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The U.S. Broadband Problem

CHARLES H. FERGUSON

The pace of deployment and technological progress in broadband, or high-speed, services remains seriously inadequate, a problem that results from the monopolistic structure, entrenched management, and political power of incumbent local exchange carriers (ILECs) such as BellSouth and Verizon and the cable television industry. It is worsened by major deficiencies in the policy and regulatory systems covering these industries. Failure to improve broadband performance could reduce U.S. productivity growth by 1 percent per year or more, as well as weaken public safety, military preparedness, and energy security. Policymakers should make structural reforms in industry, policy, and the U.S. regulatory system. Appropriate measures include structural separation of switching, enhanced services, and data transport in the telephone industry; divestiture of content from transport in the cable television (CATV) sector; mandatory open interfaces for interconnection; increased financial transparency and disclosure; and reforms in regulatory systems to increase their efficiency, high technology expertise, and political independence.

This policy brief discusses current and future policy options for "last mile" broadband services, i.e. the high-speed local data services required for large-scale videoconferencing, video telephone service, Internet-based audio and video entertainment, multimedia email and websites, telecommuting, local wireless data services, faster Internet access generally, and future voice telephone services.

THE U.S. LOCAL COMMUNICATIONS SYSTEM

For technological and historical reasons, the communications infrastructure of the United States originally evolved as a collection of separate, regulated oligopolies or monopolies in voice telephony, broadcast radio and television, postal service, cable television, and wireless services. For over fifty years, these were stable industries exhibiting low rates of technical change.

Now, digital technology is causing the convergence of many industries, ranging from photography to software publishing to entertainment to voice telephone service. For example, the same transmission technology (HDSL, one dialect of DSL) is already widely used to deliver T1

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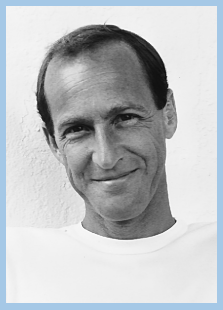

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data service, high-speed Internet service for websites, and groups of twenty-four voice telephone lines. Increasingly, all information and communication services can, and should, be delivered over an Internet-centric, broadband digital infrastructure composed of open-architecture networks that both compete and interconnect with each other—similar to the structure of the Internet itself.

The Telecommunications Act of 1996 was widely expected to generate such a modern, decentralized, competitive, and technologically dynamic industry. However, despite major efforts by AT&T, MCI/Worldcom, and so-called Competitive Local Exchange Carriers (CLECs) such as McLeod and RCN, this promise remains unfulfilled. In fact, the rate of technological progress in local services has probably declined since 1996. The ILEC and cable television industries remain overwhelmingly dominant, largely avoid competing with each other, and aggressively protect their monopoly positions.

The most frequently discussed symptom of the broadband problem is that most U.S. residences still depend on modem-based "dial-up" Internet access, with maximum speeds of 50 kilobits per second (kbps). As of mid-2002, less than 15 percent of U.S. homes use faster access based on either cable modems (provided by cable TV vendors) or ADSL (the most widely sold form of DSL, provided over telephone lines). This is indeed a problem; however, the total broadband problem is far larger, more general, and more serious.

First, the broadband problem also includes the business data services underlying all Internet services, as well as conventional voice telephone and cable television services. The business market for local broadband services is currently ten to twenty times larger than the residential market; and these services are essential to all Internet functions, including websites, as well as to high volume voice telephone services. Their technology is such that all these services should be displaying high rates of improvement in price-performance ratios, quality, and innovation. In fact, however, the entire spectrum of these services displays low, and in some cases even zero, rates of technological progress—an extraordinary situation, unlike every competitive high technology industry. This condition has already persisted for over a decade, and shows few signs of changing.

Second, the residential problem is worse than generally appreciated. Contrary to popular belief, the deployment of cable modems and ADSL has actually represented a decrease in the rate of technical progress delivered to the U.S. residential market. Until recently, dial-up Internet access improved 40 percent per year because the modem industry was fiercely competitive and closely followed the digital “technology curve” of continuous exponential progress in performance. With a modem, anyone can use the Internet with 50 kpbs symmetric service (i.e., both downstream to homes and upstream from them) from any telephone line in the United States and indeed most of the world, at no charge. Several years ago, however, modems reached technological limits imposed by the telephone network. At this point, further improvements in Internet service came to depend upon the ILECs, or at least upon access to their networks, in order to install

capital equipment required for high speed services, such as DSL modems and access multiplexers (DSLAMs).

However, the ILECs failed to move promptly to provide modern data services, and responded to the 1996 telecommunications law by resisting, litigating against, delaying, and allegedly even sabotaging Federal Communications Commission (FCC) regulations and CLEC activities. Under increasing pressure from consumers and cable modem services, the ILECs, in 2000, finally began offering residential ADSL service, typically priced at fifty dollars per month. ADSL, unlike modems and also unlike most data services, provides heavily asymmetric service; current ILEC ADSL typically receives data at 0.5-1.5 mbps (to homes) versus sending data at 64-128 kbps. One major reason is that ILECs fear cannibalizing the voice and business services they currently monopolize, and which require symmetric two-way transmission. Furthermore, the price and performance of ILEC ADSL services have remained flat, with the result that progress in residential Internet service has sharply decelerated since becoming dependent on ILEC actions.

Real competition in symmetric broadband services would probably lead to continuous price declines in basic dial tone service, enhanced services such as voicemail, and data services such as T1 and T3 (high-speed services widely used for websites, high volume voice, and other applications). To a remarkable degree, the ILECs have been able to avert this fate. Prices for these services have remained flat for the last decade. Despite major efforts by AT&T, MCI/WorldCom, and CLECs, the ILECs retain over 80 percent market share in local business voice and data services and a 95 percent share in residential voice service, and the ILECs' market share is actually increasing.

Following the Nasdaq crash of 2000-2001, the CLECs have been devastated—they have lost market share, incurred huge losses, filed for bankruptcy, engaged in mass layoffs, and encountered severe difficulties raising capital. Concomitantly, the ILECs have carefully avoided competition with each other, despite making arguments to regulators and courts that imply it would be rational and even imperative for them to attack each others' markets. Instead they have consolidated through mergers, joint ventures, and co-investments; the number of major ILECs has declined from nine to four since 1996.

Unlike every other information technology industry, the ILECs engage in virtually no research and development. With the exception of 1999-2000, their network capital spending has remained flat for over a decade. However, their political spending has increased sharply; they spend up to half a billion dollars per year on lobbying, regulatory efforts, litigation, and political contributions, including multiple legal challenges to the 1996 telecommunications law and FCC regulations. They also cooperate extensively in purchasing, investing, litigation, regulatory proceedings, and politics. This pattern appears to be the combined result of rational monopolistic conduct, and of entrenched top managements unwilling to face modern high technology competition. The ILECs' top managements and boards of directors generally contain very little technical expertise.

Residential Internet access, the most

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widely discussed portion of the broadband problem, is, ironically, the only area in which the ILECs face significant competitive pressure, because the cable television industry currently holds approximately 70 percent of this market. Indeed, this fact is regularly cited by the ILECs to demonstrate that the local broadband industry is competitive, or even that the ILECs are unfairly hampered by regulation. This is, however, misleading. Current competition is actually quite limited, and the cable industry has neither the ability nor the incentive to compete directly with the ILECs.

CABLE INDUSTRY LIMITS ON COMPETITIVE DISCIPLINE

In general, CATV systems "pass," or reach, only residences, not businesses; only 75 percent of U.S. residences at most actually subscribe to cable TV; and cable TV systems are highly technologically specific to downstream delivery of entertainment. Thus, cable modem service, like ILEC-delivered ADSL, offers only highly asymmetric Internet service, only to residences, only to cable subscribers, and at almost exactly the same price and performance levels as ADSL. Cable television prices for both video and cable modem service have, like ILEC prices for voice service, remained approximately flat over the last decade. The cable industry has made no significant attempt to compete with the ILECs' core services by offering high-speed symmetric data services, voice, or business services.

Moreover, the cable industry, like the ILECs, is highly concentrated and composed of regional monopolies that have fought to keep their systems closed, have avoided competing with each other, and which protect their proprietary content businesses. Like the ILECs, some cable providers also seem to have corporate governance problems, and/or to lack expertise in modern, competitive, high technology activities.

The cable industry also has enormous financial incentives to prevent open-architecture broadband competition. All major cable providers have investments in, or are owned by, proprietary content providers such as cable channels, music and film producers, online services such as AOL, and/or media conglomerates such as Cox Communications and AOL Time Warner. As a result, the cable industry would also be threatened by open-architecture broadband and/or Internet services that could permit independent content providers to use Internet services to deliver entertainment-quality video (high-definition television requires 20 megabits per second per channel, as opposed to the 1-2 mbps delivered by current residential "broadband" services). The industry is also threatened by symmetric services because they facilitate large-scale peer-to-peer sharing of multimedia, music, and video files. Not surprisingly, the cable industry offers no such services.

It is, in fact, in the joint interest of ILECs and cable providers to keep symmetric and/or very high speed broadband services expensive. This allows ILECs to retain their monopoly pricing on voice and business data services, and it helps the cable industry to retain its video distribution monopoly by precluding decentralized, Internet-based video distribution. It is also, of course, in both of their interests to keep their networks closed to new competitors. The two industries'

incentives are directly competitive in only one major area: the delivery of asymmetric service to residences. Even in this area, they share an interest in preventing competition from new entrants.

Thus the effect of current industry structure is to generate a stable duopoly in residential Internet services, with continued monopoly control in most other markets—by the ILECs in voice and business data services, and by the cable industry in residential video. Neither industry would logically be interested in provoking highly dynamic competition in open-architecture, high-speed, and/or symmetric broadband services to either businesses or homes. The slow pace of improvement in broadband services is not surprising. But it damages the economic growth, social welfare, and national security of the United States, and indeed of the world.

THE IMPORTANCE OF THE BROADBAND PROBLEM

There is strong evidence that the Internet has played a major role in the productivity revival experienced by the United States since the early 1990s. Productivity growth and military power are now driven primarily by information systems, which are becoming heavily Internet-dependent. As digital technology continues its progress, the broadband problem is becoming a major bottleneck in the U.S. and world economy.

If allowed to persist, the broadband bottleneck will also cause "digital divide" problems, which arise when unequal access to Internet services is thought to contribute to widening inequalities in income, wealth, and power. However, computers are not the problem: the computer industry is highly competitive, and the inherent tendency of technology is to democratize access. Indeed, the computer industry is now being reshaped by palmtop, game, and consumer-oriented systems costing only a few hundred dollars, some of which already have more processing power than personal computers built in 1990. However, at current prices, one year of ADSL costs as much as a home computer, and one year of T1 service costs as much as five office computers.

Improved broadband services would support globalization and political freedom. China and other nations, for example, have been forced to permit increasingly widespread Internet use. They will be forced to permit broadband services, despite the fact that for technical reasons they are more difficult to censor than conventional email or web pages.

And finally, local broadband deployment has significant interactions with energy, environmental, and national security policy. Nations increasingly need to maintain economic growth without increasing energy use, greenhouse emissions, and pollution. One response is to substitute communication for physical transportation via use of digital documents, videoconferencing, and so forth. However, large-scale broadband deployment is required to realize these gains. And finally, local broadband policy also has significant national security implications. U.S. national security and military power depend upon communications and information technology, whose performance is now driven by commercial markets, with military products following years later. Moreover, the widespread availability of broadband services for

surveillance, videoconferencing, and other applications would directly increase the capabilities of law enforcement, medical, and national security authorities.

POLICY ANALYSIS AND RECOMMENDATIONS

The 1994 privatization and deregulation of the Internet provides a useful template for future U.S. broadband policy. Before considering this model, however, the ILEC-supported legislation sponsored by Reps. Billy Tauzin (R-La.) and John D. Dingell (D-Mich.) deserves examination. This bill would allow ILECs to enter long-distance data communications markets without requiring them either to open their facilities to competitors or face any real competition in their local markets. The ILECs argue that the cable industry's high share of residential broadband markets demonstrates the existence of competition; that the cable television industry holds this position because it is not required to open its networks to competitors; and that the requirement that ILECs lease their networks to CLECs deprives them of any incentive to invest, because competitors would obtain the benefits of ILEC investments.

The actual conditions of competition in local broadband service, as discussed above, must lead one to view ILEC arguments with skepticism. First, the distinction between voice and data services is eroding rapidly. Second, despite massive deregulation, network capital spending by the ILECs remained flat for fifteen years, with the sole exception of 1999-2000, when they faced growing competition. Third, CLECs using ILEC lines hold less than 10 percent of the total U.S. broadband market. Indeed, history suggests that when the ILECs face increased opportunity but decreased competition, they invest less, not more. Conversely, the overwhelming lesson of high technology is that competition is the most effective way to call forth technical progress. Some of the most rapid technical progress has been found in industries facing severe competition, such as personal computer systems, semiconductors, disk drives, Internet services, and networking equipment.

There also appear to be superior alternatives based upon ILEC structural divestiture that would, however, be among the largest changes in American industry since the breakup of Standard Oil. The top managements of ILECs and cable companies would certainly not like them, because their industries would become very competitive and demanding of high technology expertise. However, such policies would improve the economic performance and welfare of the United States. There are at least two useful precedents: the divestiture of AT&T, and the privatization and deregulation of the Internet. The Internet is in some ways the more interesting case.

Prior to 1994, the Internet backbone was a monopoly operated by MCI under U.S. government contract. In order to privatize, deregulate, and commercialize Internet services, the National Science Foundation enhanced the Internet architecture by creating Network Access Points (NAPs), where both competing and complementary facilities could interconnect. This arrangement permitted decentralized, competitive, specialized, and/or cooperative investments and services by many companies while preserving the unity of the Internet as a whole. Despite astonishing growth over the last decade, the

Internet has functioned with high service quality—higher, in some ways, than the telephone network.

The Telecommunications Act of 1996 embodied similar goals, by requiring the resale of so-called Unbundled Network Elements (UNEs), portions of their networks that ILECs must supposedly make available to competitors. However, the UNEs and their technical interfaces remain under the control of the ILECs, who have no incentive to make them function well, and no comparably broad unbundling requirement exists for the cable industry. The appropriate remedy for current broadband problems, then, appears to be structural divestiture of ILECs and cable providers and creation of open interconnection interfaces within and between the resulting firms.

In the case of ILECs, one reasonable alternative—not the only one—would be divestiture of each ILEC into three parts—data transport, switching operations, and enhanced services (such as voicemail and Internet access)—with appropriate access points defined between them. In each case, the new "daughter" firms should be allowed to enter each other's markets only if their market shares were to be strictly capped at non-dominant levels, say 40 percent or below. In the case of the cable industry, the appropriate measure would probably be divestiture of content from transmission, possibly together with the divestiture of set-top box provision from CATV transmission, so that independent computer and software companies can supply set-top systems directly to end-users.

If sufficient investment and deployment do not materialize after structural separation and definition of interconnection points, then policymakers should consider investment incentives. Such incentives, however, should be available only to non-dominant providers, and only to providers of open-architecture services, in a manner analogous to the treatment of AT&T relative to long-distance competitors beginning in 1984. ILEC successor firms, then, could receive incentives for entering each other's markets, but not for investing in their own unless their market shares fell below dominant levels. Any incentives should also be made available to real estate developers, landlords, municipal governments, educational institutions, and even individuals as well as to telecommunications services companies.

Perhaps most importantly, both regulatory oversight and any financial support should be discontinued once a competitive, open architecture industry is established. The principal benefit of government intervention on behalf of major structural divestitures and creation of open interconnection interfaces is that this form of temporary intervention offers the best prospect of eliminating government regulation permanently from the industry. Price regulation, for example, becomes unnecessary in the presence of real competition. In this way, broadband services can join the rest of American high technology in being competitive, technically progressive, and unregulated.

There are two principal difficulties in considering such a policy combining structural divestitures with investment incentives. The first is political viability, given the furious and powerful opposition

This policy brief is based on a forthcoming book from the Brookings Institution Press by Charles Ferguson.

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that could be expected from the ILECs and cable companies in the face of such a significant threat to their monopoly power. The second problem is that the relevant U.S. policy, legal, and regulatory systems are still poorly equipped to deal with high technology industries. The antitrust division of the Justice Department employs more than three hundred attorneys and about fifty economists, but not a single technologist. The commissioners of the Federal Communications Commission and Federal Trade Commission (FTC) are generally as poorly trained in modern information technology as their ILEC and CATV counterparts. Major high technology antitrust cases are tried before judges lacking in technical expertise, and such cases frequently require five years or more to be resolved. Regulators, Congress, and expert witnesses are highly subject to financial and political manipulation from the affected industries.

Hence, there is a major need to improve the efficiency, technical expertise, and independence of telecommunications regulation, antitrust proceedings, and expert advice. Whether by statute or by simple presidential decision, it is imperative that the Justice Department, FCC, FTC, and U.S. federal courts possess substantial and unbiased high technology expertise. Creation of a special federal court to handle high technology antitrust cases might also be warranted. And finally, far stronger conflict of interest and disclosure requirements should be required of academic policy analysts, as well as both current and former government officials. These measures may seem politically impractical, but even incomplete progress in enacting this policy agenda could yield major improvements in U.S. economic performance, security, and general welfare.

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