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Access and innovation policy for the third-generation internet☆

François Bar[a,*], Stephen Cohen[b], Peter Cowhey[c,d], Brad DeLong[e], Michael Kleeman[f], John Zysman[g]

[a]*Department of Communication, Stanford University, Stanford, CA 943052050, USA*
[b]*City and Regional Planning, University of California, Berkeley, USA*
[c]*Graduate School of International Relations and Pacific Studies, University of California, San Diego, USA*
[d]*Institute of Global Conflict and Cooperation, University of California, USA*
[e]*Department of Economics, University of California, Berkeley, USA*
[f]*CTO, Aerie Networks, USA*
[g]*Department of Political Science, University of California, Berkeley, USA*

Abstract

The success of the internet in the US fundamentally rests on 30 years of consistent FCC policy which sought to maintain network openness by making key network components available to all, on cost-effective terms, so as to foster competition and innovation. The internet today enters a third phase of its history, when a critical mass of users are about to experience "always-on" high-speed access to the internet from their home. At this crucial time, the FCC may abandon its successful policy and allow owners of the broadband infrastructure to foreclose access to the infrastructure they own. This is, we show, precisely the wrong time for such a reversal. While the current debate is forced by AT&T's acquisition of TCI, its proposed acquisition of MediaOne, and the companies' ties to Excite@Home, this particular matter simply forces us to address the more general issue. What should be the terms of access to emerging network infrastructures when competition exists, but reflects "collective dominance" of a few players? We argue that policy inaction places network innovation in jeopardy and threatens the continuation of successful infrastructure re-invention.

Keywords: Telecommunications and internet policy; Infrastructure evolution; Broadband local loop; Open access

1. Introduction

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. Making this possible is a new

* Corresponding author. Tel.: + 1-1650-7230701; fax: + 1-1650-7252472.
E-mail address: fbar@stanford.edu (F. Bar).
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residential access infrastructure that offers LAN-like bandwidth for residential users. In addition to substantial upgrades of the second-generation access networks (modems and telephone lines) to DSL, this third-generation access network relies upon the co-axial cables of CATV providers, soon to be augmented by new terrestrial and satellite wireless access methods, even early deployments of fiber-to-the-home. The third-generation internet will be much more than a speedier version of today's internet, just as the current second-generation (epitomized by today's multimedia World Wide Web) offers much more than a faster access to first-generation text-based gophers, telnet and ftp sessions. The current internet re-invention, like previous rounds, will be driven by the cumulative creativity of multiple users, service providers and equipment makers using this new broadband platform to develop and leverage their ideas.

Or will it? Previous internet innovation cycles largely owed their success to the network's open architecture, a result of consistent FCC policy over the past 30 years. That policy maintained network openness by making key network components available to all, on cost-effective terms, so as to allow competition and innovation. The cable industry, that clearly dominates the early deployment of the internet's third-generation access infrastructure for the residential market, comes from a different policy tradition, where the cable owners control access to their network. As cable moves from "broadcast" to "broadband", policy-makers are thus faced with an important choice: should the open access requirements developed for previous-generation internet be extended to the new broadband access infrastructures, or will competition among distinct third-generation access networks serve as a substitute for open access and continue to sustain wide-ranging innovation?

This debate was precipitated in the United States by AT&T's 1998 acquisition of TCI, the largest cable network operator in the US, followed by the company's proposed acquisition of Media One in 1999. With the acquisition of TCI came AT&T's control of Excite@Home, the leading provider of broadband access over cable in the US. AT&T (along with other cable companies) argues that it should retain control over which Internet Service Providers (ISPs) have access to the Excite@Home broadband network, just as cable operators have always controlled which video programs are sent over their network. Government intervention, they argue, is unwarranted, technically unfeasible, and economically counter-productive as it would seriously decrease the company's incentives to upgrade its video network to internet capabilities. Opposing cable's position are a number of local telephone companies (mainly SBC, GTE, Bell Atlantic), ISPs and consumer organizations arguing for an "open access" policy that would let non-affiliated ISPs offer their service over cable networks just as they are able to do over the telephone network. Open access, they argue, is essential to guarantee consumer choice, to insure fairness in the emerging electronic marketplace and to sustain broad-based innovation and participation in the internet's evolution. In early 2000, AT&T has taken a fledgling step away from complete exclusivity, announcing its intent to let ISP Mindspring offer service on its cable in addition to @Home, once its current contract with @Home expires in 2002.[1] Apart from that, the line-up remains largely unchanged today, with one important exception: America On-Line (AOL), historically a leading advocate of open access, has announced its intention to merge with Time-Warner Cable, thus

[1] A copy of AT&T and Mindspring's letter of intent is available from the FCC's site at http://www.fcc.gov/csb/attmindspringletter.doc.

securing access to a broadband delivery channel of its own. AOL's markets, however, stretch far beyond Time-Warner's footprint and it remains to be seen how the merger, if it is consummated, will ultimately affect the open-access debate overall. AOL so far remains a member of the OpenNET coalition[2] and has pledged to implement open access,[3] although it no longer advocates for regulation requiring open access.

The debate takes place in two distinct policy arenas. At the national level, the FCC repeatedly rejected the idea of "open access". On August 11, 1999, the FCC decided not to open a formal proceeding on access to high-speed Internet service,[4] although it had previously acknowledged a concern that deployment of closed access cable systems might reduce competition in the access, or ISP market.[5] FCC Chairman William Kennard later explained that his agency's refusal to intervene was inspired by a "high-tech Hippocratic Oath" to "do no harm",[6] and that he believes non-intervention simply continues the FCC's "unregulation"[7] of the internet. As we go to press, Chairman Kennard just announced his intent to launch a proceeding on cable access, in response to the June 22, 2000 decision of the U.S. Court of Appeals for the Ninth Circuit in the AT&T v. City of Portland case.[8] In its ruling, the court determined that broadband calbe is both a "telecommunications" service and an "information" service, implying that it might be subject to comon carrier obligations. While the FCC reaffirmed its "authority to forbear from regulation in this area", its proceeding will aim "to resolve these issues and bring certainty to the marketplace"[9].

US Cable policy is also made by the city governments who grant cable television licenses. In fact, Portland Oregon fired the opening salvo of the debate with its December 1998 decision to require open access as a condition to transfer TCI's existing license to ATT, the new owner. Portland's decision was upheld on first appeal but reversed by the 9th Circuit Court of Appeal. A court in Broward County, Florida, similarly upheld a local law requiring open access, while Virginia overturned such a law — both decisions are being appealed. Other proceedings have

[2] See http://www.opennetcoalition.org/who/, visited May 1st 2000.

[3] "Memorandum of Understanding between Time Warner Inc. and America Online, Inc. regarding open access business practices", February 29, 2000, available at http://media.web.aol.com/media/press_view.cfm?release_num = 25100400.

[4] FCC chairman Kennard shares goal of local governments to achieve open broadband access. continues to believe that vigilant restraint is the right way to get there. (FCC Report No: CS-99-11, See also: Net access probe denied by FCC. *San Jose Mercury News*. August 12, 1999, p. 4C).

[5] Federal Communications Commission (Memorandum Opinion and Order) CS Docket No. 98-178, February 17, 1999. para. 62.

[6] The FCC has decided not to intervene in this nascent broadband market. In doing so, we are following advice as old as Western civilization itself: First, do no harm — a high-tech Hippocratic Oath (Kennard, 1999).

[7] *The unregulation of the internet: laying a competitive course for the future*. Remarks by Chairman Kennard before the Federal Communications Bar, Northern California Chapter, San Francisco, 7/20/99. The FCC has since re-iterated this position on several occasions. See for example "Consumer Choice Through Competition" Chairman Kennard's Speech at the National Association of Telecommunications Officers and Advisors 19th Annual Conference, September 17, 1999; also Chief of the FCC Cable Services Bureau, Deborah A. Lathen's op-ed, "Driving Ms. Mamie at 1.5 Mbps", Multichannel News, November 8, 1999. Both available from http://www.fcc.gov/broadband/.

[8] AT&T, et al. v. City of Portland, U.S. Court of Appeals, 9th Cirucit, Appeal No. 99-35609 (6/22/00).

[9] FCC Chairman to Launch Proceeding on "Cable Access", FCC Press Release, June 30, 2000. (http://www.fcc.gov/Bureaus/Cable/News—Releases/2000/nrcb0017.html).

followed in other cities (Los Angeles, San Francisco, Miami, Richmond, etc.), none of them currently resolved. In addition, laws requiring open access are currently pending before 13 state legislatures.[10]

To date, the debate has focused on issues of customer choice and investment incentives, as well as arguments about the proper level of policy-making, federal or local. While these are important, we believe that a critical dimension is missing from this discussion: the impact that the resulting architecture will have on shaping the third-generation internet and its innovation dynamics. History is a useful guide here. In today's debate about open access, as in the last decade's debate about open network architecture, the dominant owner of an important infrastructure argues against requirements to let in other service providers, lest it would lose incentives to invest in modernizing its infrastructure. Behind the current argument about the cable TV network, there is a fundamental issue that is unlikely to go away and needs to be confronted.

Indeed, the policy stakes are much larger than the competitive fates of particular groups of ISPs. What is at stake is the continuing evolution of the internet, the innovation in and the evolution of electronic network-based business, and therefore the competitive development of the network economy as a whole. Closed access, we believe, would undercut the current dynamic of expansion and innovation driven by internet users and network providers. We should clearly establish the principle that if market power exists, whatever becomes the natural channel of internet access will have to be configured to allow competition.[11] Openness should depend on clear policy principle, not on corporate discretion.

Beyond the specifics of the AT&T/@Home discussion, we believe that the Commission needs to define the critical elements of "open access" for all providers of broadband service, whether cable or traditional phone companies, through a rulemaking. The answers are not simple. For example, starting from a very different philosophy than the FCC about network development and interconnection, but a shared commitment to strong competition, the British telecom regulator, OFTEL, has pondered a rather inclusive definition of open access for broadband networks. Many participants have argued that policy intervention would be premature. We argue on the contrary, that there is urgency because the competitive development of a broadband internet system is so rapid that decisions made now will profoundly shape the future trajectory of its development. Any risk of limited competition in access should therefore be scrutinized carefully and immediately. While we sympathize with the worry that regulation always has costs, and is especially tricky in a dynamic technological environment, the FCC's traditional policy principles have been surprisingly robust in dealing with innovation (and fostering it). While the policy instruments need to change, the Commission should not undercut its basic principles.

This paper explores this argument in three steps. 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 current state of competition in the delivery of broadband access infrastructure.

[10] Open Access Debate Far From Closure, ZDNet, February 21, 2000 (http://www.zdnet.com/intweek/stories/news/0,4164,2441098,00.html).

[11] We thoroughly agree with Lawrence Lessig (1999), and have adapted his language here.

Our conclusion is that competition suffers severe restrictions, which offer a poor substitute for open access. Third, we examine cable's argument that open access would stifle investment, and analyze the impact of open access for innovation. Finally, we conclude with suggestions about the possible from implementation of such a policy, drawing on international policy discussion, in particular from OFTEL.

2. Network openness, internet evolution, and user-driven innovation

2.1. The third-generation internet

Since its emergence about 30 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. From the early 1990s until today the second-generation internet saw the mass adoption and commercialization of narrowband access, largely through dialup modems providing intermittent, low-bandwidth connections. The internet then took full advantage of equal access to key elements of the telephone network, leveraging the universal coverage of the telephone to provide widespread internet access. The central first-generation applications were file transfers and e-mail, while the explosion of the World Wide Web constituted the main event of the second generation. Throughout however, except perhaps for a lucky few, slow, intermittent, narrowband connections were the norm for residential use.

We are now entering a third phase of the internet's history, when a critical mass of users are about to experience "always-on" high-speed access to the internet from their home. The range and character of services and businesses available on the internet has mushroomed in the past several years; entire industries and segments of industries are being transformed. In itself this clearly is a new step. But existing services will be used very differently and fundamentally new businesses will come on line with the increased functionality that full-time broadband makes possible. Services such as online banking, interactive video telephony, home networking, and internet telephony will come of age. Beyond the radical jump in transfer speeds, up to 600 times faster than dial-up, 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.

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 what will characterize the third phase, but one thing is certain: access to the narrowband world will no more provide reliable 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 which will blossom during the third phase will come as a surprise. It is impossible to predict in a next phase of open internet development either what the value-generating uses of information technology will be, or what optimum network and market structures are necessary to deliver them to users. The answers will emerge through experimentation by users and through competition among those providing users with the tools

for that experimentation. This experimentation will include broadband content, video, interactive services, and internet telephony-based services, many of which a monopolist provider might like 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.

2.2. 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 (Oxman, 1999). 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 networking from much of telecom's regulatory baggage, including fees to fund various cross-subsidies for telephone services and prevented telephone companies from dictating the architecture of data networks.

Policy intervention, not "unregulation", forced network incumbents to open their networks to these new entrants. The FCC allowed specialized providers of data services, including Internet Service Providers (ISPs) and their customers access to raw network transmission capacity through leased lines on cost-effective terms. In addition to access, FCC policy allowed for flat rate pricing mechanisms for the internet, largely by exempting ISPs from access charges for data, and it did not impose cross-subsidy requirements on data transport tariffs. The resulting competition allowed the FCC to free the service providers from detailed regulation that would have kept them from using the full capabilities of the network in the most open and free manner. To be sure, the FCC strategy emerged haltingly but its direction never changed. Indeed, the Commission consistently backed cost-based access to the network (initially through leased lines and later through unbundled network elements). The Commission thus supported competition and innovation, time and again, by unfailingly keeping the critical network infrastructure open to new architectures and available to new services on cost-effective terms. The instruments of FCC policy were to make leased lines (and, lately, network elements) available on cost-oriented terms and to forebear from regulating internet and other data services.

Promoting ever-greater openness of the US telecommunications infrastructure has been a significant theme of US regulatory policy and an important factor in the internet's success (Oxman, 1999). The FCC chose to unbundle "network elements", the functional elements of the network, rather than to regulate end services. This policy allowed a variety of actors to take basic network building blocks and combine them in diverse and unpredictable ways. Regulating data services, by contrast, would have frozen such experimentation. The major regulatory decisions taken by the FCC over the past 40 years have opened the network and shifted the impetus

for telecommunications innovation from incumbent carriers to network users, alternative equipment suppliers and new entrants.[12] 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.[13] These decisions in turn fostered user-driven innovation by giving leading edge users — like financial services, energy and manufacturing firms — broader access to enhanced facilities and communication capabilities.

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 their development 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. These competitors provide a substantial share of DSL access service today. In its *Third Computer Inquiry*, the FCC identified standards for critical software interfaces that were to be made available at affordable tariffed rates.[14] This gradually unfolding US policy to enable user-centered innovation culminated, of course, in the FCC's implementation of the pricing and interconnection provisions of the new Telecommunications Act.

Throughout this history, the monopoly owners of the communications infrastructure strongly resisted opening their network to other service providers. For decades, AT&T resolutely and effectively resisted regulatory requirements to allow interconnection with its network, as the *Carterfone*, *Execunet*, *Open Skies*, and other legal battles all demonstrate. The RBOCs have pursued the same strategy against Open Network Architecture (ONA) and against the unbundling and interconnection provisions of the 1996 Telecommunications Act. Yet policy persistence paid off,

[12] 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.

[13] "… 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, as there stated, "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 No. 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).

[14] See Expanded Interconnection with Local Telephone Company Facilities (Special Access Order), CC Docket No. 91-141, September 17, 1992; Expanded Interconnection with Local Telephone Company Facilities (Switched Access Order) CC Docket No. 91-141, August 3, 1993; and *Third Computer Inquiry*.

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.[15] 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" mode. Network openness has in fact radically stimulated the use of incumbents' telecom assets such as second lines.

Indeed, US 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 innovation, new services, infrastructure development, increasing network usage with evident economic benefits for the U.S. economy. Open infrastructure policy fostered user-driven innovation. This meant that the principal sources of new ideas driving economic growth emerged from a long-term process of experimentation and learning, as business and consumer users iteratively adopted and shaped application of information technology and E-commerce. Such user-centered innovation processes flourish when users are granted access to a wide range of choices of facilities, services, and network elements (Bar & Borrus, 1997). 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 US a voice in global policy that went far beyond its political and market power.

Experimentation by users and competition among providers, across the range of segments that constitute the internet, generated a surge of self-sustaining innovation. 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. The World Wide Web in turn facilitated a new surge of innovation that has ushered in internet-based E-commerce. 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 were key, since nobody could foresee what would eventually emerge as successful applications. Openness allowed many paths to be explored, not only those which phone companies, the infrastructure's monopoly owners, would have favored. Absent policy-mandated openness, the Regional Bell Operating Companies

[15] For example, the FCC consistently argued that 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.

(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.

Indeed, many of the most successful paths challenged the very core of the phone monopoly business as well as the industry's technology and business assumptions. For example, the internet is largely insensitive to distance and price, both because of the character of the emerging technologies and the particular regulatory setting under which they operate. The internet, where flat-fee pricing had customers pay the same price for one or many e-mails, for sending them around the corner or around the world, forced profound change for the traditional telephone companies.

2.3. Who ought to shape the internet's third phase?

As we enter the 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 multi-channel video service to homes 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 firm is arguing it should have the right to keep access closed, or at least discretionary. Based on the history we sketched above, this should not come as a surprise. The question is obvious. The successful policy trend of the past 30 years has been to force competition and assure open access to the incumbent infrastructure. Why, now, reverse that successful policy?

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 or anyone else, has a complete monopoly over the cable infrastructure. Local franchises, moreover, only come up for renegotiations episodically or with a change of ownership, further reinforcing cable's local monopoly power. At the national level, AT&T represents a particularly significant case, because it has become the largest national cable provider with a position in a majority of local markets. As a result of its recent acquisitions, AT&T now controls the majority of the US cable television infrastructure. Thus, AT&T now has substantial market power over large sections of the present and future broadband internet, and consequently finds itself in a position to have a profound impact on the internet's third phase. This share gives it significant influence, beyond the sheer market power indicated by the number of homes passed by a cable system in which AT&T has a significant ownership stake. Indeed, it allows the company to coordinate the activities of many local monopolists and shape the overall network architecture and standards. At the moment AT&T is building a vertical structure in partnership with Excite@Home. The risks and costs of such a closed vertical structure remain even if AT&T only lets in one or a few additional ISP partners.

3. Assessing competitive provision of broadband access

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–medium term. Cable providers, who have monopoly cable 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. In this, we differ from the FCC's position that it should not necessarily be viewed separately.[16] The two offer significantly different transfer speeds, with substantial price differences[17] and, as a result, support dramatically different services and applications. To be sure, there is overlap, as broadband connections obviously offer a significant improvement for existing narrowband applications: graphics-intensive web pages load much faster, file transfers complete quickly. But broadband internet is much more than a faster version of the old narrowband internet. Rather, it enables real-time, bandwidth-intensive applications that would be impossible with dial-up narrowband access (Kwok, 1997), such as near broadcast quality video streaming, IP-based videoconferencing, or effective connections to a remote LAN. Therefore, the relevant market for our analysis is the market for broadband access, separate from the overall internet access market. In particular, competition from existing ISPs providing narrowband access would not prevent exercise of market power by an ISP that is vertically tied to the owner of broadband access facilities.[18]

A further distinction about relevant market rests on the classes of end users, where the FCC's distinction between residential and business markets makes sense. The third-generation internet marketplace will be driven by the deployment of ubiquitous, "always-on" networking with broadband content into the home. Home networks permanently connected to the internet, with access appliances or screens in several rooms, are a possible part of this vision, as are interactive video conferencing and low-cost internet telephony. But 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. Broadband means many different kinds of content and communication patterns concurrently, "always-on" makes the home a permanent part of the network. Beyond the juxtaposition of traditionally distinct voice, image and data

[16] "The Bureau expresses no view on whether the residential broadband market is a separate market from the residential narrowband market" (Lathen, 1999 p. 32).

[17] We recognize that the ISP/portal market and the broadband network access market are different. For the purposes of simplicity we do not spell out the distinctions throughout this paper. In our discussion we treat ISPs as a vertically related market to network access, but we also treat ISPs as a surrogate in some cases for users. We think that this suffices for our purposes. In our conclusion we return to the policy relevant distinction between the ISP and broadband access markets.

[18] For example, it has been argued that we must "forbear from imposing the *Computer II* regime on cable provided-Internet access services," unless "the cable Internet platform currently stands as an essential barrier to ISPs reaching their customers" (Esbin, 1998). This erroneously assumes that internet service over a phone line using a modem and over a cable line using a cable modem are identical products — if cable modems are the only feasible broadband route to the home, such a barrier exists.

streams on a common wire, this will be marked by their integration within new communication applications. 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 shape their character.

Naturally, third-generation communication applications and patterns of internet use will not be restricted to the home and will be adapted throughout the economy. But the residential market will play an important role in shaping the third-generation internet and E-commerce evolution because it will bring a population of broadband users large enough to constitute a critical mass able to sustain the development of third-generation applications. Again, the particulars of this third-generation future are in essence unpredictable, but one might look back to the development of the second-generation web for insights. As the internet became a mass medium during its second phase, the large population of internet users created justification for continued innovation in browsers and server features. The large population of browser-equipped customers in turn created powerful incentives for merchants to offer electronic commerce applications and build a cyber-marketplace. The mass market thus shaped the unfolding of second-generation internet and the current forms of early electronic commerce. Sustained development of the next generation of applications will similarly require a large enough potential audience of users with broadband network access. Only if there is a critical mass of broadband-enabled users will the full range of broadband application and use patterns be explored. Closing off key segments of the broadband infrastructure to a monopoly provider 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 policy importance.

This section argues that cable and more specifically AT&T, as a result of recent and proposed mergers, dominates residential broadband access. 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 future, marking the first five years of broadband access deployment. This initial period is particularly critical because patterns get set early.

3.1. The deployment of broadband access alternatives

The pace of broadband access infrastructure deployment is picking up quite dramatically. Both CATV operators and incumbents LECs are working hard to upgrade their networks so that they can offer broadband internet access. In addition, a number of wireless technologies are now emerging as possible broadband alternatives. These range from "wireless cable" approaches such as MMDS and 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. The FCC reports mid-1999 figures showing 1,052,000 cable subscribers versus 159,150 DSL (Lathen, 1999, pp. 25, 28). End-1999 numbers from the Yankee Group peg the total installed base of residential broadband subscribers at 1.4 million, with nearly 80% of these homes using cable modems (Yankee Group, 2000). Others show an even greater cable lead, counting 2,277,750 cable subscribers to 189,500 DSL

subscribers at the end of first Quarter 2000 (Telecommunications Reports Int'l 2000). The FCC has just initiated a data-gathering program in an effort to better gauge the real extent of broadband access competition.[19] Until results are reported, however, we can reasonably accept the most conservative industry estimates, reflecting an 80/20 lead for cable.

Predictions about the future of broadband access competition are more dispersed, although most reports agree that cable's lead probably will endure through the next two years. For example, a McKinsey/Bernstein study pegs 2004 cable share at 47% (the rest being divided between DSL and new wireless access methods)[20], the Yankee Group predicts that cable will still control 42% of this market by 2004 (Yankee Group, 2000), while the Cahners Group sees DSL overtaking cable in 2002 (Cahners In-Stat Group, 2000).

In our view, there is much support for the predictions that cable will continue to dominate. In particular, only 23% of US households are within 12,000 ft of an upgraded central office, without Digital Loop Carrier (DLC), and therefore can technically receive DSL service, while 52% of US households are passed by an upgraded two-way cable plant that can technically deliver broadband access (McKinsey & Bernstein, 2000, p. 9). The ratio worsens when one considers only households with annual income over $75,000, who are most likely to be early adopters and profitable customers: 60% of these are addressable by broadband cable, versus 20% by DSL (McKinsey & Bernstein, 2000, p. 9). 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. As an example, the price tag of SBC's "project Pronto", its network upgrade initiative aimed at making 80% of its access lines DSL capable by end-2002, carries a $6 billion price tag.[21] 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 making digital cable interactive, less than 5–8% 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 footprints, with relatively limited overlap. The cable modem footprint generally covers only residential areas and clearly dominates in many suburbs (Freed, 1999). While we can expect that eventually, most homes will have a choice between two broadband wires, cable and DSL, in the near term most will only have one option, and in most cases that option will be cable. We should also note that a few US cities, notably Palo Alto, CA and Dunwoody, GA, have undertaken fiber-to-the-home trials (Hecht, 2000). At this point, however, these remain pricey (e.g. Palo Alto's costs $1200 connection fee, and $92/month for 10 Mbps

[19] "FCC adopts data collection program to Assess Local Telecommunications Competition and Broadband Deployment", FCC press release, 3/14/00, (http://www.fcc.gov/Bureaus/Common_Carrier/News_Releases/2000/nrcc0020.html).

[20] This estimate assumes that ILECs carry through the substantial network upgrades required to deploy DSL technology, and assume significant DSL resale by major ISPs (McKinsey & Bernstein, 2000).

[21] See http://www.sbc.com/Technology/data_strategy/project_pronto/Home.html.

service, or twice those rates for 100 Mbps)[22] and their availability is likely to remain quite limited in the near future.

In its recent staff report on broadband deployment, the FCC's Cable Services Bureau notes that in addition to these wired approaches, a number of broadband wireless technologies will be offered within a few years (Lathen, 1999, p. 29). Sprint plans to deploy one such technology, Multichannel Multipoint Distribution Services (MMDS), in 83 US markets over the next two years, offering data rates and prices roughly similar to today's cable modem and DSL solutions (Boardwatch, 2000a). 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 "Wireless Competitive Local Exchange Carriers", including Advanced Radio Telecom (ART), NextLink, Teligent and WinStar, who generally plan to focus on providing broadband service to buildings in urban areas that are not served by existing fiber or CLECs (Boardwatch, 2000b). While most will initially focus on business customers, AT&T has just announced the roll-out of "Fixed Wireless" telephone service in areas where it does not have agreements with cable operators, providing initial data rates of 256 to 512 kbps, and up to 1 Mb/s by summer's end.[23] However, analysts see MMDS and fixed wireless as niche plays, estimating that they will take, respectively, 8 and 7% of the broadband access market by 2004, primarily in areas where neither cable nor DSL is available (McKinsey & Bernstein, 2000, p.31). Also on the horizon are an array of other high-bandwidth wireless technologies, such as Qualcomm's High Data Rate (HDR) wireless technology, expected to offer up to 2.4 Mbps,[24] and satellite access from Spaceway, Teledesic, or Tachyon offering two-way high-speed data links. While Tachyon started offering services to US businesses in 2000 (the equipment costs of $4000 per location and monthly service fee of $470 to $1500 make this an unlikely competitor for residential customers), both Spaceway and Teledesic are several years away. Neither will compete for residential customers in the near future.

In summary, the competitive landscape that emerges from current technology deployment and announcements is one where 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 5 years, a period roughly comparable to the existence of second-generation internet.[25] Throughout the period, 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 networks as many individual households will not be technically addressable by both systems. In fact, cable operators and Telcos often are not really competing head-on, having

[22] See "Fiber to the Home (FTTH) Trial" (http://www.city.palo-alto.ca.us/utilities/fth/index.html).

[23] See ATT press release,"AT&T" "Cuts The Cord" To Provide Services Into Homes; Debuts Nation's First Wireless Local Communications Company, March 23, 2000 (http://www.att.com/press/item/0,1354,2706,00.html)

[24] See http://www.qualcomm.com/cda/tech/hdr/whatis.html.

[25] Netscape 1.0 was released about 5 years ago, on December 14, 1994, providing a convenient marker for the start of the second-generation internet.

essentially partitioned the broadband access market: cable modems for residences, DSL for small- and medium-size businesses (McKinsey & Bernstein, 2000, pp. 10–11; see also Boardwatch, 2000c).

3.2. Switching costs are high

In the FCC's analysis, cable's initial success has created competitive opportunities and "spurred the deployment of Digital Subscriber Lines (DSL)" (Lathen, 1999, p. 9). If this is the case and if DSL providers have entered areas where they can compete head-on with cable access providers, for competition to serve as a check on cable operators' behavior it needs to be easy for residential consumers to switch from one broadband 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. In our view, however, these switching costs are substantial, and likely to combine with early deployment lead for Broadband Cable to allow the credible 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, non-refundable connection charges, 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 $600 (Table 1 provides a rough estimate of these physical switching costs.) 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 setup fees, and in these early stages, carriers occasionally waive sign up fees.[26] An additional cost — 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 should be reduced in the future as both cable and DSL technologies become more robust, and as new technology implementation, such as splitter-less "G.lite" DSL, eliminates the need for a technician visit. At this point, however, these various costs add up to substantial hurdles for residential customers, making the switch between broadband access method 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 who are not required to offer 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

[26] For example, SBC is currently waiving installation charges and equipment fees until the end of May 2000, although this requires a one-year commitment.

Table 1
Examples of residential switching costs: cable modems versus xDSL[a]

	Cable Modem[b]	DSL[c]
Installation	$103	$149
Inside wiring[d]	?[e]	$100
Customer Premises Equipment	$275[f]	$234
One-time setup fee for connectivity	$137	$100
One-time setup fee from ISP	?[g]	$38

[a] Figures in this table were averaged from the following product literature and trade press surveys: Excite@Home, "Product Guide." As of August 10, 1999. See "http://www.home.com/"; D.-R. Barbara. "DSL gets a boost". *InternetWeek*, March 1, 1999, p. 34; "Roll out the bandwidth". *Computer Letter*, February 8, 1999, p. 1; Heckart, C. and Briere, D. *Network World*. "Low-cost DSL, cable carry bottlenecks", *Network World*, February 1, 1999, p. 28; Hamblen, M. "Cable Modems." *Computerworld*, June 21, 1999, p. 89; Tilley, S. "The need for speed: Experiences with consumer-oriented, high-speed Internet access technology." *Communications of the ACM*, July 1999, p. 23; Mandel, B. "Broadband hits home." *Infoworld*, July 5, 1999, p. 30.

[b] Cable Modem prices given here represent lower-bound estimates, as potentially substantial costs are currently being capitalized by the monopoly cable carrier, presumably with the intent of recouping these costs in monthly billing.

[c] DSL prices given here may be skewed toward the high end, because a broader range of high-end offerings were sampled in the articles surveyed.

[d] Inside wiring may not be necessary at all locations.

[e] Presently paid by the monopoly carrier, presumably with the intent of recouping these costs in monthly billing.

[f] Cost estimate of what is presently paid by the monopoly carrier — however, with the advent of greater standardization, "modems and set-tops are supposed to become consumer electronics items that consumers pick up and pay for" Higgins, J.M. "All for just $5,000." *Broadcasting and Cable*, May 10, 1999, pp. 16–18.

[g] May not be relevant to cable modems, as the ISP presently *is* the cable provider, or closely affiliated — or may be paid by the monopoly carrier.

switch relatively easily between ISPs and 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.[27] Additional inconvenience would include the loss of adaptive setups that provide ease of access or access to special services. This category of switching cost, we should note, is not specific to cable, but affects users switching either from DSL to cable, or 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.

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 (Higgins, 1999). 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.[28] 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 to create distinctive packages. AT&T could, and apparently intends to offer integrated bundles of phone services (both local and long distance), cable TV, mobile services, and ISP. If competitors cannot create equivalent bundles, the resistance to switching one component of the bundle — broadband access — to an alternate supplier obviously increases. The anti-competitive 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 (Galperin & Bar, 1999).

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 we 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. This is not the case when picking between two alternative broadband access services. Prices are not always what they seem, with countless hidden costs ranging from re-wiring to domain name re-setting, and packaging is less than transparent when broadband services come as part of complicated and hard-to-compare bundles.

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 like cereals, customers will not know what they are missing until they buy the competitor's product and try it out. But unlike cereals, where it is easy to buy two different boxes and give them a taste-trial over breakfast, few customers will

[27] Obviously at this time, this is only a "problem" DSL customers face since broadband cable customers are prohibited from running any kind of server from their home through their cable modem service, as per 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).

[28] This represents $49.5 million of the value of @Home's present subscriber base of 330,000. Estimate of @Home subscriber base from Kinetic Research, cited in Lash (1999).

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 chose, 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 two years ago, 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, we typically rely on others to help us choose. We 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, as Goolsbee and Klenow (1999) have shown, are strongly influenced by their local social network. But neighbors will not be of 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.

3.3. 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. The precise form of market power may vary according to local market conditions. The precise market structure, or set of different local market structures, will only unfold over time. But no matter how the structure of a local market unfolds, it is likely to be less than fully competitive. In some set of local markets — likely to be a significant set given the limitations on DSL — cable will be the only broadband option. There, consumers are likely to be harmed: they will pay the access fees an unregulated monopolist 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 players' network is open and the other closed. They will have a choice between the cable-blessed access provider allowed to operate over the cable line, and the 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 that there are two sources of concern.

First — as discussed above — Cable's early lead in deployment, coupled with substantial physical and logical switching costs are likely to give cable operators substantial power even in potential dual-access local markets. Second, denying access for non-affiliated ISPs to the cable wire 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 wire is closed, competitive DSL access providers will face a monopolist in their RBOC. In the end, residential customers would be better served if there was real market competition, with cable and telcos each vying for ISPs' business.

Thus, in markets where cable and DSL compete, we should not assume that the cable company would then be forced to open its system in order to attract customers. Indeed, by keeping access closed, the cable owner would strengthen the ILECs bargaining position vis-à-vis ISPs, thereby decreasing competitive pressure on its own integrated ISP. 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. Closed-access cable and open-access ILEC would in effect have a common interest in keeping cable closed-access, thus creating the basis for implicit collusion that would strengthen their respective positions over non-affiliated ISPs. 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.

The recent merger announcement between AOL and Time Warner underscores this point and magnifies our concern that competition alone might not be a sufficient source of discipline to yield open access. Despite its considerable pre-merger clout, AOL has 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 which will find themselves unable to merge with a cable operator. The merged AOL–Time Warner would combine the world's largest ISP and America's second largest cable operator with 20 million cable households, 85% of which are broadband addressable (McKinsey & Bernstein, 2000, p. 12). It has pledged to implement open access, but we are short on details as the merger is being finalized and winds its way through the approval process.

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 amongst 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."[29] Such capacity-constrained systems can create "joint dominance", a situation with a very limited

[29] OFTEL's response to the UK Green Paper — Regulating communications: approaching convergence in the information age, January 1999. www.oftel.gov.uk/broadcast/gpia0199.htm p. 4 paragraph 13.

number of competing suppliers. In that case, OFTEL argued that it may be necessary to apply the same rules that govern individual firms with market power.[30]

4. Nurturing third-generation innovation

To encourage the successful deployment of third-generation internet access infrastructure and the promotion of the accompanying wave of innovation, policy makers need simultaneously to pursue two goals. First, they must ensure that sufficient incentives exist for industry to invest in upgrading 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 these 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 this dichotomous vision, the cable industry warns that 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 in the absence of 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 channels innovation along the sole interests of the infrastructure owners. With the previous section's assessment of the competitive situation, this lays the groundwork for our concluding section exploring possible policy approaches to escaping this false trade-off between infrastructure investment and service innovation.

4.1. Sustaining investment in third-generation access infrastructure

The cable industry argues that if it cannot impose its affiliated ISP as the exclusive choice for cable broadband access, its network upgrades will be too risky and unprofitable to warrant the

[30] p. 59 of "Beyond the Telephone, the Television and the PC — III," OFTEL's second submission, March 1998, found at www.oftel.gov.uk/broadcast/dcms398/htm. It defines an "open state" as a market where "there is universal access control (i.e., 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, par. 2.6).

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 resonates strongly with the FCC, whose preliminary findings repeat the industry's threat that regulation or the threat of regulation ultimately slows deployment of broadband (Lathen, 1999, p. 33). 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 appears 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) (Owen & Rosston, 1998).

On this issue of investment incentives, our view differs from that of the NCTA in a number of respects. First, we note that the claim that regulatory constraints will hinder investment is not new and that in fact, throughout its history AT&T has repeatedly argued along these lines against opening its network to devices like Carterfone or alternative service providers like MCI. Regardless of this, regulatory action to introduce competition proceeded and network investment continued. Second, the argument neglects 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 (TIA, 1998).[31] 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 importantly, to offer cable-based phone service.

Third, these investments, and the large sums AT&T spent to acquire these companies, were predicated on more than simply broadband internet. In particular, an upgraded local cable plant would allow AT&T to save considerable sums in access and interconnection fees, estimated to run as high as fifteen billion dollars in 1998, about a third of its domestic wireline revenues (Darby, 1999). Cut these 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 in four to five years. In that case, gains from video services, let alone internet access, are just gravy (MacKie-Mason, 1999, p. 12). 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.[32]

Fourth, the cable industry claims that open-access regulation would reduce its revenues and its incentives to invest. The FCC repeats these claims, reporting that "there was near unanimous agreement among the cable and investment panelists that government regulation of the terms and

[31] Cited in MacKie-Mason (1999).

[32] Providing broadband internet access via cable modem is estimated by the FCC to cost the cable operator $800–1000 per subscriber. Federal Communications Commission. "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." (Report) CC Docket No. 98-146. February 2, 1999. chart 2. Federal Communications Commission. "Annual assessment of the status of competition in markets for the delivery of video programming." (Fifth Annual Report) CS Docket No. 98-102. December 23, 1998. para. 40 DePompa-Reimer (1999).

conditions of third-party access to cable systems would cast a cloud over investment" (Lathen, 1999, p. 34). Several analysts, however, including Merill Lynch and Jupiter Communications believe on the contrary that open access would be profitable for cable operators (MacKie-Mason, 1999, p. 35), because it would create additional wholesale revenues. MacKie-Mason's (1999) 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. 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 US counterparts in deploying broadband facilities (MacKie-Mason, 1999, p. 27).

In summary, we believe that there is ample reason to strongly question cable's claim that open-access requirement would stop the deployment of broadband cable access. 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, policy makers have apparently decided that deployment speed is not the only value at stake. They instead decided that fostering an open innovation environment was an equally worthwhile goal, even at the cost of a hypothetical deployment slowdown.[33] If this logic is appropriate for the FCC's Common Carrier Bureau, why is it unfit for its Cable Services Bureau?

4.2. Fostering innovation in third-generation applications

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 will take place, simply that only the technology trajectories that line-up with their interest will be pursued. As a result, the kind of wide-ranging, open innovation and experimentation that has been central to previous generations of internet explosion will 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 they 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, @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 @Home understandably configured its service so as 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.

[33] For a similar argument, see Lemley, Mark and Lawrence Lessig, 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, 1999.

The overall internet usage pattern encouraged by Excite@Home is strongly 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.[34]

(a) Limits on up-stream traffic, that curtail consumers' ability to experiment with their own uses of the network including internet telephony and interactive video teleconferencing.[35]
(b) Prohibitions on setting up any kind of server.[36]
(c) Technical biasing against and limits on the performance for non-partner content that will structure the cyber marketplace, limiting experimentation and innovation.
(d) Prohibitions on using Excite@Home for work-related activities, for which customers are expected to purchase the more expensive (and DSL-based) "@Work" service. This means that 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.
(e) In order to enforce these rules, @Home must constantly monitor its customers' data traffic, raising serious privacy concerns.[37]

Arguably, these restrictions flow from the limitations of cable technology. They represent, however, @Home's own approach to dealing with these limitations, encouraging communication patterns that happen to fit well with @Home's business strategy. It would certainly be interesting to see how innovative non-affiliated ISPs might explore alternative ways around these limitations.[38] However, while it will still be possible to receive internet service from other ISPs, though still paying for @Home ISP service, alternative service providers will be denied access to key network performance features of the @Home infrastructure, such as dynamic caching and collocation on the @Home network. Closure and usage limits thus preclude experimentation with

[34] See: At Home Corporation. *@Home Acceptable Use Policy*. http://www.home.com/support/aup/ (Last modified: September 21, 1999 – visited May 1, 2000); At Home Corporation. *@Home User Guide*. http://www.home.com/support/netscape/ (Visited May 1, 2000); At Home Corporation. *@Home Frequently Asked Questions*. http://www.home.com/support/netscape/faq/faq.html (Visited May 1, 2000)

[35] "Excite@Home speed caps draw fire, prompt new plans", Corey Grice, CNET News.com, June 28, 1999, (available at http://www.news.com/News/Item/0,4,38479,00.html)

[36] "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 http://www.home.com/support/aup/

[37] See "Excite@Home: Protection Or Invasion?" By Karen J. Bannan, Inter@ctive Week, June 21, 1999 (Available at 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 better improve connections to its backbone. In addition, the company said, monitoring individual usage helps the company to upgrade its services.

[38] 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.

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, in the absence of competitive or regulatory constraints, will also logically try to extend its infrastructure ownership into control of the services and content it carries. There are 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 assure 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[39] is very clear on these strategic practices and includes details of how @Home offers speedier service to internet content providers who agree to become "content partners" and share their revenue stream (At Home Corporation, 1999). 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 (At Home Corporation, 1999, p. 8)

Further, the report notes that:

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

[39] The 1999 Annual Report is much more vague about the specifics of these practices. There are, however, no indications that they have been abandoned.

These quotes describe two strategies aimed at shaping the architecture of the cyber-marketplace. The first is "collocation", the second is "replication". Both function to allow @Home to privilege partners and exclude competitors — they differ only slightly in their implementation. @Home has developed partnerships with non-competing firms in each of several content areas (interactive shopping, gaming, digital audio, digital photography, and search services) and it is presently collecting "fees relating to content partnering arrangement" (At Home Corporation, 1999). In keeping with its cable origins, @Home sees these practices as "programming" and it sees itself as "programming the Internet" (At Home Corporation, 1999, p. 8). @Home is promoting itself as offering collocation service to bring better performance to @Home customers (merchants as 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 appears to be exclusive to a particular area of content. A collocated partner has faster access to @Home consumers because of their presence on the same network. In 1999 @Home 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 pre-loading it at sites that are close and well-connected to subscribers. As of 1999, @Home replicated news feeds from CNN and Bloomberg. @Home then promotes replicated and collocated partners on its portal and with its "wizards", making competitors harder to get to. The result is the creation of a cyber-marketplace which systematically favors the providers of content, services or transactions who have a privileged financial relationship with the monopoly owner of the infrastructure which supports that cyber-marketplace. If customers had a real choice of broadband access infrastructure, this would matter less, but within the current situation, when they become customers of @Home's access infrastructure, they automatically and unknowingly receive access to a cyber-marketplace biased to favor @Home's financial partners. As of 1999, @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.[40]

In addition, it certainly is possible to manipulate the caching architecture in many other ways to favor partners. @Home has the incentive, given its relationship with content providers, to further utilize the caching system to actually slow requests to competitors' "programming", rather than merely speeding up access to its own brands.[41] @Home's annual report also notes that "local caching servers can compile far more comprehensive usage data than is normally attainable on the Internet" (At Home Corporation, 1999, p. 10). If this data were shared with partners, this would create a further barrier to competition from non-partner content providers. Not only could an @Home partner know detailed information about @Home subscribers using their service, it would also be possible to know the same detailed information about who was using a competitor's service or to restrict access to a competitor's service while substituting their own.

[40] Amicus Curiae Brief of Excite@Home, Re: AT&T v. Portland, August 16, 1999. esp. footnotes 17, 18, 19 and 20 (http://techlawjournal.com/courts/portland/19990816exc.htm).

[41] In their joint letter to FCC Chairman Kennard, dated July 29, 1999, 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. A copy of that letter is available at http://tap.epn.org/cme/kennard.html.

In summary, @Home proposes in its own materials to structure a cyber-marketplace that steers @Home customers, unknowingly, toward merchants who partner with @Home. @Home can structure the cyber-marketplace both through the advantageous positioning and access of partners and through @Home's devices such as "How-Do I" wizards.[42] @Home's own reports explain how they will provide superior quality performance to partnering merchants on their network. If you are a merchant, either you are on @Home's service network or the majority of broadband customers (those that use AT&T@Home cable service) will not be able to access your site, as you intended.

Opponents of Open Access requirements believe 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. Speta (2000) explains that, while telecommunications networks derive value from connecting people to each others 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" (Speta, 2000, p. 84). This view overlooks strategies such as those we just documented in @Home's case. Indeed, as @Home argues 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, @Home is acting very much like Microsoft using its control of the operating system's architecture to favor some applications over others, with similar anti-competitive 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 are 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, we should note, even allowing the choice of another ISP for no additional fee (for example, if customers could choose to substitute AOL for @Home as the default ISP over their broadband cable access) would not correct the competitive problems created by broadband access architecture that rewarded @Home with performance advantages over all rivals. There are at least two reasons.

First, electronic commerce certainly is one of, if not *the* killer application 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 provider: @Home. Second, business-to-business e-commerce has dominated until now. Broadband will facilitate the full-fledged emergence of retail e-commerce. Closed access would, as a matter of policy, permit @Home to structure the cyber-marketplace for a significant portion of the American consumer population. With control of the broadband service provision, @Home would become a truly dominant influence in American retail. Even if @Home's control of the broadband market

[42] @Home describes the "wizards" at http://www.home.com/howdoi.html.

were more limited, it would nonetheless structure the cyber-marketplace used by a substantial number of American consumers. The biases will not be immediately obvious and they will 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 a 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?

5. Conclusion: dealing with joint dominance

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 absence of a policy to assure open access, 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? We think that the most important point is to recognize that the situation is ripe for an explicit set of policy decisions, not wait and see. 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 with, some believe that the main policy issue is that consumers should not have to pay twice for the use of an ISP other than @Home. This emphasis on non-discriminatory 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 might write the requirement into decisions on the AT&T–Media One and AOL–Time Warner mergers. Other countries would have to find appropriate policy instruments, as we will discuss shortly.

Just as importantly, a non-discrimination rule in itself would not solve the underlying problems that we have described. For example, suppose that the rule simply said that non-affiliated ISPs will pay the same as @Home for access to the cable broadband network. This would not prevent

AT&T from taking its rents on the network access charge and simply bundling in @Home for no fee. This would be like Microsoft making its money off Windows while charging nothing for its browser.[43] Is this satisfactory, or not? After all, these ISPs could change their business model to the one used by Yahoo (or AOL in its UK operations for some customers) where there is no monthly charge for email and access. Revenues derive from ads and sales commissions.

Arguably, the "don't pay twice" rule, while straightforward, only addresses one of the least important issues discussed in this paper. The real issue is the ability to achieve an open architecture for broadband services. Policy makers should aim to stimulate innovative designs and uses of the network. But the vertical arrangement between the AT&T/TCI broadband network and an ISP may defeat this because the network will be optimized to give superior performance to the preferred ISP and superior service to the ISP's favored partners.

As we have stressed throughout this paper, 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.[44] 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.

It is precisely in regard to the intersection of market power, even jointly shared with other providers, and network architecture that the British telecom regulator, OFTEL has engaged in a powerful dialogue. OFTEL's analysis has changed over time but captured many of the right policy questions. This initiative is particularly interesting because OFTEL, while being a strong advocate of competition, has generally been less disposed than the FCC to "unbundle" network elements for local access. Yet, in 1999 OFTEL argued that the regulator should use its power to force disclosure of the underlying network architecture, and a form of mandatory mediation among all stakeholders about how to make the architecture sufficiently non-discriminatory in order to blunt the worst abuses of market power. The OFTEL idea was one way to think about an intermediary policy solution. It was not proposing anything like unbundling of network elements or LRIC pricing. But it was looking for a measured policy response to the challenge explored in this paper.

As such, OFTEL's approach served as an important referent in the current policy debate. It recognized the problem and created the condition for an informed and open public debate to address it, rather than simply wishing that it would all go away if regulators let the cable companies proceed. Differences in OFTEL's premises, as well as the specifics of the British policy discussion, meant that OFTEL's tentative answer might not have been right for America.[45]

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[43] In effect, it is like the first DOJ 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).

[44] FCC Memorandum Opinion and Order approving the AT&T–TCI Merger, February 18, 1999 (FCC 99-24).

[45] OFTEL began with some premises that the FCC might reject. For example, OFTEL was especially concerned about set-top boxes. And its analysis of market power was influenced by the fact that the underlying network offering DSL in the UK has not been subject to unbundling in the same manner as in the United States.

Since then, the Canadian government has announced a much more intrusive policy for approaching the relevant competition issues while OFTEL and the European Commission have redefined their approaches. In their terminology "joint dominance" addresses issues of "collective dominance" and "Significant Market Power." Collective dominance refers to a situation where a small group of oligopolists (presumably operating in an industry with homogenous product and high entry barriers) have a collective ability and incentive to impede competition in such a way as to restrict output or raise prices.[46] Significant market power does not, in OFTEL's language, "require that the operator is able to act independently of its rivals".[47] (The European Commission presumes that the minimum threshold for this power is a 25% share of the relevant market.)

The European Commission has suggested that it would be appropriate for Member States to place an 'obligation to negotiate access' on a cable TV operator with significant market power for delivery of broadband services (or an obligation to grant access in the case of a dominant operator), with the possibility of NRA [National Regulatory Authority] intervention if commercial negotiation fails.[48]

In our judgment OFTEL and the European Commission have focused excessively 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 that are crucial to interactive services. The Commission has noted the possibility that it may need to impose "compulsory licensing and publication" of the interfaces and require "functional interoperability."[49] This is analogous to the issues raised in this paper about broadband services.

The FCC has emphasized that technological innovation may resolve competition issues about broadband access before any regulatory intervention (that would inevitably impose some losses) could do much good. Perhaps. But in its anxiety not to stifle investment in cable television upgrades the FCC is proceeding 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. Even a detailed public inquiry into these issues may deter some forms of anti-competitive behavior by sending a powerful signal that the government might intervene.

For the signal to be credible the Commission has to put rules in place that give it authority to act if it finds a problem. Having to go through a two-year rulemaking in order to establish the authority would make public inquiries toothless. Once the Commission has clearly affirmed its power to act, and a process for doing so, it can choose to forebear on detailed regulation if it wishes. But it should forebear while prominently and continually scrutinizing the market. Some of the

[46] OFTEL, "Guidelines on Market Influence": March 2000, pars. 1.21–1.25. OFTEL notes that case law in the European Court limits the applicability of this concept but future rulings may expand the concept in such a way as to make it clearly applicable to many areas of communications policy.

[47] OFTEL, "Market Influence," pars. 1.17–1.20.

[48] European Commission, COM (1999) 539, "Towards a new framework for Electronic Communications infrastructure and associated services: The 1999 Communications Review" par. 4.24.

[49] European Commission, 4.2.5

questions may involve the effect of particular network architectures on competition and innovation. Some might look at generic questions like the desirability of all owing consumer purchase of set-top boxes and methods of lowering switching costs for consumers.

In closing, we would like to note that it would be highly desirable in itself 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. Problems about how to assure competitive network infrastructure for broadband access exist everywhere in the world. The FCC's silence leaves a leadership vacuum in the global policy arena that others will surely fill, perhaps with results that the United States may not like.

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