

Resource Utilization

This Briefing Paper includes excerpts from chapters 3 and 4 of the National Broadband Plan¹. Chapter 3 covers the current state of the broadband ecosystem while chapter 4 looks into broadband competition and innovation policy. Concluding this chapter are examples and best practices of community owned fiber networks with related links².

Excerpted from the National Broadband Plan Chapter 3

NETWORKS

Network service providers are an important part of the American economy. The 10 largest providers have combined annual revenue of more than \$350 billion and annual capital investments in excess of \$50 billion. These investments have led to the deployment of multiple networks that today bring fixed and mobile broadband to end-users via the telephone, cable television, satellite and third-generation (3G) and fourth-generation (4G) mobile networks.

Terrestrial Fixed Broadband Availability

Today, 290 million Americans—95% of the U.S. population— live in housing units with access to terrestrial, fixed broadband infrastructure capable of supporting actual download speeds of at least 4 Mbps. Of those, more than 80% live in markets with more than one provider capable of offering actual download speeds of at least 4 Mbps. Meanwhile, 14 million people in the United States living in 7 million housing units do not have access to terrestrial broadband infrastructure capable of this speed. Although housing units without access to terrestrial broadband capable of 4 Mbps download speeds exist throughout the country, they are more common in rural areas where businesses and community anchor institutions are often served by broadband. Ninety-six percent of all business locations have access to Digital Subscriber Line (DSL) service, and 92% have access to cable broadband service. In addition, 99% of all health care locations with physicians have access to actual download speed of at least 4 Mbps. Finally, 97% of schools are connected to the Internet, many supported by the federal E-rate connectivity programs.

But crucial gaps exist: More than 50% of teachers say slow or unreliable Internet access presents obstacles to their use of technology in classrooms, and only 71% of rural health clinics have access to mass-market broadband solutions. Further, many business locations, schools and hospitals often have connectivity requirements that cannot be met by mass-market DSL, cable modems, satellite or wireless offers, and must buy dedicated high-capacity circuits such as T-1 or Gigabit Ethernet service. The availability and price of such circuits vary greatly across different geographies, and many businesses and anchor institutions face challenges acquiring

¹ <http://www.broadband.gov/download-plan/>

² <http://www.ilsr.org/initiatives/broadband/>

the connectivity to support their needs. Typical advertised broadband speeds that consumers purchase have grown approximately 20% each year.

This growth has been driven by a shift in consumer preferences to faster, more advanced technologies, improved performance of different technologies and large investments by service providers in network upgrades. Both telephone and cable companies continue to upgrade their networks to offer higher speeds and greater capacities. Many have announced specific upgrades. For example, Verizon plans to pass over 17 million homes by the end of 2010 with its FiOS fiber-to-the-premises (FTTP) service, three million more than today. AT&T has announced it will build fiber-to-the-node (FTTN) infrastructure to serve 30 million homes by 2011, 11 million more than today. In addition, many smaller companies plan to aggressively build FTTP networks. If the targets in these public announcements are met, at least 50 million homes will be able to receive peak download speeds of 18 Mbps or more from their telephone company within the next 2 years. Cable companies have also announced that over the next 2–3 years they will upgrade their networks to DOCSIS 3.0 technology, which is capable of maximum download speeds of more than 50 Mbps. One analyst predicts that by 2013, leading cable companies will cover 100% of the homes they pass with DOCSIS 3.0. The top five cable companies currently pass 103 million housing units, or about 80% of the country's homes. As noted in a recent report from the Columbia Institute for Tele-Information (CITI), history suggests that service providers will meet these announced targets. So it is likely that 90% of the country will have access to advertised peak download speeds of more than 50 Mbps by 2013. The affordability and actual performance of these networks will depend on many factors such as usage patterns, investment in infrastructure, and service take-up rates. However, these major announced build outs target areas already served by broadband. It is unlikely there will be a significant change in the number of un-served Americans based on planned upgrades over the next few years, although some small companies may upgrade their networks to support broadband in currently un-served areas.

The performance of fixed broadband connections is often advertised in terms of maximum "up to" download and upload speeds. For example, an end-user with a connection for which download speeds are "up to 8 Mbps" can expect to reach 8 Mbps download speeds, but not necessarily reach and sustain that speed all or even most of the time. Data show that actual speeds experienced by end-users differ considerably from the "up to" speeds advertised by service providers. This distinction is important because it is the actual experience of the consumer (not theoretical technical capabilities) that enables or limits the use of different applications by end-users. Estimates of the average advertised "up to" download speed that Americans currently purchase range from 6.7 Mbps to 9.6 Mbps, with the most detailed data showing an average of approximately 8 Mbps and a median of approximately 7 Mbps. As noted, the average advertised speed purchased by broadband users has grown approximately 20% each year for the last decade. Upload speeds are significantly lower, as the advertised "up to" upload speed typically is closer to 1.0 Mbps. However, the actual experienced speeds for both downloads and uploads are materially lower than the advertised speeds. Data indicates the average actual download speed in American households for broadband is 4 Mbps (median actual is 3.1 Mbps). Therefore, the actual download speed experienced on broadband connections in American households is approximately 40–50% of the advertised "up to" speed to which they subscribe. The same data suggest that for upload speeds, actual performance is approximately 45% of the "up to" advertised speed (closer to 0.5 Mbps). Actual download speeds vary by technology as well. While median actual download speeds for fiber and cable are 5–6 Mbps, median actual download speeds for DSL are 1.5–2 Mbps, and under 1 Mbps for

satellite. Despite this variation in performance across technologies, on a percentage basis, the gap between advertised and actual speeds experienced by consumers is consistent and prevalent across all types of connection technologies. This performance gap between advertised “up to” speeds and actual performance is consistent with reports published in a number of other countries. A study in the United Kingdom found that average actual speeds were typically about 57% of average advertised speeds. Studies in New Zealand, Australia, Italy and Ireland have shown similar results.

Excerpted from the National Broadband Plan Chapter 4

Competition in Residential Broadband Markets

Competition provides consumers the benefits of choice, better service and lower prices. This section begins by analyzing the available data to assess the current state of competition among wireline broadband services and mobile wireless broadband services, and the competitive dynamics across different broadband technologies. It does not analyze the market power of specific companies or reach definitive conclusions about the current state of competition for residential broadband services. The section then discusses how new technologies and network upgrades present both opportunities and challenges to competition in the near future. It concludes with several recommendations to promote competition and to improve the data the government collects to assess the state of competition in broadband markets in the future.

Competition in industries with high fixed costs

Building broadband networks—especially wireline—requires large fixed and sunk investments. Consequently, the industry will probably always have a relatively small number of facilities-based competitors, at least for wireline service. Bringing down the cost of entry for facilities-based wireline services may encourage new competitors to enter in a few areas, but it is unlikely to create several new facilities-based entrants competing across broad geographic areas. Bringing down the costs of entry and expansion in wireless broadband by facilitating access to spectrum, sites and high-capacity backhaul may spur additional facilities-based competition. Whether wireless competition is sustainable in driving innovation, investment and consumer welfare will depend on the evolution of technology and consumer behavior among many other factors.

**How can your
community
incentivize FTTP
providers to serve**

Given that approximately 96% of the population has at most two wireline providers, there are reasons to be concerned about wireline broadband competition in the United States. ***Whether sufficient competition exists is unclear and, even if such competition presently exists, it is surely fragile. To ensure that the right policies are put in place so that the broadband ecosystem benefits from meaningful competition as it evolves, it is important to have an ongoing, data-driven evaluation of the state of competition. In general, broadband subscribers appear to have benefited from the presence of multiple providers.***

Fixed broadband service

Unlike many countries, the majority of U.S. broadband subscribers do not connect to the Internet via local-access infrastructure owned by an incumbent telephone company. The U.S. cable infrastructure was advanced and ubiquitous enough to allow cable companies to offer broadband access services to large portions of the country, in many cases before the telephone companies. As a result, the U.S. market structure is relatively unique in that people in most parts of the country have been able to choose from two wireline, facilities-based broadband platforms for many years. Approximately 4% of housing units are in areas with three wireline providers (either DSL or fiber, the cable incumbent and a cable over-builder), 78% are in areas with two wireline providers, about 13% are in areas with a single wireline provider and 5% have no wireline provider. These data do not necessarily mean that 82% (78% + 4%) of housing units have two or three competitive options for wireline broadband service—the data used here do not provide adequate information on price and performance to determine if multiple providers present in a given area compete head-to-head.

Indeed, competition appears to have induced broadband providers to invest in network upgrades. Cable and telephone companies invested about \$48 billion in capital expenditures (capex) in 2008 and about \$40 billion in 2009. While it is very difficult to accurately disaggregate service provider capital expenditures into broadband and other areas, a review of analyst reports at Columbia Institute for Tele-Information (CITI) suggests that of this total, wireline broadband capital expenditures were about \$20 billion in 2008 and expected to be about \$18 billion in 2009. Companies channeled these investments into network upgrades in recent years.

Consumers are benefiting from these investments. Top advertised speeds available from broadband providers have increased in the past few years. Additionally, typical advertised download speeds to which consumers subscribe have grown at approximately 20% annually for the last 10 years.

The presence of a facilities-based competitor impacts investment. Indeed, broadband providers appear to invest more heavily in network upgrades in areas where they face competition. Providers of broadband over any given wireline technology—Digital Subscriber Line (DSL), cable or fiber—generally offer faster speeds when competing with other wireline platforms. So, for example, available cable speeds are higher in areas in which cable competes with DSL or fiber than in areas where cable is the only option. DSL and fiber show similar results. Available speeds are even higher where three wireline providers compete (e.g., where a cable over-builder is also present).

New choices—at new, higher speeds—are becoming available, as well. Clearwire offers download speeds of up to 2 Mbps service in several cities and plans to have its WiMAX service available to about 120 million people by 2011. Two satellite providers plan to launch new satellites in 2011 and 2012; with ViaSat (WildBlue) expecting to advertise download speeds of up to 2–10 Mbps and Hughes Communications planning to advertise download speeds of up to 5–25 Mbps.

Mobile broadband competition

Third-generation (3G) wireless service covers roughly 60% of U.S. landmass. In addition, approximately 77% of the U.S. population lived in an area served by three or more 3G service providers, 12% lived in an area served by two, and 9% lived in an area served by one. About 2% lived in an area with no provider.

These measures likely overstate the coverage actually experienced by consumers, since these figures report *advertised* coverage as reported by many carriers who all use different definitions of coverage. They may convey a false sense of consistency across geographic areas and service providers. As with fixed broadband, most areas without mobile broadband coverage are in rural or remote areas. Nonetheless, the data can help benchmark mobile broadband availability nationwide. In total, while United States service providers are building out mobile broadband coverage, the U.S. is far from having “complete” coverage.

Mobile data users typically receive download speeds ranging from hundreds of kilobits per second to about one megabit per second. Several competing firms offer mobile broadband. In addition to the nationwide service providers AT&T, Verizon, Sprint and T-Mobile (two of which are also leading providers of wireline broadband), new competitors such as Leap Wireless and MetroPCS have emerged in metropolitan areas in recent years. Like wireline broadband providers, these firms may compete along many dimensions including coverage, device selection, roaming and services. Many service providers have focused on network upgrades to 3G services.

While projections should be viewed cautiously, wireless broadband capital expenditures are expected to be about \$12 billion in 2010 and increase steadily to \$15 billion in 2015 as service providers roll out their 4G services. Mobile broadband services are relatively new and their competitive dynamics are changing rapidly. As new technologies such as High Speed Packet Access (HSPA), WiMAX and Long Term Evolution (LTE) are introduced and rolled out by different carriers, new devices support different uses and consumers turn to different applications.

Wireline-wireless competition

Whether wireless broadband, either fixed or mobile, can compete with wireline broadband is an important question in evaluating the status of broadband services competition. The answer depends on how technology, costs and consumer preferences evolve, as well as on the strategic choices of firms that control wireline and wireless assets, including firms that offer both fixed and mobile broadband.

Consumers’ preferences differ depending on how they use their broadband connections and how much they are willing to pay such use. Some value download speeds more than any other attribute, some value mobility and new converts from dial-up may still even value the simple “always on” connection. A user who values little more than e-mail and browsing news sites has, in principle, many choices—nearly any broadband access technology will do. But a user who streams high-definition video and enjoys gaming probably requires high download and upload speeds and low latency. That user will likely have few choices.

Wireless broadband may not be an effective substitute in the foreseeable future for consumers seeking high-speed connections at prices competitive with wireline offers. **Given**

enough spectrum, however, a variety of engineering techniques may make wireless a viable price/performance competitor to wired solutions at far higher speeds than are possible today, further increasing consumer choice.

The ongoing upgrade of the wireless infrastructure is promising because of its potential to be a closer competitor to wireline broadband, especially at lower speeds. For example, if wireless providers begin to advertise, say, 4 Mbps home broadband service, wireline providers may be forced to respond by lowering prices of their broadband offerings. This could be true even if wireless services are more expensive, especially if the service is also mobile. Such an outcome is a possibility—for instance, Long Term Evolution Systems (LTE) could offer speeds between 4 and 12 Mbps, with sustained speeds of up to 5 Mbps.

Potential future issues for fixed broadband competition

Analysts project that within a few years, approximately 90% of the population is likely to have access to broadband networks capable of peak download speeds in excess of 50 Mbps as cable systems upgrade to DOCSIS 3.0. About 15% of the population is likely to be able to choose between two robust high-speed service services—cable with DOCSIS 3.0 and upgraded services from telephone companies offering fiber-to-the-premises (FTTP). Some evidence suggests that this market structure is beginning to emerge as cable's offers migrate to higher peak speeds.

As with fixed-mobile substitution, how the evolution of network capabilities affects competition depends on how pricing, consumer demand, technology and costs evolve over time. For example, if users continue to value primarily applications that do not require very high speeds (e.g., speeds in excess of 20 Mbps), and are not willing to pay much for vastly increased speeds, then a provider may not gain much of an advantage by offering those higher speeds. In contrast, if typical users require high speeds and only one provider can offer those speeds, and expected returns to telephone companies do not justify fiber upgrades, then users may face higher prices, fewer choices and less innovation. Because of this risk, it is crucial that the FCC track and compare the evolution of pricing in areas where two service providers offer very high peak speeds with pricing in areas where only one provider can offer very high peak speeds. The FCC should benchmark prices and services and include these in future reports on the state of broadband deployment.

Municipally Owned Fiber Networks Case Studies and Best Practices³

Chattanooga, Tennessee (EPB Fiber) Highlights

- HomeServe moved its call center to Chattanooga, creating 140 new jobs after HomeServe's CEO learned that the **minimum** connection speed on the city-owned network was faster than the **maximum** they had available at headquarters.
- Companies in Knoxville, 100 miles away, have decided to expand in Chattanooga to take advantage of the much lower telecom costs.
- TractManager, a national company, credits the city network with some of their success: "It's a huge plus for us. It's a competitive advantage for the business."

³<http://www.ilsr.org/initiatives/broadband/>

- An academic study estimated the first 10 years of the network will yield over 3,600 new jobs directly linked to the City's triple play services.

Link: <http://www.ilsr.org/wp-content/uploads/2012/04/muni-bb-speed-light.pdf>

(This is ILSR's 75 page report on three community owned fiber networks including Chattanooga)

Chanute, Kansas (Chanute Municipal Network) Highlights

- Spirit AeroSystems, looking for a home for its new manufacturing facility, chose Chanute in part due to its exceptional broadband infrastructure. The plant will create over 100 new jobs.
- MagnaTech, a local designer and manufacturer, was on the verge of leaving Chanute when private providers would not meet its telecom needs. But the municipal network connected them and kept 35 jobs in the community.

Link: <http://www.ilsr.org/chanute-rural-gigabit/>

Bristol, Virginia (OptiNet) Highlights

- CGI and Northrup Grumman created 700 jobs paying twice the average wage in the community because of connections from the publicly owned network.
- Alpha Natural Resources - The coal company was considering moving its headquarters away from the region after a merger with another coal company headquartered in Baltimore. But the BVU Authority network allowed them to stay local.
- DirecTV began using OptiNet for a virtual call center in Bristol, creating 100 new home based positions.

Link: <http://www.ilsr.org/broadband-speed-light/>

Lafayette, Louisiana (LUS Fiber) Highlights

- Pixel Magic created a studio in Lafayette after working there on a temporary basis for a movie shoot. The studio created 100-200 new jobs because LUS Fiber could connect it to studios and partners anywhere in the world.
- NuComm International brought a call center to Lafayette, announcing 1,000 new positions.

Link: <http://www.lusfiber.com/index.php/about-lus-fiber>

Springfield, Missouri (SpringNet) Highlights

- After a national carrier could not meet its needs, SpringNet stepped in to provide Expedia with the necessary connectivity to bring over 400 jobs to the community.
- SpringNet connects over 200 businesses and operates an impressive 56,000 sq. ft. data center 85 feet underground.

Martinsville, Virginia (MiNET) Highlights

- This publicly owned network has been credited with attracting several new businesses, including SPARTA, Inc., a defense contractor.
- ICF International, a professional and technology services firm, plans on bringing 539 new jobs to Martinsville because of its fiber network.

Danville, Virginia (nDanville) Highlights

- The municipal network connects most of the medical community with connections twice as fast as those previously used at 30% lower cost.
- The network also connects over 150 businesses and can offer 10Gbps connections upon request.

Link: <http://www.bbpmag.com/MuniPortal/EditorsChoice/1111editorschoice.php>