BUILDING A STRONGER AMERICA

A PLAN TO EXTEND SUPER-FAST BROADBAND CONNECTIONS TO ALL AMERICANS

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A Century Foundation Report

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This paper is part of The Century Foundation's new series, Building a Stronger America, which focuses on providing specific, concrete ideas for upgrading the nation's decaying and inadequate infrastructure. The goal of the series is both to deepen and to broaden the public's understanding of the problems we now confront, while offering proposals beyond the plans already in wide circulation. Carrying out these ideas will not only help the country to emerge from the current, severe economic downturn, but also will greatly enhance the prospects for good jobs and sustained, broadly shared prosperity decades into the future.

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Introduction

In many ways, broadband communications[1] are the future. Few doubt that broadband services are increasingly vital to our social and economic well-being. The universal availability of affordable high-speed access to the Internet has become essential not only for business, but also for public safety, research, education, health care, and protecting the environment. One recent survey found that people now value broadband more than any other of the new communication and entertainment services entering the market, even more than high-definition television (HDTV).[2]

Unfortunately, many other nations are far ahead of the United States in terms of the speed and availability of broadband. Furthermore, within the United States, there is a wide gap between haves and have-nots in terms of access to broadband. Yet the U.S. government has no national broadband policy, and does not treat broadband as a form of infrastructure and does not regard broadband as an "essential" service. Instead, the U.S. market for broadband services is largely deregulated, under the theory that the marketplace will provide the optimal level of broadband in response to customer demand.

This hands-off approach to broadband infrastructure has proved to be a mistake. Competition in the broadband industry is not working: the broadband industry is not investing as much to build and deploy broadband networks as the nation needs. As a result of this approach, U.S. broadband capabilities are falling behind those of other developed countries, the "digital divide" in rural and low-income markets is worsening, and broadband providers are asserting their right to control Internet traffic. Businesses are relocating and sometimes failing altogether because sluggish Internet connections prevent them from receiving and filling orders or processing payments quickly. Rural hospitals are providing only basic medical service because they cannot engage in instantaneous, online consultations with medical experts in emergencies. Craig Mundie, Microsoft's chief research and strategy officer, calls the U.S. approach to broadband a "total policy failure."[3]

The federal government needs to formulate a comprehensive approach to the development of broadband in America so that the national interest is served best. The following discussion analyzes the broadband market, the current U.S. regulatory approach, the experiences of other countries, and the benefits of an improved broadband network for the American economy as well as for the areas of health care, research and education, and the environment. The paper then suggests a broadband policy that would enhance broadband deployment, promote competition, and ensure that high-capacity broadband networks are open and available to all Americans at affordable prices.

The Roots of America's Broadband Failure

Broadband communications emerged in the late 1990's, a time when policymakers were seeking to inject competitive forces into the telecommunications market. Congress passed the Telecommunications Act of 1996 (the "1996 Act")[4] on the theory that competition would both promote network investment and safeguard the interests of consumers, and thereafter allow the government to take a less regulatory approach. Cable companies (through cable modem broadband services) and telephone companies (through digital subscriber line services, or DSL) were the first to begin offering high-speed, always-on access to the Internet. In addition, satellite, cellular, and energy companies were thought ready to provide competitive broadband services.

Unfortunately, the deregulatory caboose jumped ahead of the competition engine. The critical sequence enacted in the 1996 Act—first ensure competition, then deregulate—was abandoned in the first half of this decade in favor of an overly simplistic deregulation-first philosophy. The Federal Communications Commission (FCC) was reluctant to apply the full panoply of either telephone or cable television regulations to these new broadband services. The FCC believed that new and existing providers would invest more if they were unencumbered by government bureaucracy. As a result, the U.S. government abandoned the effort to promote competition, and turned a blind eye to the provisions of the 1996 Act that directed it to promote broadband investment. For example:

- In March 2002, the FCC concluded that broadband Internet service provided by cable companies would be treated as a deregulated "information service," not

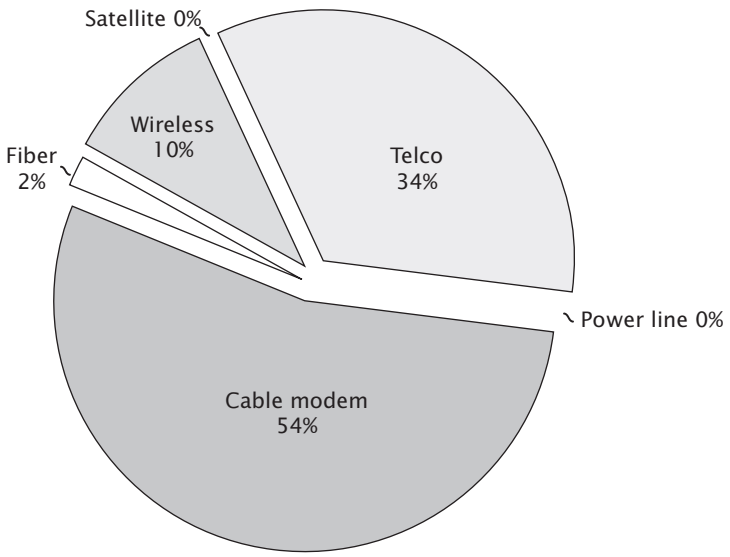
a regulated "telecommunications service." This conclusion was upheld by the Supreme Court in 2005. The FCC made similar findings soon thereafter for DSL services, broadband over power lines, and wireless broadband. As a result of these decisions, cable, telephone, and wireless companies do not have to make their broadband services open to and accessible by independent Internet service providers (ISPs), such as AOL and Earthlink. While the country once had hundreds of independent ISPs, the cable companies and telephone companies now dominate the provision of Internet access service across the country.

- The FCC eliminated many "unbundling" provisions that required local telephone companies to make their networks available to nascent competitors. For instance, the FCC ruled that telephone companies that deployed fiber optic facilities[5] were not required to make them available to competitors. Nascent competitors do not have the financial resources or the access to the rights-of-way to deploy their own fiber. For this reason, the 1996 Act authorized competitors to lease the facilities of the telephone companies at cost-based rates. The FCC, however, ruled that fiber optic cables were exempt. Although the FCC's decision was intended to spur additional fiber investment by the telephone companies, it effectively precludes competitors from providing service to many homes and businesses across the country because they do not have their own facilities in the ground to reach those customers.

The FCC's hope that facilities-based competition would materialize and broadband investment would increase has simply not borne fruit. The provision of broadband over power lines serves a measly 0.01 percent of the broadband market, four years after FCC Chairman Michael Powell labeled it a promising competitor.[6] Wireless firms provide a minimal broadband service (generally less than 1 megabit per second, or mbps), but signal coverage issues and the slow standards-setting process have greatly inhibited their potential. Satellite broadband services also have turned out to be less than ideal, as the equipment costs are high and the signal can only be received with a south-facing view with no trees or buildings interfering with the line of sight.

This blind adherence to deregulatory ideology has led to a cable-telco duopoly[7] that dominates the broadband market, as shown in Figure 1 (see page 6).

Figure 1. Residential Advanced Services Lines (market share as of June 2007)



Source: "Trends in Telephone Service," Federal Communications Commission, August 2008, Table 2.4 (available online at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-284932A1.pdf).

To be sure, the cable and telephone companies do compete with each other. Both are now seeking to offer the so-called "triple play" of television, telephone and high-speed Internet services, and this competition has led to a certain degree of investment by both industries. According to FCC estimates, 82 percent of American households now have access to DSL service and 96 percent have access to cable modem service.[8] The upshot is this: the elimination of the pro-competitive provisions of the Telecommunications Act of 1996 has created a duopoly for broadband services provided by the cable and telephone companies.

The Disappointing Consequences of the Broadband Duopoly

Economics teaches that duopoly is generally an imperfect mode of competition. Duopolies will provide less output (build less broadband) at higher prices than a

perfectly competitive market. Furthermore, duopolies have an incentive to engage in tacit collusion to increase their profits.

Just as the theory predicts, the U.S. duopoly is quite unsatisfactory. The disappointing state of our broadband economy is apparent from the following:

The Worsening of the Digital Divide

The "Digital Divide"—the gap between those who have access to cutting edge digital technologies and those who do not—is getting worse, especially for rural and low-income households. The latest survey conducted by the Pew Internet and American Life Project shows that the connection gap between low-income households and high-income households has grown wider over the last four years, as has the gap between rural and non-rural households (see Table 1). The percentage of black households with a broadband connection consistently trails both white and Hispanic households.

Table 1. Percentage of Households with a Broadband Connection

Household Type	2005	2008	Growth 2005–2008
White	31	57	26
Hispanic	28	56	28
Black	14	43	29
Urban	31	57	26
Suburban	33	60	27
Rural	18	38	20
Low-income (below $20,000 annual salary)	13	25	12
High-income (above $100,000 annual salary)	62	85	23

Source: John B. Horrigan, "Home Broadband Adoption 2008," Pew Internet and American Life Project, July 2008, p. 3, available online at http://www.pewinternet.org/pdfs/PIP_Broadband_2008.pdf.

Lack of Speed

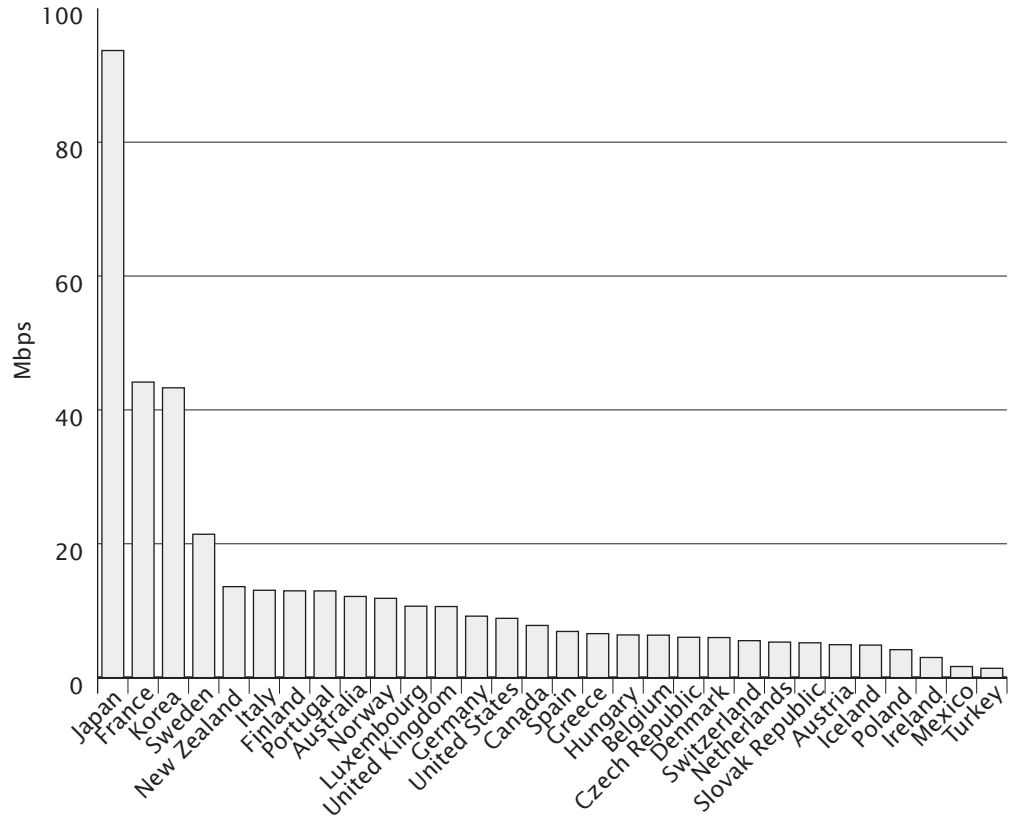
The majority of all local broadband connections are slower than 2.5 mbps. This speed is much too slow to handle the growth in demand for Internet traffic. In 2007, the FCC reported that, of the total number of connections classified as broadband (over 200 kilobits per second, or kbps, in one direction), 31 percent cannot carry traffic faster than 200 kbps in one direction, and an additional 26 percent are slower than 2.5 million bits per second (mbps).[9] Since the FCC's analysis lumps business and residential connections together, it is expected that most of the connections above 2.5 mbps are business connections, not residential. The predominant residential services are simply too slow, even in urban and suburban areas.[10]

While broadband connections less than 2.5 mbps are capable of carrying e-mail and providing basic Web site connectivity, these local broadband connections are not capable of carrying the level of traffic that is expected over the next decade. For instance, looking at recent trends in the growth of broadband usage, Technology Futures predicts that households will need 100 mbps capacity within the next decade. The Fiber-to-the-Home Council, TechNet, EDUCAUSE, Free Press, and the Communications Workers of America (CWA) have all called for policymakers to take steps to encourage construction of networks capable of providing 100 mbps to every home and business.

Even the most conservative of analysts, such as Dr. Andrew Odlyzko of the University of Minnesota, who runs the Minnesota Internet Traffic Studies (MINTS) project, measures annual Internet traffic growth rates at 50–60 percent both in the United States and around the world.[11] The advent of video traffic on the Internet may send growth rates surging higher than these historical rates of growth. Several firms (for example, Apple, Netflix, Amazon, Hulu, and so on) currently are providing television programs and movies over the Internet. Transmitting standard video requires eight to ten times as much bandwidth as voice phone calls or music files. High-definition television (HDTV) will require five to six times the bandwidth of standard definition video.[12]

Further evidence that the United States is doing a poor job of providing high broadband speeds comes from the Organisation for Economic Co-operation and Development (OECD). According to Figure 2, the United States is fourteenth in average advertised broadband speed, a level that trails most of our key international rivals.[13]

Figure 2. Average Advertised Broadband Download Speed, by County, Mbps, October 2007



Source: The Organisation for Economic Co-operation and Development, OECD Broadband Portal, October 2007, Worksheet 5a, available online at http://www.oecd.org/sti/ict/broadband.

This is not to say that investment in broadband is at a standstill. Verizon is investing in FiOS, a fiber optic broadband service that is expected to serve 19 million homes by 2010. AT&T anticipates it will have more than 1 million customers for its U-verse service by the end of 2008, and plans to pass more than 30 million homes with its fiber-to-the-neighborhood network by the end of 2010.[14]

Several cable companies are beginning to deploy DOCSIS 3.0 modems, which promise speeds of 100 mbps in selected markets. Clearwire (a joint venture by Sprint, Google, Intel, and two cable firms) recently launched its Wi-Max service in Baltimore and Portland, Oregon, and is planning to expand across the country.

But, except for Verizon's FiOS, these services are not likely to provide a long-term solution. AT&T's U-verse, for instance, is being offered at only 10 mbps, which is far less than the 50 mpbs or 100 mbps that most observers believe will be necessary in the next decade. The DOCSIS 3.0 modems still will operate over networks that are shared among hundreds of homes in a neighborhood, and the actual speeds that a customer experiences will depend on how many neighbors are using the network at the same time. The actual expected speeds of Clearwire's Wi-Max service will be in the range of 5–7 mbps, which may well provide a useful complement, but not a substitute, for wired broadband service.

As a result of this growing demand and shortage of supply, one study predicts that severe Internet "slowdowns" will start as early as 2010.[15] This means that Internet users may begin to experience "netlag"—long wait times for loading Web pages, and impossible delays for those who attempt to watch video over the Internet. Distance learning, medical monitoring, graphics production and other visually-intensive services will simply not feasible over the Internet at current and anticipated broadband speeds. In fact, rather than building more capacity to serve these uses, several local broadband providers are trying to dampen demand by imposing "bit caps" on usage to reduce congestion on their systems.[16]

Falling Behind Internationally

The United States broadband capabilities are not keeping pace with our international rivals. Data from the International Telecommunications Union (ITU) show that the United States' international rank in number of broadband subscribers per 100 people has dropped every year since 1999 (see Table 2).

The OECD also collects data comparing each country's broadband performance. The OECD data show that the United States is trailing many OECD nations on price and speed as well as subscribership.[17] When the OECD first collected data comparing broadband subscribers per capita in 2001, the United States ranked fourth; at the end of 2007, the United States ranked fifteenth. Denmark, the

Netherlands, Norway, and Sweden currently lead the OECD in broadband penetration per capita.

Table 2. U.S. International Rank in terms of Broadband Subscribers per 100 People

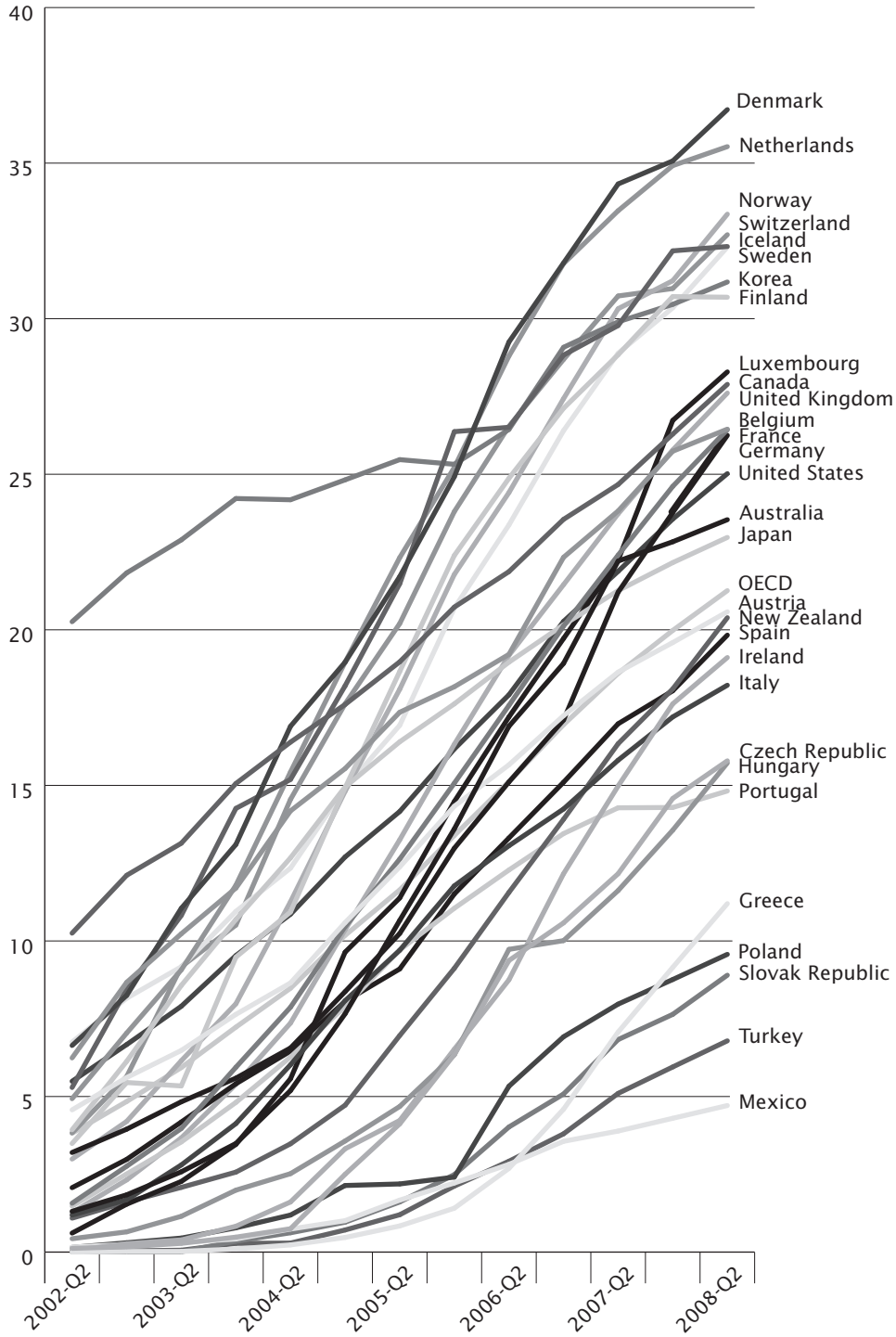
Year	Rank
1999	3rd
2000	5th
2001	7th
2002	11th
2003	15th
2004	18th
2005	19th
2006	20th
2007	22nd

Source: International Telecommunications Union, ICT Statistics Database, available online at http://www.itu.int/ITU-D/ICTEYE/Indicators/Indicators.aspx.

It is clear from Figure 3 (see page 12) that the countries of Northern Europe have broken out of the pack and have surged to the top of the rankings. The larger European countries (the United Kingdom, France, and Germany) have shown quite rapid growth over the past few years. The rates of growth in these countries approximates the "S" curve that often describes the introduction of new technologies. In contrast, South Korea, Japan, Canada, and the United States have grown in roughly a straight line, and, as a result, have fallen behind.

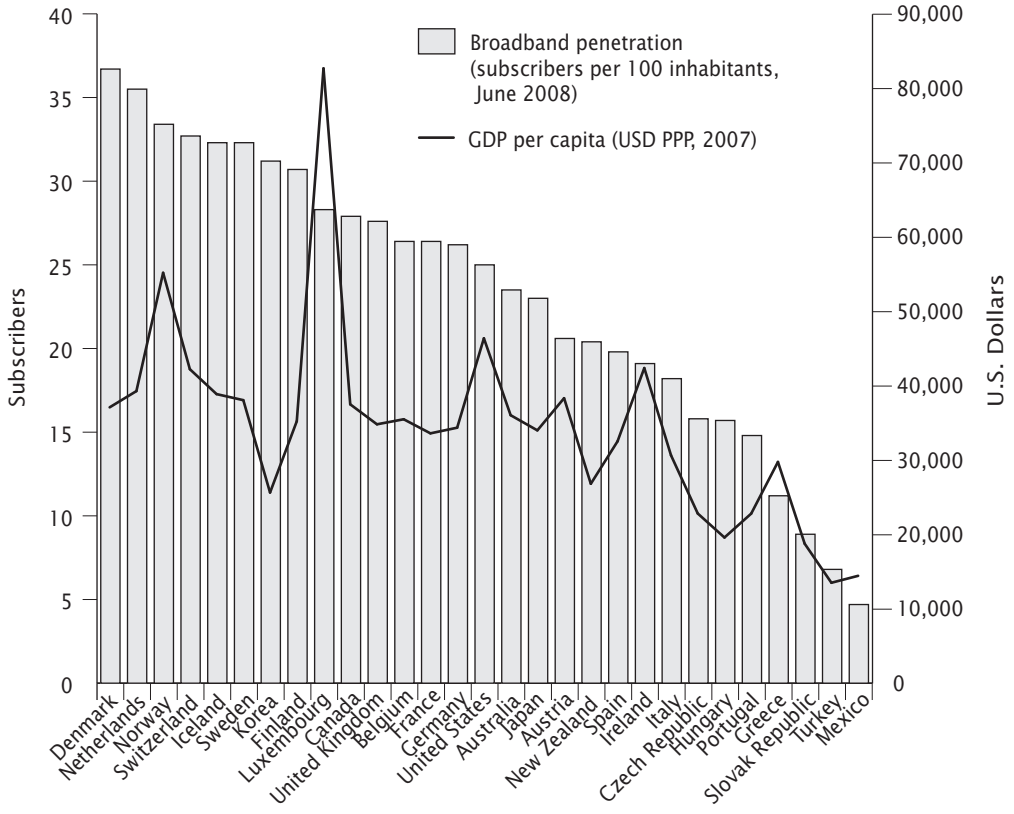
What can explain the relatively low level of U.S. broadband penetration? Not the relative size of the economies. The line in Figure 4 (see page 13) reflects each of the thirty OECD nations' Gross Domestic Product (GDP), which measures a country's total economic output. The United States has the third highest GDP among all OECD members when measured on a per capita basis (exceeded only by Norway and Luxembourg). In other words, many countries whose economies are significantly smaller (on a per capita basis) than that of the United States nonetheless have a significantly higher adoption of broadband services.

Figure 3. Historical Broadband Penetration Rates in OECD Countries, by Percentage of Households with Broadband



Source: The Organisation for Economic Co-operation and Development, OECD Broadband Portal, June 2008, Worksheet 1g, available online at http://www.oecd.org/sti/ict/broadband.

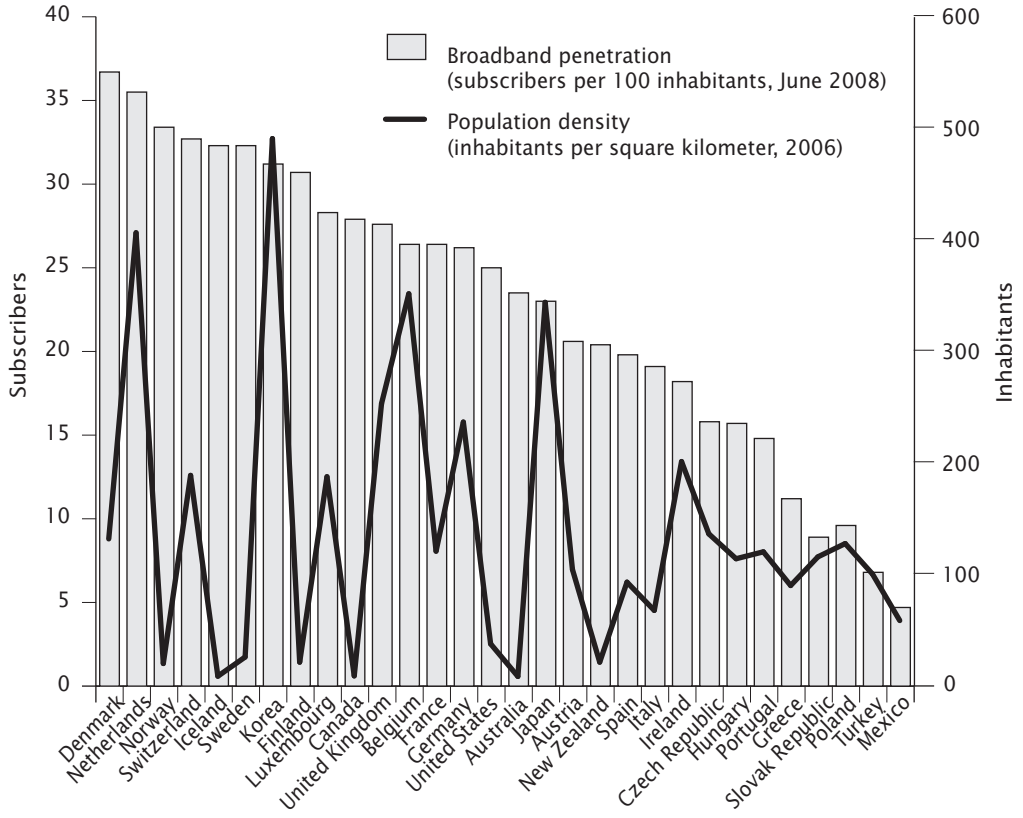
Figure 4. Broadband Penetration Rates and Gross Domestic Product Per Capita in OECD Countries



Source: The Organisation for Economic Co-operation and Development, OECD Broadband Portal, June 2008, Worksheet 1k, available online at http://www.oecd.org/sti/ict/broadband.

Nor can the relatively average U.S. broadband adoption rate be attributed to the large amount of rural territory in the United States. Large rural areas may affect broadband deployment, as it is more costly to dig trenches or install antennas in rural areas. Yet, according to the FCC, cable modem services are already deployed and available to 96 percent of American homes, and DSL services are available to 82 percent, so these networks are already available. Figure 5 (see page 14) shows that many nations with more rural territory than the United States (such as Norway, Finland, Sweden and Canada) have higher broadband adoption rates than the United States.

Figure 5. OECD Broadband Penetration and Population Densities in OECD Countries

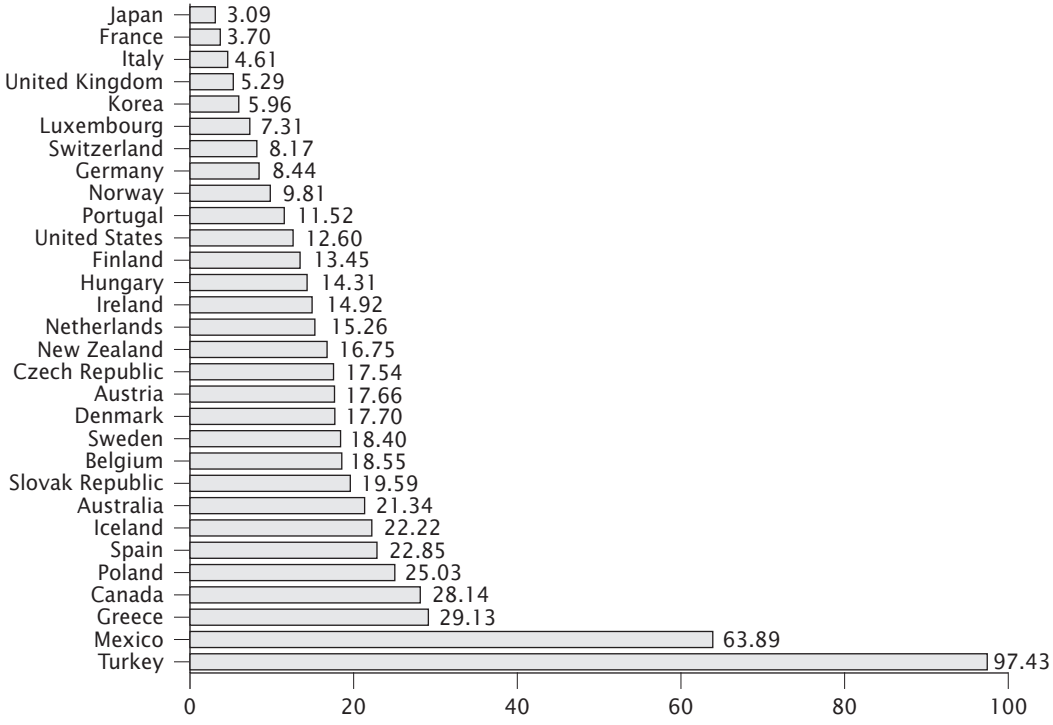


Source: The Organisation for Economic Co-operation and Development, OECD Broadband Portal, June 2008, Worksheet 3a, available online at http://www.oecd.org/sti/ict/broadband.

One key factor that may well explain the relatively average performance of the United States is the price of broadband services. As Figure 6 shows, seven of the ten countries that have lower prices per megabit than the United States also have greater broadband penetration. The lower prices offered in these countries may reflect the pro-competitive policies adopted by the European Union (EU). One commonality of all the Northern European nations is that they have implemented strict "unbundling" rules that permit competitive broadband providers to use the networks of the incumbent telephone company in each country. These efforts to promote retail competition have spawned a more competitive marketplace that has driven down prices and driven up subscribership. Based on this progress, the EU is now considering going one step further by separating the

telephone companies into separate wholesale and retail units to promote even greater competition.[18]

Figure 6. Average Broadband Monthly Price per Advertised Mbps, October 2007, U.S. Dollars PPP



Source: The Organization for Economic Co-operation and Development, OECD Broadband Portal, October 2007, Worksheet 4f, available online at http://www.oecd.org/sti/ict/broadband.

The Loss of Openness and Accessibility

Broadband providers are exercising greater control over Internet use. For example, the FCC found that, in an effort to avoid network congestion, Comcast was inserting "reset packets" that would block certain high-volume consumers from uploading Internet files. The FCC determined that Comcast's practice was unlawful and ordered it to stop blocking traffic. Nevertheless, Comcast is not alone. A company called Vuze, which transmits video over the Internet, submitted evidence that several other cable Internet providers are engaged in a similar practice.[19] A telephone company blocked a VoIP (Voice over the Internet Protocol) provider, until a complaint was filed and the

FCC threatened to take action against the company.[20] Wireless providers assert that they have the right to deny certain text messaging applications.[21]

Together, these actions raise concern about the openness and accessibility of broadband Internet connections in the future. Broadband providers would prefer to treat their broadband service like a traditional cable television service, where the cable operator determines the programming that is available. They envision a system in which the owner of the broadband pipe is allowed to sell prioritized transmission to certain content or applications providers. But this vision is fundamentally at odds with the original design and indeed the beauty and power of the Internet. The Internet was founded on the principle that the Internet should be provided on an open platform that allows any user, application, or service provider to use the network as he/she/it sees fit. An open Internet provides limitless opportunities for entrepreneurs, Web publishers, bloggers, and other socially beneficial services to grow and prosper. Unfortunately, the United States has yet to adopt an enforceable policy to protect the openness of the Internet. Our failure to adopt such a policy inhibits investment into new Internet-based applications and services because there is no guarantee that broadband providers will transmit them.

America's Unwillingness to Face Broadband Reality

The United States has been reluctant to admit that the deregulatory philosophy of the past decade has underperformed. Rather than exploring the causes of and seeking remedies for the poor international ranking of the United States, the Bush administration had turned a blind eye. In a report issued in January 2008, titled "Networked Nation: Broadband in America 2007," the Department of Commerce cavalierly stated that the U.S. broadband marketplace continues to grow, neglecting the evidence shown above that the United States is not growing as fast as other countries.

> Recognizing this transformative power [of broadband technologies], four years ago President Bush articulated a national vision: universal, affordable access to broadband technology. From its first days, the Administration has implemented a comprehensive and integrated package of technology, regulatory, and fiscal policies designed to lower barriers and create an environment in which broadband innovation and competition can flourish. The

> results have been striking. The last several years have witnessed substantial growth in the broadband marketplace punctuated by increases in capital investment, innovation, and market entry.[22]

The report goes on to cite the increases in broadband investment, as well as in deployment of and subscription to a large variety of broadband services. The report, however, makes not a single comparison of the U.S. broadband growth with the growth occurring in other countries. In fact, the ITU and OECD data cited above are never mentioned or cited.

Similarly, every one of the reports issued by the FCC has found that broadband services are being deployed in a "reasonable and timely manner." The most recent of the FCC's reports on broadband takes note of America's fifteenth-place ranking in broadband subscription, but offers less-than-convincing argument that this ranking is of no concern.[23]

First, it notes that the United States has the greatest total number of broadband subscribers—about 66 million—which is more than the total number of broadband subscribers of the top twelve ranked countries combined. Using this logic, however, the United States (the third most populous nation) also would be one of the world leaders in the number of people who do *not* have a broadband connection. Citing the absolute number of subscribers is thus not a useful gauge of the United States' broadband performance.

Second, the FCC says that broadband statistics depend upon the geography and population distribution of the country. "It is likely to be significantly more costly to deploy broadband infrastructure in countries where a significant portion of the population is located in rural and sparsely populated areas compared with countries where the vast majority of the population is located in urban areas."[24] The FCC ignores the fact that low-speed broadband services have already been deployed to almost all American homes, yet most Americans are still not subscribing because of the high price and lack of competition. Furthermore, the OECD data discussed above already demonstrate that there is very little correlation between the rurality of the country and broadband penetration.

Third, the FCC says that the U.S. market is distinctive because of its multiple broadband platforms, such as cable modems, wireless, and broadband over power lines, while most other countries are dominated by DSL service provided by the local telephone company. As we have already shown, the actual market

presence of satellites and broadband-over-power-line platforms is negligible, and wireless services do not generally have enough capacity to provide robust broadband services. But even if we take the FCC at its word, the availability of these multiple service providers actually cuts the other way. If the United States had a greater number of broadband providers and platforms, one would expect it to have a higher rate of broadband subscription than other countries. The fact that the United States has a lower broadband subscription rate despite having multiple providers is even more damning evidence that the U.S. policies are not working.

Finally, the FCC points to the prevalence of wireless services, including Wi-Fi "hot spots," that are not taken into account in the OECD rankings. But the FCC does not even attempt to compare the U.S. wireless capabilities with those of other countries. This is not surprising, as it is widely known that European countries have more wireless users than North America.[25]

The overwhelming evidence demonstrates that the United States is falling further behind other nations in broadband, and that the U.S. government's attempts to explain away the country's poor broadband performance are simply not credible.

The Benefits of Better Broadband

But why should we care? Is broadband worth all the fuss? The answer clearly is yes. Broadband technologies are fast becoming the cornerstone of economic growth in the twenty-first century. As shown below, there appears to be a direct link between the ubiquitous availability of broadband and enhanced economic activity. But perhaps even more important, broadband services can also provide significant benefits for the environment, for education, for public safety, for health care, and a wide variety of other essential needs. Not only is broadband becoming an important infrastructure in itself, it may reduce the need for spending on other forms of infrastructure.

Economic Growth

The economic advantages of widely deployed broadband networks have been demonstrated in both academic studies and in real world examples. Several firms have conducted analyses of the economic benefits of broadband

networks, including Criterion Economics,[26] TeleNomic Research,[27] MIT/ Carnegie Mellon University,[28] the Brookings Institution,[29] the Strategic Network Group,[30] and Connected Nation.[31] The Information Technology and Innovation Foundation (ITIF) predicts that capital spent on the diffusion of information technology and telecommunications hardware, software, and services has three to five times the impact on productivity than capital spent elsewhere. Collectively, these reports predict that greater broadband deployment and usage will generate significantly increased economic activity, such as job growth and tax revenue, and will reduce costs.

Several case studies come to the same conclusion. For example, a handful of municipalities have decided to build their own fiber optic broadband networks, which have often saved existing local businesses or attracted new firms. Broadband capacity provides a number of important benefits for businesses: it allows them to send and receive orders for goods or services instantaneously, thereby reducing the costs of reaching their customers; broadband services allow delivery companies to engage in real-time monitoring of trucking and transportation of products around the world; rather than sending maps, x-rays, or product reports in the mail, companies can market and send their information electronically at virtually no additional cost. Such e-commerce is expected to become the dominant mode of business sales in the next decade, reducing the need for paying rent for retail locations. Communities that recently have built their own local broadband networks include:

- Lafayette, Louisiana, attracted Nucomm International and one thousand new jobs because of its plans to build a fiber optic system.[32]

- Ft. Wayne, Indiana, built a new broadband network, which prompted Raytheon to expand its presence in the city, helping it turn a decade of declining growth into a 4 percent annual growth rate.[33]

- Cedar Falls, Iowa, used its hybrid fiber/coaxial cable network to attract Peregine Financial Group and several other businesses to relocate there, some of them from the neighboring city of Waterloo, which has no broadband network.[34]

- Bristol, an economically depressed area of southwestern Virginia, overcame the opposition of the telephone and cable companies to build a fiber-to-the-home network that has attracted two new employers that will bring 1,500 high-paying jobs.[35]

- Tacoma, Washington, began building a broadband network ten years ago and has attracted more than one hundred high-tech businesses as a result.[36]

- Scottsburg, Indiana, saved more than sixty jobs and a local Chrysler repair shop by building a wireless broadband network that also saves the city $6,000 per month in reduced telecommunications expenses.[37]

Environment

Broadband services can generate significant environmental benefits. According to the Fiber to the Home Council, broadband networks lead to significantly more telecommuting from home, which reduces automobiles on the road and thus carbon emissions.[38] Broadband networks can also enable municipalities to monitor traffic patterns and adjust traffic signals to minimize traffic congestion, thereby reducing pollutants even further. Businesses can use broadband services to monitor and reduce their energy usage. These are but a few of the expected environmental benefits of broadband deployment and usage.

Health Care

Affordable health care is one of the most urgent needs in America today, and broadband technologies offer new hope for reducing the cost and extending the reach of high-quality medical care. Using broadband networks, the high level of care found in urban hospitals can be exported beyond municipal boundaries to rural areas and non-hospital health care facilities (nursing homes, community clinics, and so on) through "telemedicine" and "tele-health." Broadband services can allow remote patient monitoring and training, and even surgeries can

be performed or coached from many miles away. According to one Brookings Institution study, broadband services could reduce the costs and expand the productivity of caring for senior citizens and persons with disabilities to achieve savings of $927 billion through 2030.[39] Notably, these benefits include reduced institutionalized care and increased workforce participation (both because more seniors will be able to live independently and thus be eligible to work, and because broadband makes it easier for elderly people to work from home). Another study found that remote monitoring of health conditions reduced the need for hospitalization by 40 percent to almost 70 percent.[40]

Research and Education

College campuses are the breeding grounds for some of the most innovative uses of broadband technologies. The leading research universities, such as the two hundred members of Internet2,[41] already have very-high-speed broadband networks on campus and are linked across the country via multi-gigabit fiber networks. For instance, Internet2 members can take advantage of the Internet2 Commons, a Videoconferencing Service that allows subscribing members to schedule and hold distributed working groups, classes, meetings, and conferences in support of research and education.

But education does not stop at the campus boundary. The large majority of college students live off-campus, and educators need the public broadband network to be as capable as on-campus networks to ensure that off-campus students enjoy the same opportunities as on-campus students. Distance learning needs widespread availability of broadband networks so that community college students and commuter school students can benefit from the best in teaching techniques and research materials.

Fifty-six percent of all two-year and four-year colleges offer e-learning courses, and 51 percent use two-way interactive videoconferencing.[42] To give one example, Texas A&M University has deployed an extensive wireless broadband network covering more than 235 miles, connecting the main Kingsville campus to twenty-four school districts in Southeast Texas. The network supports two-way voice, video and data communications (including for online courses), and university support services such as admissions, financial aid programs, and

workforce training.[43] Distance learning is gaining in popularity and use in both K–12 and secondary schools as well. At least one-third of public school districts have students enrolled in distance education courses, and most intend to expand their distance education courses. But the lack of available broadband networks hinders the extension of distance learning to students, especially in rural and inner city neighborhoods.

Public Safety

Broadband networks can help protect America in case of terrorist attacks or natural disasters. As we learned on September 11 and with Hurricane Katrina, communications capability is vital to deploying police, fire, and rescue personnel in time to save lives and protect important national assets. Ideally, the United States should have redundant broadband networks, wired and wireless, that can provide adequate back-up in case one network is disrupted.

A Plan for Government Investment in Broadband

America needs a comprehensive federal policy to promote broadband development and use. But there is no silver bullet that will solve America's broadband woes. The problems are too complex, and the marketplace too diverse, to adopt a "one-size-fits-all" approach. The United States needs a holistic strategy that includes a variety of tools, including both "carrots" and "sticks." There are four areas of need that the government must address in order ensure that our broadband infrastructure meets our future needs.

Providing "Seed" Funding for Broadband Development

The first step must be to embark on a significant effort to provide government "seed" funding to build high-capacity broadband networks across the country. The U.S. government should ensure that everyone has access to this essential technology, especially people in rural, inner city, and unprofit-

able areas. Sweden, Canada, Australia,[44] Japan, South Korea, and others are making such investments and, as a result, have faster broadband capabilities and higher subscription rates than in the United States. The United States must begin investing in broadband infrastructure to serve the needs of its citizens and to remain competitive with its international rivals.

If the United States is going to make this investment, it must do so with a long-range view. It would make little sense to invest federal dollars in short-term technologies that will be overwhelmed by Internet traffic growth in five years. It will be much more efficient to build technologies that are scalable upwards (that is, can handle larger and larger amounts of traffic) and can last for decades. This calls for a national strategy to build broadband networks with large enough capacity to handle a minimum of 100 mbps, and perhaps faster. Building such networks would allow us to leap-frog many other countries and allow the United States to reclaim its position as a world leader in broadband connectivity.

Promoting Investment

In addition to the federal investment described above, the United States should adopt additional measures to promote investment by the public and private sectors. Access to federal, state, and local rights-of-way is absolutely critical to laying wires and building wireless towers; the United States should adopt streamlined and enforceable policies to ensure that local officials make access to rights-of-way more easily available at cost-based prices. Federal and state tax policies should encourage ownership, construction, and use of broadband networks. Despite opposition from the industry, municipal governments and some state governments have begun building or considered building their own broadband networks; these efforts should be permitted, and even encouraged.

Revising Our Regulatory Approach

We must clarify the regulatory approach that will apply to all broadband networks for the future. The types of services being offered over broadband

networks cut across all the old boundaries between telephone, cable, and even broadcast services. The FCC, the states, and the courts are all struggling to shoehorn broadband into the antiquated classifications of cable/telephone/broadcast that simply do not apply to the current and future marketplace. Instead, broadband should be treated as an underlying infrastructure that permits all of these services to flourish. Providing a stable regulatory approach will provide greater certainty to owners and users and thereby encourage investment. Essential elements of this broadband regulatory approach should include:

- Joint federal-state jurisdiction should be established over broadband networks. There is a need for national uniformity, because broadband networks are inherently national in scope, and the carriage of Internet traffic is distance-insensitive. On the other hand, state regulatory authorities have a better understanding of the needs of consumers and industries in their geographic region than do federal regulators. Thus, there should be joint and cooperative jurisdiction over broadband networks.

- Federal rules should preserve the openness and accessibility of broadband networks for users, service and applications providers, and equipment providers. All those who have access to the broadband networks will benefit if they know in advance what rules apply. There is very little policy in effect at this time that governs the use of broadband networks, and even the FCC's most recent attempt to enforce its usage principles is being challenged in court. Having a clear set of policies that govern broadband networks will encourage further research and economic growth.

- Federal rules should also be developed to address the interconnection of networks. In some markets, there may be multiple broadband providers; in other markets, there may be only one. Ensuring the seamless operation of these networks is an essential and important role that government can play to prevent the "balkanization" of our broadband future. Federal broadband policies should encourage both retail and wholesale competition over broadband networks.

Stimulating Adoption and Usage of Broadband Services

Finally, government can do more to stimulate the adoption and use of broadband services, such as subsidizing computer ownership for low-income persons, educating consumers about the value of on-line services, protecting the openness and accessibility of the Internet, and increasing state and local governments' use of e-government services. Broadband technologies can bring great benefits to people who heretofore have not been connected. Farmers can use broadband connections to monitor grain prices and adjust their planting and harvesting. Rural residents can find employment information. Low-income people can use broadband connections to obtain government benefits and services. But these population subgroups may not be aware of these beneficial uses unless they have a computer and training. Computer ownership in the United States is below that of many of the nations that are ahead of the United States in broadband subscriptions, and policies should be adopted to reduce the price and ease the accessibility of computers. Governments at all levels can be involved in enhancing their e-government services and promoting educational efforts within communities to demonstrate the advantages of broadband connections. As with any "network," encouraging greater use not only benefits the individual, it also spreads the cost of such networks across a larger base, thereby reducing the expenses to all.

Conclusion

The United States faces an unprecedented challenge. Long praised as a leader in Internet and broadband technologies, the United States is falling far behind other countries in providing high-speed Internet access. Even more important, the U.S. broadband market is failing to meet the needs of its consumers and businesses for high-speed Internet connectivity. The lack of widespread broadband networks hinders our economic growth, limits educational opportunities for students and teachers, raises the cost of medical care, and reduces the opportunities to curb pollution. A modest amount of funding by the federal government, combined with a simplified regulatory approach, could address the needs of our nation for widely deployed and affordable high-speed Internet

access over the next four years. Such a federal investment in broadband will pay for itself many times over in enhanced tax revenue and in lower medical, educational, and environmental protection expenses. Finally, a federal investment in national broadband infrastructure will restore the U.S. position as the world leader in Internet ingenuity and entrepreneurship.

Notes

1. The term broadband communications refers to high-speed, always-on connections to the Internet. The first type of Internet access was dial-up, in which a consumer's computer would use a modem to dial the phone number of an Internet provider over a local telephone line. A broadband service provides a better connection than dial-up because it is always on (no need for a modem to dial an Internet provider) and is much faster. The two most common forms of broadband connections for consumers are cable modem services provided by cable companies, and digital subscriber line (DSL) services provided by the telephone companies. Cellular, satellite, and energy companies also provide broadband access, although, as described below, these services have shortcomings. In general, broadband speeds begin at 768 kilobits per second (kbps) and can go to 100 megabits per second or higher. Fiber optic cables frequently can carry traffic as fast as 10 gigabits per second (10,000 megabits) and have a potentially unlimited speed.

2. "Communications Industry Survey: Views on the U.S. Economic and Regulatory Climate," Pike & Fischer Broadband Advisory Services, summarized in Jacqui Cheng, "Study: Consumers Lust After High-Speed Broadband, Not HDTV," ars technicae Web site, June 12, 2008, available online at http://arstechnica.com/news.ars/post/20080612-study-consumers-lust-after-high-speed-broadband-not-hdtv.html.

3. Peter Whorisky, "Microsoft's Mundie: U.S. Broadband Efforts 'A Total Policy Failure,'" Washington Post, October 3, 2008, available online at http://voices.washingtonpost.com/posttech/2008/10/microsofts_mundie_us_broadband.html.

4. The Telecommunications Act of 1996 was the most comprehensive reform of communications law since the original Communications Act of 1934. The purpose of the act was to introduce greater competition into virtually every communications market, including the local telephone, long distance, data, satellite, cable (video), and many other markets. It gave federal and state regulators sometimes vague authority and contradictory directions to alter their regulatory approaches to accommodate the more competitive landscape. See, P.L. No. 104-104, 110 Stat. 56 (1996).

5. A fiber optic cable transmits communication signals using light waves over a glass or plastic fiber. The use of fiber permits transmission over longer distances and at higher data rates ("bandwidth") than any other transmission medium.

6. "For example, broadband over power line technology (BPL) has the potential to speed access to every home already on the power grid using existing lines. BPL could also improve the provision and management of electric power systems, enhance homeland security, and protect vital elements of our Nation's critical infrastructure." Remarks by Michael K. Powell, Chairman, Federal Communications Commission, at the Kansas Rural Broadband and Telemedicine Summit, University of Kansas, February 20, 2004, available online at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-244205A1.pdf.

7. In each geographic market there is usually one cable company and one telephone company, each of which provides broadband service. The largest cable companies are Comcast, Time Warner, Cox, Charter, and Cablevision. The two largest telephone companies are now AT&T and Verizon. However, many small markets are served by small, independent cable or telephone companies that are not owned by one of the large national providers. In some of these small markets, there may be only one or no broadband provider.

8. "High-Speed Services for Internet Access: Status as of June 30, 2007", Industry Analysis and Technology Division, Wireline Competition Bureau, Federal Communications Commission, March 2008, Table 14, available online at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-280906A1.pdf.

9. Derived from ibid., Table 5.

10. The shortage of capacity appears to be most prominent in the local access, which is also called by "last mile." In contrast, there does not appear to be a shortage of capacity in long-haul backbone networks. According to TeleGeography, prices for long-haul data transit dipped 10–20 percent in 2007, a sign that the world's backbone providers have more capacity than the demand. See "Wholesale Revenue Growth Remains Elusive," TeleGeography, available online at http://www.telegeography.com/wordpress/?p=71.

11. See the Web page of the Minnesota Internet Traffic Studies Project, University of Minnesota, available online at http://www.dtc.umn.edu/mints/home.php.

12. "The Diverse and Exploding Digital Universe, 2008," IDC, March 2008, available online at http://www.emc.com/collateral/analyst-reports/diverse-exploding-digital-universe.pdf. However, MatrixStream Technologies promises to allow ISPs to offer streaming of HDTV signals with as little as 1.5 mbps transmission speeds. See "MatrixStream MatrixCast HD Streaming over the Internet," MatrixStream Technologies, available online at http://www.matrixstream.com/MatrixCast_IPTV_Solution_Explained.php.

13. See the Organisation for Economic Co-operation and Development, OECD Broadband Portal, available online at http://www.oecd.org/sti/ict/broadband.

14. Verizon is selling its symmetrical 20 mbps FiOS package at $64.99 per month and a 50 mbps service for $89 to $139 per month. See the rates posted at "Verizon FiOS Internet," Verizon, available online at http://www22.verizon.com/content/ConsumerFiOS/packages+and+prices/packages+and+prices.htm (accessed of October 13, 2008). AT&T does not list prices on its Web site (https://uversecentral1.att.com/uvp/home/explore), but one site suggests that AT&T's U-verse service offers 10 mbps at $55 per month.

15. "Internet Demand Could Outstrip Network Capacity by 2010,"gizmag, November 20, 2007, available online at http://www.gizmag.com/internet-demand-could-outstrip-network-capacity-by-2010/8379/.

16. "Following in the footsteps of Time Warner Cable, Frontier Communications and several U.K. internet service providers, AT&T unveiled a tiered broadband service in Reno, Nev., on Nov. 1. . . . AT&T executives met with the legal adviser to FCC Chairman Kevin Martin to discuss 'usage based pricing' as a form of network management." "AT&T Trials Tiered Broadband in Nevada," GigaOM, November 3, 2008, available online at http://gigaom.com/2008/11/03/att-trials-tiered-broadband-in-nevada/.

17. OECD Directorate for Science, Technology, and Industry, Organisation for Economic Co-operation and Development, OECD Broadband Portal, "Broadband Statistics to December 2006," April 2007, available online at http://www.oecd.org/sti/ict/broadband.

18. "EU Adopts Law to Raise Telecom Competition," International Herald Tribune, September 24, 2008, available online at http://www.iht.com/articles/2008/09/24/business/telecom.php.

19. See ex parte filing of Vuze Inc. in WC Docket No. 07-52, April 22, 2008, available online at http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6519995859.

20. Madison River Communications LLC, Consent Decree, 20 FCC Rcd 4,295 (2005), available online at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-05-543A2.pdf.

21. See Public Knowledge, et al., Petition for Declaratory Ruling Stating that Text Messaging and Short Codes are Title II Services or are Title I Services Subject to Section 202 Nondiscrimination Rules, WT Docket No. 08-7 (December 11, 2007).

22. "Networked Nation: Broadband in America 2007," National Telecommunications and Information Administration, U.S. Department of Commerce, January 2008, p. i, available online at http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf.

23. In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, GN Docket No. 07-45, Fifth Report and Order, June 12, 2008, available online at http://www.fcc.gov/broadband/706.html.

24. Ibid., p. 34.

25. In March 2006, one publication noted that wireless penetration had hit 100 percent in Europe, while the U.S. wireless penetration was about 70 percent. See Tomi T. Ahonen, "A Mobile Phone for Every Living Person in Western Europe: Penetration Hits 100%," March 20, 2006, available online at http://communities-dominate.blogs.com/brands/2006/03/phone_for_every.html.

26. Robert W. Crandall and Charles L. Jackson, "The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access," Brookings Institution, July 2001, available online at http://www.att.com/public_affairs/broadband_policy/BrookingsStudy.pdf. See also, Robert W. Crandall, Charles L. Jackson, and Hal Singer, "The Effect of Ubiquitous Broadband Adoption on Investment, Jobs, and the U.S. Economy," New Millennium Research Council, September 2003, available online at http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf.

27. Stephen P. Pociask, "Building a Nationwide Broadband Network: Speeding Job Growth," New Millennium Research Council, Feburary 2002, available online at http://www.newmillenniumresearch.org/event-02-25-2002/jobspaper.pdf.

28. Sharon E. Gillett, William H. Lehr, Carlos A. Osorio, and Marvin A. Sirbu, "Measuring Broadband's Economic Impact," Economic Development Association, U.S. Department of Commerce, February 28, 2006, available online at http://www.eda.gov/ImageCache/EDAPublic/documents/pdfdocs2006/mitcmubbimpactreport_2epdf/v1/mitcmubbimpactreport.pdf.

29. Robert Crandall, William Lehr, and Robert Litan, "The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data," Issues in Economic Policy 6, Brookings Institution, June 2007, available online at http://www.brookings.edu/papers/2007/06labor_crandall.aspx.

30. Michael Curri, "The Transformative Effects of FTTP," Strategic Network Group, March 2008, available online at http://www.sngroup.com/documents/documents/SNG%20-%20The%20Transformative%20Effects%20of%20FTTP%20-%20issued%20July%2011%202008.pdf.

31. "The Economic Impact of Stimulating Broadband Nationally," Connected Nation, February 21, 2008, available online at http://www.connectednation.com/research/economic_impact_study/.

32. Christopher Mitchell, "Municipal Broadband: Demystifying Wireless and Fiber-Optic Options," Institute for Local Self Reliance, January 2008, available online at http://www.newrules.org/info/munibb.pdf.

33. "Doing the Work: 2007 Verizon Corporate Responsibility Report," Verizon, May 2008, available online at http://responsibility.verizon.com/pdfs/verizon_cr_report_2007.pdf.

34. Drew Anderson, "With Relocation of Peregrine Financial Group, Comes Lots of Spending Money," WCFCourier.com, June 24, 2007, available online at http://www.wcfcourier.com/articles/2007/06/24/business/local/c8f3fa51d61835ca86257303001cbd2a.txt.

35. Paul Miller, "Bristol's Broadband Push," Virginia Business, November 2006, available online at http://www.gatewayva.com/biz/virginiabusiness/magazine/yr2006/nov06/tele1.shtml.

36. Karin Kahn, "Getting Enough Fiber in Tacoma," Business Facilities, February 2002, available online at http://www.businessfacilities.com/bf_02_02_move.asp.

37. "Scottsburg, Indiana, USA: Award Winning Network Ensures Continued Survival of Small Town's Economy," Alvarion, 2006, available online at http://www.alvarion.com/upload/contents/291/alv_cs_Scottsburg_LR.pdf.

38. "More than 13 percent of the respondents to the survey, conducted by RVA Market Research (www.rvallc.com), said that their fiber optic connections enable them to work from home more often—a monthly average of 7.3 more workdays at home instead of the office." Fiber to the Home Council, "Growth of Fiber-to-the-Home Drives Teleworking, Home-Based Businesses," July 10, 2007, available online at http://www.ftthcouncil.org/?t=262.

39. Robert E. Litan, "Great Expectations: Potential Economic Benefits to the Nation from Accelerated Broadband Deployment to Older Americans and Americans with Disabilities," New Millennium Research Council, December 2005, available online at http://www.newmillenniumresearch.org/archive/Litan_FINAL_120805.pdf.

40. Neal Neuberger, "Advancing Healthcare through Broadband: Opening Up a World of Possibilities," Internet Innovation Alliance, October 2007, available online at www.internetinnovation.org/tabid/56/articleType/ArticleView/articleId/86/Default.aspx.

41. See the Internet2 Web site, available online at www.internet2.edu.

42. "Research, Statistics and Distance Learning Resources," United States Distance Learning Association, available online at http://www.usdla.org/html/aboutUs/researchInfo.htm.

43. "Motorola Wireless Deployed for Texas University Distance-Learning Network," Motorola, available online at http://www.motorola.com/staticfiles/Business/Solutions/Industry%20Solutions/Education/MOTOwi4/_Documents/static%20files/Texas-AM-US%5B1%5D.pdf.

44. "Australia Broadband Guarantee Funding through 2012," Web site of the Honorable Stephen Conroy, Australia, May 13, 2008, available online at http://www.minister.dbcde.gov.au/media/media_releases/2008/032.

45. None of the existing federal telecommunications programs are appropriate vehicles to fund construction of a nationwide broadband infrastructure. For instance, the $7 billion federal Universal Service Fund (USF) is primarily oriented toward subsidizing basic voice telephone service. The USF program has served many useful purposes, but its rules and policies are intricate, and politically charged. The Rural Utility Service (RUS) within the Department of Agriculture administers a Rural Broadband Loan and Loan Guarantee Program and a much smaller Connectivity Grant Program for rural communities that have no broadband service. While these RUS programs have been very successful in certain small communities, they are not designed to address the larger needs of the nation as a whole because they are limited to rural areas. Furthermore, the eligibility criteria are too difficult for most entities to meet. Of the 218 applications received since 2003, only 92 have been approved, for a total of $1.8 billion over five years. (See page 15 of the RUS presentation for the Broadband Workshop, Northampton, Mass., October 15, 2008, available online at http://www.usda.gov/rus/telecom/broadband/workshops/MassworkshopOct15.pdf.)

46. See "Mid-Session Review of the Budget of the U.S. Government, Fiscal Year 2008," Office of Management and Budget, July 11, 2007, p. 35 available online at http://www.whitehouse.gov/omb/budget/fy2008/pdf/08msr.pdf.

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