable and DSL net-

20. FCC Cable Service Bureau (2000, p. 29).

21. "Sprint Rolls Out Wireless Cable: Ubiquitous Broadband Coverage Planned", *Boardwatch*, February 2000.

22. These include Advanced Radio Telecom (ART), NextLink, Teligent, and WinStar, which generally plan to focus on providing broadband service to buildings in urban areas that are not served by existing fiber or CLECs.

23. McKinsey and Bernstein (2000, p. 31).

24. See ([www.qualcomm.com/cda/tech/hdr/whatis.html](http://www.qualcomm.com/cda/tech/hdr/whatis.html)). There is great controversy over the feasibility of satellite systems like Spaceway and Teledesic. Another major development is the advent of the wireless local area network, symbolized by the 802.11 systems. However, these local area networks in homes (or uniting clusters of homes) still require a high-speed pipe to feed them.

25. Netscape 1.0 was released on December 14, 1994, providing a convenient marker for the start of the second-generation Internet.

works, as many individual households will not be technically addressable by both systems. In fact, cable operators and telecom companies (telcos) often are not really competing head on, having essentially partitioned the broadband access market: cable modems for residences, DSL for small- and medium-size businesses.<sup>26</sup>

### *The High Costs of Switching*

At one point, the FCC suggested that cable's initial success has created competitive opportunities and "spurred the deployment of Digital Subscriber Lines (DSL)."<sup>27</sup> Still, for competition to serve as a check on broadband providers' behavior, it needs to be easy for residential consumers to switch from one provider to another. In areas where both broadband cable and DSL are available, competitive discipline only works if the costs of switching from one technology to the other are low enough that consumers do not feel "trapped" by the provider they happened to choose initially. These switching costs are substantial, however, and combined with broadband cable's early deployment lead, they militate against the free exercise of market power. The switching costs have several sources: the network's physical architecture, its logical architecture, and the "stickiness" that results from structuring one's activities around specific network services.

The physical architecture of the network creates substantial switching costs. Different requirements for inside wiring, different terminal equipment, nonrefundable connection charges, and different computer setups in many cases are among the factors that can easily push the physical cost of switching between cable and DSL up to several hundred dollars.<sup>28</sup> There is much variability in these costs: some cable operators allow their customers to buy cable modems while others include a rental charge in the service fee, different operators and telcos charge different set-up fees, and in these early stages, carriers occasionally waive sign-up fees.<sup>29</sup> An additional cost—

26. McKinsey and Bernstein (2000, pp. 10–11). See also "Give Peace a Chance," *Boardwatch*, April 21, 2000.

27. FCC Cable Service Bureau (2000, p. 9).

28. Bar and others (2000, p. 20) provide a detailed itemization of these costs as of mid-1999. They tend to change often, as the broadband providers refine their marketing plans, and various incentives and pricing plans make a side-by-side comparison difficult.

29. For example, SBC waived installation charges and equipment fees during the first half of 2000 in exchange for a one-year commitment.

inconvenience or lost work hours—comes from the fact that today, both DSL and cable installation require a service call by a technician during business hours (and sometimes, in these early days of the technology's development, several service calls). These costs also decline as both cable and DSL technologies become more robust and as new technology implementation, such as splitterless "G.lite" DSL, eliminates the need for a technician visit. At this point, however, these various costs and inconveniences add up to substantial hurdles for residential customers, making the switch between broadband access methods much more costly and cumbersome than either switching from one DSL provider to another or switching among narrowband ISPs. As a result, broadband cable providers that are not required to offer fully open ISP choice may well have several hundred dollars' worth of room to maneuver before their customers look somewhere else.

The logical architecture of the network and the associated software also create important switching hurdles. Information access and transmission systems become embedded with one's current provider. This is in contrast to narrowband Internet service provision, where customers can switch relatively easily between ISPs and still have equally convenient access to various kinds of content. Let us consider these several costs of switching from one broadband system to another.

First, many everyday communication activities are tightly entangled with one's Internet provider, so that shifting providers may range from the inconvenient to the truly burdensome. With narrowband Internet access, the inconvenience is typically limited to getting a new e-mail address and modifying a few dial-up settings. Already, the absence of an "e-mail portability" equivalent to telephony's number portability represents a non-negligible switching cost. However, switching among broadband access providers would be much more cumbersome because broadband Internet supports an increasingly wide range of new communication activities. For example, for customers who elect to use their "always-on" broadband connection to run web servers from their home, the switch would require a modification of the DNS tables to link their domain name to the new IP address they would receive.<sup>30</sup> Additional inconvenience would include the

30. Obviously, at this time, this is a "problem" only DSL customers face, since broadband cable customers are prohibited from running any kind of server from their home through their cable modem service according to the terms of their service agreement. The cost of that operation depends on the ISP providing the DNS service. For example, Pacific Bell Internet charges \$100 for its DSL customers to link their IP address to a domain name (or to change such link).

loss of adaptive set-ups that provide ease of access or access to special services.<sup>31</sup>

Second, if arguments about bundling are correct, competition is all the more stifled. Some market analysts estimate that merely the prospect of bundled services creates approximately \$150 in new value per subscriber for a cable system, irrespective of value created by the anticipated revenue from each individual service offering.<sup>32</sup> There may be competitive advantages in the package of services created, advantages in pricing those services, and advantages in a single bill. Indeed, the consumer's preference for one bill is believed to be strong enough to reduce switching, even without price reduction for the services in a bundle.<sup>33</sup> Consider only the geographic monopolies noted above. In those areas, cable's competitors cannot create equivalent packages. The ability to include television offerings in its bundles, whatever the rules on control of program content may be, certainly makes it easier for AT&T and AOL-Time Warner to create distinctive packages. AT&T could, and apparently intends to, offer integrated bundles of phone service (both local and long distance), cable TV, mobile services, and ISP.

The new AOL-Time Warner company probably will offer different service bundles, but these would raise similar concerns. For example, these bundles may not include telephone services but would include instant messaging (and its upcoming multimedia extensions), which many see as a significant alternative to IP telephony. As the FTC and FCC both argue, AOL is a dominant ISP. Some aspects of its ISP service, the Network Presence Database (NPD) function-service for instant messaging, can create market power in specific applications such as instant messaging. As a consequence, the AOL-Time Warner merger results in the combination of entities with upstream (NPD) and downstream (cable network) market power, further increasing their ability to define unique service bundles that include features over which they exert substantial market power.

More broadly, the vertical nature of the AOL-TW merger led the FTC to raise concerns over vertical foreclosure, including control of programming

31. This category of switching cost, it should be noted, is not specific to cable but affects users switching from DSL to cable, or from cable to DSL, or even among different DSL providers. Their dampening effect on competition might be mitigated, though not eliminated, by rules addressing e-mail portability or IP address portability.

32. John M. Higgins, "All For Just \$5,000," *Broadcasting and Cable*, May 10, 1999, pp. 16-18.

33. This represents \$49.5 million of the value of @Home's present subscriber base of 330,000. The estimate is from Kinetic Research, cited in Alex Lash, "Surfing the Skies," *Industry Standard*, February 1, 1999, p. 30.

content. In particular, the FTC has pointed out that AOL-TW would have incentives to interfere with content provided by nonaffiliated companies, especially when this competes directly with AOL's recently introduced interactive TV offerings.<sup>34</sup> However, the flip side of this position is that AOL does have bargaining power with AT&T cable et al. Indeed, the FTC went so far as to impose conditions designed to make sure that an integrated AOL system could not use its market power to discourage build-out by rival DSL networks. Time Warner's merger with AOL has provided the media giant with AOL's massively successful Instant Messenger (IM) service. Bundling broadband video streaming IM with cable service could mean AOL-Time Warner dominance over a potential third-generation Internet's "killer app."<sup>35</sup> If competitors cannot create equivalent bundles, the resistance to switching one component of the bundle—broadband access—to an alternate supplier obviously increases. The anticompetitive effect of such bundling strategies will be further amplified through cable players' efforts to leverage control of the set-top box and capture an increasing share of upside services.<sup>36</sup>

Finally, and more fundamentally, consumers may never find out what they are missing by being denied open access and thus may never be in a position to decide whether switching broadband provider is worth the costs just described. With traditional products, we tend to think of switching costs as part of a rational decision between two well-known alternatives. For example, customers switching from one brand of cereal to another have all the information they need to make a rational choice: they know the prices, they see the packaging, and they can easily compare objective nutritional value and subjective taste. Not so when picking between two alternative broadband access services. Prices are not always what they seem, with countless hidden costs ranging from rewiring to domain name resetting, and packaging is less than transparent when broadband services come as part of complicated and hard-to-compare bundles.

34. See FTC, "AOL Analysis" ([www.ftc.gov/os/2000/12/aolanalysis.pdf](http://www.ftc.gov/os/2000/12/aolanalysis.pdf)).

35. The FCC decided that IM was an earned dominant market position in permitting the merger. However, it also decided that the IM name and "presence" database (how you know someone else is online) have become dominant due to tipping effects in the market. The merger would not change the degree of market power. But there was the issue of a potential to leverage dominance in current IM into new advanced video streaming IM services. The FCC has consequently decided to insert a condition that for advanced video IM, AOL will be impelled to release the name and presence databases with rivals, albeit after AOL has improved security and privacy safeguards.

36. Galperin and Bar (1999).

More insidious is the difficulty to assess real-life performance (the service's objective "nutritional value") or to really understand the difference between "open-access" and "closed-access" communication experiences (the service's subjective "taste"). Just as with cereals, customers cannot know what they are missing until they buy the competitor's product and try it out. But unlike the case with cereals, where it is easy to buy two different boxes and give them a taste trial over breakfast, few customers will subscribe to both cable service and DSL and benchmark them against one another before deciding which one they like best. The good news is that whichever they choose, it is likely to be much better than the analog modem it replaces. The bad news is that they will probably never know how much better it could have been had they picked the other one. Until 1998, when France Telecom finally decided to take a real stab at offering mass-market Internet access, French citizens thought that second-generation Minitel was very cool. As they marveled at their new Minitel terminals displaying alpha-mosaic images faster than ever before, they never suspected that across the Atlantic (and across the Channel), the web had vastly overtaken their once-pioneering *télématique*.

In such cases, when first-hand information is hard to obtain, users typically rely on others to help them choose. They follow the lead of neighbors or read *Consumer Reports*. Operationally, for broadband consumers, comparative shopping will generally mean comparing notes with friends and neighbors who have an alternative. There is clear evidence for this behavior from the PC world. PC users, Austan Goolsbee and Peter Klenow have shown, are strongly influenced by their local social network.<sup>37</sup> But neighbors will not be much help if what broadband access service is available to them depends on which cable providers control the local monopoly. French customers certainly could not count on their French neighbors to tell them about the Internet. Even trade magazine benchmarking reports may be of limited use because in the short term, until full-fledged third-generation services emerge, the differences between various flavors of broadband Internet access will seem subtle to the residential consumer. Indeed, the average household does not directly experience "open broadband Internet-access" or "dynamic caching" but rather the services delivered over broadband access infrastructure—web pages loading faster or smoother streaming video. But even when delivered over a third-generation infrastructure, these still remain second-generation applications.

37. Goolsbee and Klenow (1999).

*The Nature of Cable's Dominance*

The combination of cable's early and continuing lead with high switching costs strongly suggests that cable owners will hold considerable power over the broadband residential access market during the formative stages of the third-generation Internet. The precise form of market power may vary according to local market conditions. However the structure of a local market unfolds, it is unlikely to be fully competitive. In one set of local markets—presumably a significant set given the technical limitations of DSL—cable will be the only broadband option. There, absent regulatory safeguards, consumers are likely to be harmed: they will pay the access fees a cartelized industry can charge and they will suffer from limitations on the kinds of services offered and the degree of experimentation allowed by the single access provider.

In other local markets, the typical residence will possess two active wires capable of carrying broadband video services subsidizing high-speed data services. Consumers will then be faced with an asymmetric duopoly, where one player's network is fully open and the other much less open. They will have a choice between the limited set of cable-blessed access providers allowed to operate over the cable line and the full set of ISPs and local exchange carriers buying access over the telephone line from the local incumbent phone company. Is there reason to think that consumers with the potential for dual access would then be worse off than if ISPs could themselves offer access over either wire? We believe there are three sources of concern.

First, cable's early lead in deployment, coupled with substantial physical and logical switching costs, will give cable operators substantial advantage even in potential dual access local markets. Second, a cable provider's ability to deny access to certain ISPs changes the dynamics of the market in which ISPs and CLECs face the RBOC. ISPs and CLECs purchase broadband access and collocate equipment at a regulated price, but regulators cannot fully specify the quality and reliability of service they receive, or the incumbent's responsiveness to ISP requests for assistance and accommodation. A credible threat on the part of ISPs to vote with their feet and desert telephone wire for cable wire would provide significant competitive discipline on the RBOC, enhancing its incentives to provide high-quality and flexible service for ISPs and CLECs. But as long as the cable owner tightly controls access to its wire, all but a few competitive DSL access providers will face a monopolist in their RBOC. In the end, residential customers

would be better served if there were real market competition, with cable and telcos each vying for ISPs' business.

Third, as the FTC complaint has pointed out, AOL's merger with Time Warner will significantly reduce its incentives to market and promote broadband access to its services over DSL, particularly in Time Warner areas. The same would also be true of Excite@Home but is especially significant because AOL is by far the largest residential provider of Internet services and content. As a result of the merger, AOL has incentives to prefer marketing its high-speed services to users who buy Time Warner's cable broadband access rather than to DSL customers. The FTC has expressed concern that this could limit DSL rollout, especially in Time Warner's areas of market dominance, but also nationally. The result would be to further increase cable dominance. The FTC's order that AOL promote DSL access in Time Warner's areas to the same level as it promotes them in other regions goes some way toward mitigating these concerns. However, it cannot prevent AOL from scaling down its overall nationwide support of DSL if the company finds it more profitable to focus on promoting cable access in the smaller but more lucrative regions covered by Time Warner.

Thus in markets where cable and DSL compete, we should not assume that the cable company would then be forced to open its system fully in order to attract customers. Indeed, by keeping tight control over access, the cable owner would strengthen the ILECs' bargaining position vis-à-vis ISPs, thereby decreasing competitive pressure on its own integrated ISP and its few "favored" ISPs.<sup>38</sup> Limited access cable and open access ILEC would in effect have a common interest in keeping cable restricted, thus creating the basis for implicit collusion that would strengthen their respective positions over nonaffiliated ISPs. By contrast, if both network providers were open, ISPs could then negotiate with the owners of both wires to the home and give their business to the one with the best terms and conditions. Perhaps both network owners would prefer not to cooperate with the ISPs, but if both were open that would be a much harder implicit bargain to strike. So even where cable and DSL are in a position to effectively compete with one another, one can imagine scenarios under which this would not necessarily result in forcing cable to open access to its infrastructure or in fair competitive terms for all ISPs.

38. Indeed, if the cable system also had upstream power in the ISP, as at AOL, it might hurt both rival ISPs and DSL.

The merger between AOL and Time Warner underscores this point and magnifies the concern that competition alone might not be a sufficient source of discipline to yield open access. Despite its considerable premerger clout, AOL had vehemently protested against @Home's closed access, suggesting that other smaller ISPs may be even more vulnerable. If open access was so critical to AOL as an unaffiliated ISP, it must be equally critical for smaller ISPs that will find themselves unable to merge with a cable operator. The merged AOL–Time Warner combines the world's largest ISP and America's second cable operator with 20 million cable households, 85 percent of which are broadband addressable.<sup>39</sup> Before the merger clearance, nods to "open access" were made by the two corporations. The U.S. government's actions on AOL have spelled out a cautious policy for open access that goes beyond the corporate offers, but a decision on conditions for a specific merger falls well short of a general mandate for open access.

The consequences for the innovative dynamic of the Internet will be quite different in these three cases: effective monopoly, asymmetric duopoly with one side closed and the other open, and real competition between network owners and among ISPs. In all three cases, however, we have strong suspicions that competition alone would fail to guarantee open access throughout the emerging broadband infrastructure. As the British regulator OFTEL argued, there must be "rules to deal with market power exercise by firms with control over capacity constrained systems."<sup>40</sup> Such capacity constrained systems can create "joint dominance," a situation with a very limited number of competing suppliers. In that case, OFTEL argued that it might be necessary to apply the same rules that govern individual firms with market power.<sup>41</sup>

## Nurturing Third-Generation Innovation

To encourage the successful deployment of third-generation Internet access infrastructure and the promotion of the accompanying wave of innovation, policymakers need to pursue two goals simultaneously. First, they must ensure that sufficient incentives exist for industry to invest in upgrad-

39. McKinsey and Bernstein (2000, p. 12).

40. U.K. Office of Telecommunications (1999, p. 4, para.13).

41. U.K. Office of Telecommunications (1998, p. 59). It defines an "open state" as a market where "there is universal access control (that is, all consumers can enter into a direct commercial relationship with the suppliers of electronic information delivered over electronic networks) and no scarcity of transmission capacity" (p. 9, para. 2.6).

ing existing access infrastructures—cable, phone, and wireless—and to pursue the development of new ones. Second, they must shape a governance framework for this access infrastructure that stimulates innovative competition not simply between alternative access infrastructures but also among the service providers (ISPs and others) and the end-users who will take advantage of broadband access to invent and deliver third-generation communication applications.

Much of today's access debate views those two goals as substitutes in a zero-sum game where we must choose between either setting up the right incentives to generate infrastructure investment or creating the right framework to foster broad-based competition in services. Following that dichotomous vision, the cable industry warns that universal open access requirements would destroy its incentives to invest in modernizing the cable infrastructure. It further argues that infrastructure competition is a fine substitute for service competition. ISPs conversely claim that absent open access to cable and phone infrastructures, innovation would be smothered by dominant infrastructure owners.

In our analysis, by contrast, the paramount policy goal should be to balance both goals because they are equally important to the success of third-generation Internet. Without incentives to invest in upgrading existing access infrastructures, there will be no platform to explore and leverage innovative service ideas; and without vibrant competition among alternative uses of upgraded infrastructures, we would explore only a limited set of innovative ideas—those of the infrastructure owners. This section analyzes the two facets of this argument in turn. First, we argue that open access requirements would not eliminate the cable industry's incentive to invest in the deployment of third-generation access infrastructure. Second, we show how a closed access infrastructure could channel innovation along the sole interests of the infrastructure owners, using a case study of AT&T's strategy for Excite@Home. Third, we show how the merger of AOL and Time Warner has changed the dynamics underlying the cable industry's argument. With the previous section's assessment of the competitive situation, this lays the groundwork for our concluding section exploring further possible policy approaches to escaping this false trade-off between infrastructure investment and service innovation.

### *Sustaining Investment in Third-Generation Access Infrastructure*

The cable industry argues that if it cannot limit the ISPs operating over cable broadband access, its network upgrades will be too risky and unprofitable to

warrant the large investment needed. The consequence, it is implied, would be to stall the deployment of a digital cable infrastructure, holding back not only the wide diffusion of broadband Internet access and digital television but also the emergence of a nationwide facilities-based competitor for residential telephony. This argument initially resonated strongly with the FCC, whose preliminary findings on broadband access supported the industry. Separately from the broadband access debate, the FCC is quite eager to encourage facilities-based local telephony competition, and AT&T's suggestion that open access requirements might slow that as well appeared to carry weight. This line of argument was first and most extensively laid out in a December 1998 filing by the National Cable Television Association (NCTA).<sup>42</sup>

On this issue of investment incentives, our view differs from that of the NCTA in a number of respects. We use the AT&T investment in cable to illustrate our logic. First, the argument omits to point out that a great deal of investment to upgrade cable facilities has already been undertaken within a very protected environment. Indeed, cable networks are franchise monopolies in most markets and they are built, capitalized, and largely upgraded under a monopoly market operation. For example, cable operators deployed more fiber in 1997 than all the RBOCs combined.<sup>43</sup> When it acquired TCI, AT&T did not buy companies in competitive markets, but rather bought a set of video distribution monopolies. These monopolies had, arguably, largely made the decision to upgrade their networks to digital video in order to compete with direct broadcast and, perhaps most important, to offer cable-based phone service.

Second, these investments, and the large sums AT&T spent to acquire these companies, were predicated on more than simply broadband Internet. In particular, upgraded local cable plant would allow AT&T to save considerable sums in access and interconnection fees, estimated to run as high as \$15 billion in 1998, about a third of its domestic wireline revenues.<sup>44</sup> Cut those charges in half, and AT&T's net income doubles. Some estimates suggest that AT&T plans to have extensive and exclusive cable-phone penetration by 2005. In that case, gains from video services, let

42. Bruce M. Owen and Gregory L. Rosston, "Cable Modems, Access and Investment Incentives," filed on behalf of the National Cable Television Association, December 1998.

43. David MacKie-Mason (1999), citing the Telecommunications Industry Association's "1998 Multimedia Telecommunications Market Review and Forecast," p. 46.

44. Larry Darby, "Open Access: The AT&T Internet Business Case?" *Last Mile Telecom Report*, August 12, 1999.

alone Internet access, are just gravy.<sup>45</sup> Seen that way, AT&T will obtain Internet access for a small marginal cost, since the modifications required to add Internet capacity to an existing digital cable system are much lower than the estimates of the costs required for upgrade of the digital network itself.<sup>46</sup>

Third, the cable industry claims that open access regulation would reduce its revenues and its incentives to invest. The FCC initially backed these claims, reporting that “there was near unanimous agreement among the cable and investment panelists that government regulation of the terms and conditions of third-party access to cable systems would cast a cloud over investment.”<sup>47</sup> Several analysts, however, including Merrill Lynch and Jupiter Communications, believe on the contrary that open access would be profitable for cable operators<sup>48</sup> because it would create additional wholesale revenues. MacKie-Mason’s own detailed economic modeling of this question on behalf of the Open Access Coalition shows in fact that open access would yield substantial revenues for cable operators.<sup>49</sup> Such economic models, just like the less quantitative claims of the NCTA economists, are obviously always subject to argument. MacKie-Mason, however, also points to compelling additional evidence in what he calls a “controlled experiment”: the Canadian CRTC’s 1996 announcement that it would require open access did not stop investment, and in fact, the major Canadian cable operators are ahead of their U.S. counterparts in deploying broadband facilities.<sup>50</sup>

In summary, we believe there is ample reason to strongly question cable’s claim that open access requirement would stop the deployment of broadband cable access. Moreover, the waves of mergers undertaken by both AT&T and Time Warner demonstrate that the companies have adequately readied themselves for the challenge of rapidly acquiring a broad market

45. MacKie-Mason (1999, p. 12). Owen (1999, pp.120–25) points out that cable is an industry with economics similar to real estate. It takes heavy depreciation to gain tax advantages and rarely runs an accounting profit. Nonetheless, it can sustain major investments with substantial positive cash flows. Its biggest risks include modification of tax laws influencing its depreciation strategies and the possibility that rival technologies will create alternative ways to deliver video-related services. The cable plant is a capital-intensive system with few alternative uses.

46. Providing broadband Internet access via cable modem is estimated by the FCC to cost the cable operator \$800–1,000 per subscriber. Federal Communications Commission (1999a, chart 2); Federal Communications Commission (1998, para. 40); DePompa-Reimer (1999).

47. FCC Cable Service Bureau (2000, p 34).

48. MacKie-Mason (1999, p. 35).

49. MacKie-Mason (1999).

50. MacKie-Mason (1999, p. 27).

share: AT&T through its purchase of smaller cable companies, Time Warner through its merger with AOL's enormous user base. We might also add that, if open access requirements were such an obstacle to broadband deployment, it would be appropriate to call for lifting such requirement from the ILECs. But continuing regulatory requirements that they open their network to all ISPs appear not to stop the telcos from carrying out ambitious DSL deployment. Perhaps they would race to deploy DSL even faster, were it not for these constraints. But in their case, policymakers have apparently decided that deployment speed is not the only value at stake; fostering an open innovation environment is an equally worthwhile goal, even at the cost of a hypothetical deployment slowdown.<sup>51</sup>

*Fostering Innovation in Third-Generation Applications:  
The "Closed Access" of AT&T and Excite@Home*

Closed access control would allow cable owners to pursue only the exploration and deployment of those third-generation services that directly benefit them. This is not to say that no innovation would take place, simply that only the technology trajectories that line up with their interest would be pursued. As a result, the kind of wide-ranging, open innovation and experimentation that has been central to previous generations of Internet explosion would be stifled. We examine here the early experience with the Excite@Home broadband offering as an illustration of the implications of such an incentive structure. While the practices of Excite@Home are perfectly understandable and legal, they create concerns when consumers have no alternative. We separate two categories of consequences: first, the restrictions imposed on end use and second, the upstream implications of closed network architecture for electronic communication and commerce.

First, Excite@Home imposes a number of restrictions on its customers' usage patterns. Of course, any network owner, left unconstrained, will logically attempt to shape network uses along patterns that best serve its own interests, and Excite@Home understandably configured its service to force usage that fits the specific patterns that generate the most profits. Excite@Home's limits on what its users do are spelled out in the "acceptable use policies" they agree to when they subscribe to the service. The overall Internet usage pattern encouraged by Excite@Home is strongly

51. For a similar argument, see Lemley and Lessig (1999).

aligned with a vision of third-generation Internet as an extension of a broadcast network: a communication where traffic patterns are asymmetrical, where users download much more than they send, and where users are passive consumers rather than publishers of multimedia content. The practices involve a number of elements:<sup>52</sup>

- limits on upstream traffic, which curtail consumers' ability to experiment with their own uses of the network, including Internet telephony and interactive video teleconferencing;<sup>53</sup>

- prohibitions on setting up any kind of server;<sup>54</sup>

- technical biasing against and limits on the performance for nonpartner content that will structure the cyber marketplace, limiting experimentation and innovation;

- prohibitions on using Excite@Home for work-related activities, for which customers are expected to purchase the more expensive (and DSL-based) "@Work" service. That means it will be difficult to hook up to corporate LANs from home, which will limit the present diffusion of innovative forms of work at home.

In order to enforce these rules, Excite@Home must constantly monitor its customers' data traffic, raising serious privacy concerns.<sup>55</sup>

Arguably, these restrictions flow from the limitations of cable technology. They represent, however, Excite@Home's own approach to dealing with these limitations, encouraging communication patterns that happen to fit well with Excite@Home's business strategy. It would certainly be interesting to see how innovative nonaffiliated ISPs might explore alternative ways

52. See At Home Corporation, "@Home Acceptable Use Policy" ([www.home.com/support/aup/](http://www.home.com/support/aup/) [February 5, 2001]), "@Home User Guide" ([www.home.com/support/](http://www.home.com/support/) [February 5, 2001]), and "@Home Frequently Asked Questions" ([www.home.com/qa.html](http://www.home.com/qa.html) [February 5, 2001]).

53. Corey Grice, "Excite@Home Speed Caps Draw Fire, Prompt New Plans," *CNET News.com*, June 28, 1999 (available at [www.news.com/News/Item/0,4,38479,00.html](http://www.news.com/News/Item/0,4,38479,00.html)).

54. "Examples of prohibited uses include, but are not limited to, running servers for mail, http, ftp, irc, and dhcp, and multi-user interactive forums" (see [www.home.com/support/aup/](http://www.home.com/support/aup/)).

55. See Karen J. Bannan, "Excite@Home: Protection Or Invasion?" *Inter@ctive Week*, June 21, 1999 ([www.zdnet.com/intweek/stories/news/0,4164,2279510,00.html](http://www.zdnet.com/intweek/stories/news/0,4164,2279510,00.html)): "One percent of the subscriber base is responsible for 80 percent of the traffic flow. We're just watching to make sure this group of users that are trying to use a \$40 product like a \$1,200 T1 [1.5-megabit-per-second] line don't spoil it for the rest of the users," said Milo Medin, the company's chief technology officer. The company not only tracks how much traffic is going and coming into a specific household, but it also tracks where the traffic goes once it leaves the home and what kind of data is being sent and received, he said. Don Hutchinson, senior vice president of the company's @Work division, said Excite@Home tracks a customer's data destination in order to pinpoint where it might need to improve connections to its backbone. In addition, the company said, monitoring individual usage helps the company upgrade its services.

around these limitations.<sup>56</sup> However, while it will still be possible to receive Internet service from other ISPs though still paying for Excite@Home ISP service, alternative service providers will be denied access to key network performance features of the Excite@Home infrastructure, such as dynamic caching and collocation on the Excite@Home network. Closure and usage limits thus preclude experimentation with a range of alternative patterns of use, in a provider-dominated context reminiscent of telephony's pre-deregulation, pre-Internet era. By contrast, open access to cable would allow dynamic network innovation in the broadband era to unfold with the force, pace, and innovative imagination of the narrowband era. The development logic that has characterized the Internet to date could continue.

Second, whoever owns the network, absent competitive or regulatory constraints, will also logically try to extend its infrastructure ownership into control of the services and content it carries. There is clearly a range of strategies available for the provider of a large cable modem network to bias Internet access to the advantage of some content providers over others. Though some may be intelligent ways to speed up the Internet experience for customers (dynamic caching is a good example), these practices could easily become abuses of dominant position if applied differentially to different service and content providers. Indeed, if a single ISP has sole access to these strategies, it can then at its discretion, and at its discretion alone, systematically shape what content and services gets to the end-users under optimal conditions. Further, it could shape the very terms of innovation on the Internet, deciding who gets to experiment and who can capture the resulting benefits. Open access, by contrast, would ensure that other ISPs could use the cable infrastructure to pursue similar approaches, where appropriate, and would foster healthy competition of network applications, programming, and architecture.

In the present case, AT&T-@Home strives to leverage its cable access monopoly into e-markets that ride on top of cable access, well beyond the bundling of Internet service provision with other AT&T services. The @Home 1998 annual report<sup>57</sup> was very clear on these strategic practices and included details of how @Home offered speedier service to Internet content providers that agreed to become "content partners" and share their

56. As a comparison, the open DSL market is starting to spur innovative ways to exploit DSL technical characteristics—for example, the provision of multiple voice lines over a single DSL line.

57. The 1999 annual report is much more vague about the specifics of these practices. There are, however, no indications that they have been abandoned.

revenue stream.<sup>58</sup> Under the sole control of a broadband access monopoly, the potential for serious abuse is evident. Consider in particular:

The @Media group offers a series of technologies to assist advertisers and content providers in delivering compelling multimedia advertising and premium services, including replication and co-location. Replication enables our content partners to place copies of their content and applications locally on the @Home broadband network, thereby reducing the possibility of Internet bottlenecks at the interconnect points. Co-location allows content providers to co-locate their content servers directly on the @Home broadband network. Content providers can then serve their content to @Home subscribers without traversing the congested Internet.<sup>59</sup>

Further, the report noted:

We have established relationships with certain of our interactive shopping and gaming partners whereby we participate in the revenues or profits for certain transactions on the @Home portal. We also allow certain of our content partners to sponsor certain content channels for a fee.<sup>60</sup>

These quotes describe two strategies aimed at shaping the architecture of the cyber marketplace. The first is “collocation,” the second is “replication.” Both functioned to allow Excite@Home to privilege partners and handicap competitors—they differ only slightly in their implementation. Excite@Home developed partnerships with noncompeting firms in each of several content areas (interactive shopping, gaming, digital audio, digital photography, and search services) and collected “fees relating to content partnering arrangement.”<sup>61</sup> In keeping with its cable origins, Excite@Home saw these practices as “programming,” and it viewed itself as “programming the Internet.”<sup>62</sup> Excite@Home also offered collocation service to bring better performance to Excite@Home customers (merchants as

58. At Home Corporation (1999).

59. At Home Corporation (1999, p. 8).

60. At Home Corporation (1999, p. 9).

61. At Home Corporation (1999, p. 9).

62. At Home Corporation (1999, p. 8).

well as end-users), but the term “collocation” is not meant in the nondiscriminatory sense that those familiar with telecommunications are wont to use. Rather, each partnership appeared to be exclusive to a particular area of content. A collocated partner has faster access to Excite@Home consumers because of a presence on the same network. In 1999 Excite@Home had already collocated at least one partner (SegaSoft) and was planning to collocate others.

Replication is manipulation of the caching system to favor partners. It essentially speeds requests for certain content by preloading it at sites that are close and well-connected to subscribers. As of 1999, Excite@Home replicated news feeds from CNN and Bloomberg. Excite@Home then promoted these replicated and collocated partners on its portal and with its “wizards,” making competitors harder to get to. The result was the creation of a cyber marketplace that systematically favored the providers of content, services, or transactions who have a privileged financial relationship with the monopoly owner of the infrastructure that supports that cyber marketplace. If customers had a real choice of broadband access infrastructure, this would matter less, but when they became customers of Excite@Home’s access infrastructure, they automatically and unknowingly received access to a cyber marketplace biased to favor Excite@Home’s financial partners. As of 1999, Excite@Home had such agreements with partners including Amazon.com, BuyDirect.com, AutoConnect, N2K, PC Connection, QVC, Realtor.com, Reel.Com, Travelocity, Bloomberg Radio, CNET Radio, Net Radio, SportsLine, and Spinner.com.<sup>63</sup>

In addition, it certainly is possible to manipulate the caching architecture in many other ways to favor partners. Excite@Home had the incentive, given its relationship with content providers, to further use the caching system to actually slow requests to competitors’ “programming” rather than merely speeding up access to its own brands.<sup>64</sup> Excite@Home’s annual report also noted that “local caching servers can compile far more comprehensive usage data than is normally attainable on the Internet.”<sup>65</sup> If

63. See the amicus curiae brief of Excite@Home, Re: *AT&T v. Portland* (August 16, 1999), especially notes 17, 18, 19, and 20 ([techlawjournal.com/courts/portland/19990816exc.htm](http://techlawjournal.com/courts/portland/19990816exc.htm)).

64. In their joint letter to FCC chairman Kennard, dated July 29, 1999 ([tap.epn.org/cme/kennard.html](http://tap.epn.org/cme/kennard.html)), the Consumer Federation of America, Consumers Union, Media Access Project, and the Center for Media Education have documented a variety of such possible manipulations. The technical basis for their claims is laid out in “Controlling Your Network: A Must for Cable Operators,” Cisco White Paper (1999).

65. At Home Corporation (1999, p. 10).

this data were shared with partners, this would create a further barrier to competition from nonpartner content providers. Not only could an Excite@Home partner know detailed information about Excite@Home subscribers using its service, it would also be possible to know the same detailed information about who was using a competitors' service or to restrict access to a competitors' service while substituting its own.

In summary, Excite@Home proposed in its own materials to structure a cyber marketplace that would steer Excite@Home customers, unknowingly, toward merchants who partner with Excite@Home. Excite@Home was able to structure the cyber marketplace in various ways—for example, through the advantageous positioning and access of partners or through the organization of its site around devices such as “How Do I” wizards.<sup>66</sup> Excite@Home's own reports explained how they would provide superior quality performance to partnering merchants on their network. If you were a merchant, either you were on Excite@Home's service network or the majority of broadband customers (those that use AT&T@Home cable service) would not have been able to access your site, as you intended.

Opponents of open access requirements argue that market forces will naturally bring cable operators to open their networks because they will want to maximize the amount and diversity of content available to their subscribers. Jim Speta explains that, while telecommunications networks derive value from connecting people to each other and thrive on direct network externalities (the more connections, the greater the value of each connection), cable networks derive value from bringing content to people and benefit from indirect network externalities (the more content, the greater the value of each connection). Therefore, he argues, “a broadband access provider has the incentive not to restrict the market for information services and the availability of those services to its subscribers even if it has a monopoly in the provision of broadband access.”<sup>67</sup> This view overlooks strategies such as those just documented in Excite@Home's case. Indeed, as Excite@Home argued to its investors in its annual report, a cable operator clearly benefits from using its control over network architecture to design a biased cyber marketplace, favoring affiliated content and network services, especially if it has a monopoly in the provision of broadband access. In this respect, Excite@Home was trying to act very much like Microsoft,

66. @Home describes the “wizards” at ([www.home.com/howdoi.html](http://www.home.com/howdoi.html)).

67. Speta (2000, p. 84).

using its control of the operating system's architecture to favor some applications over others—with similar anticompetitive implications.

These capacities to structure the cyber marketplace are of startling significance, especially when customers are unaware of the marketplace's structured biases. They are particularly important if a single ISP has a local monopoly and of broad significance if a single ISP holds stakes in enough local monopolies or dominant positions locally to influence the very structure of the cyber marketplace. And, it should be noted, even allowing the choice of another ISP for no additional fee (for example, if customers could choose to substitute Earthlink for Excite@Home as the default ISP over their broadband cable access) would not correct the competitive problems created by broadband access architecture that rewarded Excite@Home with performance advantages over all rivals. There are at least two reasons.

First, electronic commerce is certainly one of the—if not the only—killer applications of the broadband era. The unfolding of e-commerce will drive innovation throughout all segments and elements of a competitive network. Yet suddenly the competition across segments and elements that has driven the evolution will be squeezed into and captured by a vertical structure with a single buyer, the ISP. Second, business-to-business e-commerce has dominated until recently. Broadband facilitates the full-fledged emergence of retail e-commerce. Closed access would, as a matter of policy, permit Excite@Home to structure the cyber marketplace for a significant portion of the American consumer population. With control of the broadband service provision, Excite@Home would become a truly dominant influence in American retail. Even if Excite@Home's control of the broadband market were more limited, it would nonetheless structure the cyber marketplace used by a substantial number of American consumers. The biases would not be immediately obvious, and they would not necessarily be brought to the attention of the consumer. The competitive possibilities of e-commerce, ease of entry, and experimentation producing new business strategies and new business organization would be wiped away. Broad gains to the American economy would be lost.

In the absence of a policy requiring open access, the suppliers of the network component and services, the merchants seeking to reach consumers through the cyber marketplace, and the users of the network will confront AT&T/@Home's market power. The Internet and e-commerce will then evolve as the result of strategy choices made by AT&T and @Home alone, not as a result of market competition. Is this the "digital economy" we really want?

*The AOL–Time Warner Merger: A Halfway House?*

The FTC and FCC decisions to approve the merger of AOL and Time Warner were concluded by January 12, 2001. Together they marked a new chapter in access policy for the cable industry. The two agencies approved the merger subject to a number of conditions that, as it stands, will provide the regulatory framework for broadband access for the first phase of nationwide broadband deployment. As regards enabling ISP access to Time Warner cable, the FTC adopted AOL's offer to provide the ISP Earthlink (the largest ISP in the United States after AOL) effective access over Time Warner cables before AOL broadband can be released over the network. In addition, within ninety days of AOL's service commencing, two other ISPs must be provided with effective access within major urban areas. Other ISPs are permitted on the Time Warner network provided this causes no further technical problems. The FTC has appointed a permanent monitor to oversee this transition and access issues. While this settlement clearly prevents AOL from securing sole access to Time Warner cable (mirroring Excite@Home's situation), it is a compromise built on several policy gambles.

In a first gamble, the decision still limits the number of ISPs likely to operate on the Time Warner network. While EarthLink has been given a hand up, other ISPs will have to wait three months to secure access rights, by which point AOL's powerful marketing machine could have siphoned up much of the potential market. The FTC has essentially given the two fastest ISPs a head start. The promise of later additions of two other ISPs is further bolstered by the equivalent of a "most favored nation" (MFN) clause that grants any other ISP the right to get the same terms as AOL. However, the FTC does recognize the possibility of technical constraints on access. The self-regulatory nuances of determining "technical feasibility" of future ISPs beyond the first four operating on the Time Warner network may mean that access becomes even further constrained.

The FTC remedy thus rests on hopes that the phased introduction of four other ISPs on the Time Warner cable network, along with a very general MFN policy, will suffice to curb AOL–Time Warner's exercise of market power. The FCC bolstered the FTC safeguards by further insisting that rival ISPs control the users' "first screen" and billing arrangements. It also warned AOL not to engage in technical discrimination against other ISPs. However, these rules do not match the detailed FCC guidelines that open up local phone networks for DSL competitors.

The resulting “limited access” environment set for the AOL–Time Warner cable network falls short of the “open access” model set for the telephone network. With respect to our concern about the innovation dynamics this sets for the third-generation Internet, this arrangement misses the mark in two important respects. First, it entrusts the cable owner with the selection of the lucky few ISPs that will be allowed alongside AOL. AOL–Time Warner may, for example, be inclined to favor ISPs that share its vision of where the third-generation Internet should be heading (perhaps a network that resembles AOL’s Interactive TV project, probably not one that encourages Gnutella-inspired swapping of Time Warner media content) and to think more kindly of the ISPs whose strategy does not directly challenge AOL’s.

Second, even assuming that AOL–Time Warner’s selection of ISPs will not be biased, the “limited access” policy vision assumes that ISPs constitute an adequate proxy for other network users, that ISPs will explore the full range of possible network services and applications. This is far from obvious. Consider the contrasting situation in the telephone network. There, open access does not simply mean that nonaffiliated ISPs can get access on equal terms with the telecom-affiliated ISP, but that *any* network user can get cost-based access to unbundled network elements, thus creating conditions for much broader experimentation. Indeed, the telephone network supports not only ISPs who offer alternative ways to take advantage of telecom-developed DSL, but allows the implementation of other flavors of DSL and lets providers offer various service level agreements and quality of service guarantees. It allows corporate users to tap into the phone network to extend their local networks and make it possible for their employees to get secure intranet access from home. The current architecture of the cable network does not support that level of unbundling. Neither did the architecture of the telephone network until the 1980s, before the FCC progressively established unbundling requirements.

In another gamble, the merger decisions propose regulations that are limited to the partners in this particular merger, Time Warner and AOL. No parallel conditions have been imposed for AT&T’s cable network, where Excite@Home’s retains exclusivity. By neglecting to draw up a comprehensive access policy, the FTC and FCC have thus passed the buck. They have declined to address the more generic problem of ensuring open access and end-to-end innovation over evolving networks, preferring an incremental approach. Missing this opportunity to outline broader goals, regulators have created uncertainty as to when and how exactly they might

rule in the future. Clearly, not every “open access” issue will result in a merger review.

In the short term, though, the FCC and FTC decisions are a significant step forward. They will prove at least one critical assertion: whether “open access,” however limited, is technically feasible over the cable networks. The stalemate has finally been cleared and an opportunity to move on has been created. Now that they have ruled, the FCC and FTC will need to monitor the performance of AOL–Time Warner vis-à-vis AT&T closely. The limitations imposed on the former may become handicaps in its battle against AT&T, whose bundled packages and vertical integration could provide a competitive edge. This may push regulators eventually to explore a more comprehensive cable broadband policy for all industry participants, not just those engaging in controversial mergers. Conversely, AOL and Time Warner may discover that open access serves them well, fostering greater traffic and innovation on their network. Perhaps AT&T might then be inspired to follow suit and open its own cable network. At the least, the creation of a limited open access environment on one of the cable networks will open a window to observe the unfolding of competitive dynamics which, even if limited, will inform the next stages of policy debate.

### **Conclusion: Dealing with Joint Dominance**

Broadband third-generation services for households represent a new market. For the very large percentage of all buildings unlikely to obtain fiber optic access in the next fifteen years, there is a fundamental issue about how competitive the market will be for the supply of broadband access to these households. And, of equal import, does limited competition produce other adverse effects, such as the ability to restrict innovation in third-generation services in ways that harm consumers in the long term?

This is a technologically and economically volatile market. We are very sympathetic to fears that regulators find it difficult to chart rules with more benefits than costs in such a market. However, we are equally concerned that technological upheaval is being equated with the emergence of effective market competition in a timely manner.

At best, for the next several years it appears that most homes will be served by a monopoly or a duopoly for broadband services. Joint dominance in broadband access, even monopoly power over broadband access in many cases, raises serious threats to the public interest. If the joint

dominance continues, the resulting vertical integration and closed access defeat the fundamental innovation dynamics that have made the Internet successful. Open standards, open access, a clear set of competitive principles and prohibitions against leveraging access control into control of service architecture, cyber marketplace, communication patterns, and content will all wane. Vertical disintegration has traditionally led to real competition and innovation in each segment as well as competition and innovation in alternative ways to package combinations of services.

The policy problem arises at the moment at which the cable television “broadcast” system, built up with local monopolies and successfully built out because of the appeal of cable TV offerings, is being transformed into a broadband digital system and integrated into the national communications network. The current debate stems from the collision of the policy legacy of cable’s monopoly and restricted access origins with the evolving open access thrust of telecommunication policy that has enabled the successful explosion of competition throughout the telecom network segments, ushering in user-driven innovation and the Internet revolution. Reversing the set of policy innovations that have led to broad American communications leadership would be unwise, at best.

But what can be done? The most important point is to recognize that the situation is ripe for an explicit set of policy decisions, not wait and see. By including access requirement in their merger rulings, the FCC and FTC have finally recognized this need, even if they stopped short of calling for rules that would apply to AOL–Time Warner’s competitors as well. The question as to the right prescription is not one that we wish to resolve here. But we would offer some observations about how to proceed.

To begin, in the access debate some believe that the main policy issue was that consumers should not have to pay twice for use of an ISP other than that bundled with cable service. This emphasis on nondiscriminatory access to the broadband cable network for all ISPs, they suggest, requires only a light regulatory touch. But, however light, the touch may be essential. The FCC and FTC could have, and probably should have, written the requirement into decisions on the AT&T–Media One merger, as they indirectly did on the AOL–Time Warner merger. Other countries would have to find appropriate policy instruments, as we discuss shortly.

Just as important, a nondiscrimination rule in itself would not solve the underlying problems that we have described. For example, suppose that the rule simply said that nonaffiliated ISPs will pay the same as Excite@Home for access to the AT&T cable broadband network. This would not prevent

AT&T from taking its rents on the network access charge and simply bundling in Excite@Home for no fee. This would be like Microsoft making its money off Windows while charging nothing for its browser.<sup>68</sup> Is this satisfactory? After all, these ISPs could change their business model to the one used by Yahoo (or AOL in its U.K. operations for some customers), in which there is no monthly charge for e-mail and access. Revenues derive from ads and sales commissions.

Arguably, the “don’t pay twice” rule, while straightforward, addresses only one of the least important issues discussed in this chapter. The critical issue is the creation of an open architecture for broadband services that supports widespread innovation. Policymakers should aim to stimulate, or at least not to stifle, innovative designs and uses of the network. But the vertical arrangement between the AT&T–TCI broadband network and Excite@Home, as well as AOL–Time Warner’s integration, may defeat this goal. The infrastructure owner will have strong incentives to configure its network to give superior performance to the preferred ISP and superior service to the ISP’s favored partners. Nothing will prevent such bias in AT&T’s case, and we will have to see how effectively FTC and FCC monitoring prevents abuses in AOL–Time Warner’s case.

As we have stressed throughout this chapter, the problem is not just the adverse effect on competition in the markets for Internet service provision. The closed architecture of the underlying broadband network will also restrict access to the “network performance features” that are so vital to innovation. In its decision on the AT&T purchase of TCI, the FCC rightly expressed concerns about some matters of the network architecture but settled for rather toothless promises by AT&T in its filings to the commission.<sup>69</sup> The right question is whether there are policy options that are lighter-handed than the regulatory regime for DSL imposed on the ILECs and yet responsive to the issues posed by broadband cable networks.

We have noted how the combined approach of the FTC and FCC opened the way to a limited open access policy that tried to get enough competition in the ISP market to remove AOL–Time Warner’s incentive to exercise market power. It combined a mandate for a certain number of competitors, a loose MFN rule for others, and some rules guiding other

68. In effect, it is like the first U.S. Department of Justice consent decree with Microsoft, whereby Microsoft ended its licensing agreement provision that charged OEMs for Windows on every system that they shipped (even if the OEM had installed Unix or OS2 on the computer instead of Windows).

69. Federal Communications Commission (1999b).

network capabilities. In addition, the FCC laid down a guideline for the important IM market. It declared that AOL had market power in regard to the NPD, but then said that the FCC would not regulate this market unless AOL tried to launch broadband IM services such as videoconferencing that uniquely tapped the capabilities created by the merger.

Some have claimed that the FCC action on IM was either a needless intrusion (including the dissent by current FCC Chairman Powell)<sup>70</sup> or ineffective because it did not touch the current IM market. The FCC staff clearly thought that broadband applications of IM were likely, so the trigger requiring AOL to open access to its NPD would be tripped. From our viewpoint the FCC was, albeit tentatively, tackling precisely the question of when network architecture poses a serious risk to flourishing competition. This was precisely the same conclusion of Britain's OFTEL and the EU Commission: not to spell out the technical characteristics of an unbundled network architecture for the future, but to lay down a process for the consideration of situation when architectural features could create a problem. Regulation is costly, but so is neglect.

OFTEL and the European Commission have rightly sought to create a more technology-neutral view of services and regulations. But at times they seem excessively focused on the issue of pricing and the ability of those with market power to raise prices to consumers at the expense of addressing issues of manipulating the technical architecture of the network in such a way as to slow innovation and restrict competition. However, both authorities have recognized that such issues, if significant for competition, are of concern. For example, the European Commission has extended its analysis of digital television to the question of applications program interfaces (APIs) that are crucial to interactive services. They have noted the possibility that regulators may need to impose "compulsory licensing and publication" of the interfaces and require "functional interoperability."<sup>71</sup> This is analogous to the issues in this chapter about broadband services. The European Commission has also suggested that "it would be appropriate for Member States to place an 'obligation to negotiate access' on a cable

70. "Statement of Commissioner Michael K. Powell, Concurring in Part and Dissenting in Part," February 11, 2001 (re: "Memorandum Opinion and Order, Applications for Consent to the Transfer of Control of Licenses by Time Warner Inc. and America Online, Inc., Transferors, to AOL Time Warner, Inc., Transferee," FCC CS Docket 00-30).

71. European Commission (1999, para. 4.2.5).

TV operator with significant market power for delivery of broadband services with the possibility of NRA [National Regulatory Authority] intervention if commercial negotiation fails.”<sup>72</sup>

The FCC has emphasized its hopes that technological innovation may resolve competition issues about broadband access faster than could any regulatory intervention—thus avoiding the inevitable downsides of regulation. Perhaps. But in its anxiety not to stifle investment in cable television upgrades, the FCC may proceed too cautiously. It needs to examine the issues of the competitive implications of the architecture of broadband systems as carefully as it worked out the logic of open network architectures in the telephone networks. Even a biennial detailed public inquiry into these issues may deter some forms of anticompetitive behavior by sending a powerful signal that the government is aware of the potential risks and might intervene. It also ought to consider laying out a policy statement on technology-neutral principles for assessing network architecture and its impact on market power. This would be akin to the Justice Department’s antitrust guidelines. Such a statement, wielded by a chairman intent on modernizing regulation for the next generation of Internet services, could guide analysis of the deluge of day-to-day cases considered by the FCC. But it would leave the details, including the ability to forebear to act, to the individual case without creating sweeping new rules.

In closing, it would be highly desirable if the United States again established itself as the international leader for broadband Internet policy. Silence in policy in the United States takes away America’s significant advantage globally in shaping the policy for the next generation of global Internet services. The key factor governing future success must be present urgency. Problems about how to assure competitive network infrastructure for broadband access exist everywhere in the world. In an increasingly competitive world market, neglecting to ensure domestic competition constitutes an unnecessary burden. Moreover, the global economy will not itself “wait and see”; action must be taken now. The trajectory of broadband will be set today, not by future FCC reregulation. The FCC’s hesitation leaves a leadership vacuum in the global policy arena that others will surely fill, perhaps with results that the United States may not like.

72. European Commission (1999, para 4.24).

## References

- At Home Corporation. 1999. "1998 Annual Report." February 29.
- Bar, François, and Michael Borrus. 1997. "The Path Not Yet Taken: User-Driven Innovation and U.S. Telecommunications Policy." University of California, Berkeley Roundtable on the International Economy.
- Bar, François, and others. 2000. "Access and Innovation Policy for the Third Generation Internet." *Telecommunications Policy* 24 (July–August): 489–518.
- DePompa-Reimer, Barbara. 1999. "Cable Modems, Wireless Networks Slow to Spark Interest." *Internet Week* 34 (1): 34.
- European Commission. 1999. "Towards a New Framework for Electronic Communications Infrastructure and Associated Services: The 1999 Communications Review." COM 539. Brussels.
- Federal Communications Commission (FCC). 1998. "Annual Assessment of the Status of Competition in Markets for the Delivery of Video Programming." CS Docket 98-102 (December 23).
- . 1999a. "Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996." CC Docket 98-146 (February 2).
- . 1999b. "Memorandum Opinion and Order Approving the AT&T–TCI Merger." 99-24 (February 18).
- FCC Cable Service Bureau. 2000. "Broadband Today."
- Galperin, Hernan, and François Bar. 1999. "Reforming TV Regulation for the Digital Era: An International/Cross-Industry Perspective." Paper prepared for the Twenty-Eighth Telecommunication Policy Research Conference. Alexandria, Va., September 25–27.
- Goolsbee, Austan, and Klenow, Peter. 1999. "Evidence on Learning and Network Externalities in the Diffusion of Home Computers." Working paper. University of Chicago (July).
- Hart, Jeffrey, François Bar, and Robert Reed. 1992. "The Building of the Internet: Implications for the Future of Broadband Networks." *Telecommunications Policy* (November).
- Hecht, J. 2000. "Fiber to the Home." *Technology Review* (March–April).
- Kuptz, Jerome. 2000. "The Peer-to-Peer Network Explosion." *Wired* (October).
- Lemley, Mark, and Lawrence Lessig. 1999. "Written Ex-Parte in the Matter of the Application for Consent to the Transfer of Control of Licenses MediaOne Group, Inc. to AT&T Corp." FCC CS Docket 99-251.
- MacKie-Mason, David. 1999. "Investment in Cable Broadband Infrastructure: Open Access Is Not an Obstacle." University of Michigan.
- McKinsey and Co. and Sanford C. Bernstein and Co. 2000. "Broadband." (January).
- Owen, Bruce. 1999. *The Internet Challenge to Television*. Harvard University Press.
- Oxman, Jason. 1999. "The FCC and the Unregulation of the Internet." OPP Working Paper 31. Federal Communications Commission (July).
- Salzter, Jerome H., David P. Reed, and David D. Clark. 1981. "End-to-End Arguments in System Design." Paper prepared for Second International Conference on Distributed Computing Systems. April.

- Speta, J. 2000. "Handicapping the Race for the Last Mile? A Critique of Open Access Rules for Broadband Platforms." *Yale Journal on Regulation* 17 (1): 39–91.
- U.K. Office of Telecommunications (OFTEL). 1998. "Beyond the Telephone, the Television, and the OC—III." London (March).
- . 1999. "OFTEL's Response to the UK Green Paper—Regulating Communications: Approaching Convergence in the Information Age." London (January).

