

HIGH-SPEED CHASE

TAKING BROADBAND TO THE LIMIT

BY BETTY JOYCE NASH

Fast, reliable Internet access shrinks time and distance like no predecessor technology. It's hard to exaggerate the significance of this "broadband" service that packs data through lines, over airwaves, or via satellite at a clip fast enough for a doctor to interpret an X-ray or monitor a patient's chronic disease from afar in real time. A firefighter can download a building plan, in the heat of the moment, via a mobile device. Broadband can also bring big businesses to regions that otherwise might get bypassed.

Most of the people who want broadband in the United States have it already. But bringing everyone up to speed gets iffy, especially in remote places, where low subscriber numbers might not justify the cost of deploying wire and fiber. This "last-mile" problem led the government to wire segments of the nation with electricity and telephone lines in the previous century.

Government grants have been spurring investments in "middle-mile" fiber installation, which will help, but taxpayers can't fund every last mile. Could the broadband gap ultimately be closed using wireless configurations, satellite, and even existing power lines?

The Broadband Advantage

Worldwide, governments want citizens connected via broadband — it enhances productivity, innovation, and may cut costs. Economist Robert Litan of the Kauffman Foundation and the Brookings Institution, for example, has written about broadband's potential to deliver health care and information to the elderly and the disabled. Remote medical monitoring and two-way communications between patients and health care providers could delay or even eliminate the need for institutionalized living. Broadband would also make it easier for both populations to work, if they chose.

When people can't access broadband, it's due not only to geography, as in the case of rural residents, but also to sociology, especially relating to the elderly, disabled, minorities, or poor. Most people who can easily be connected *are* connected. Many of those without broadband have decided against it for a variety of reasons. Thirty-eight percent of those rural households without broadband, when asked, say

they don't need it, or they're not interested. Affordability is cited by 22 percent of rural nonusers (and, tellingly, 28 percent of urban nonusers). But only 11 percent of rural households say they don't use broadband because it's not available. About 65 percent of rural households, compared to 69 percent of urban households, already have Internet use "at least somewhere." These numbers come from *Digital Nation*, a report published by the U.S. Department of Commerce based on data collected in October 2009.

So as the above numbers show, it's not only a last mile problem, it's a "last user" problem. The push for affordable broadband access in every nook and cranny has been a stated national goal since 2004. Rural schools, health clinics, hospitals, and businesses may benefit most from these high-capacity circuits that can improve learning, medical care, and economic development.

Money from the federal government's stimulus package aimed at expanding broadband access nationwide, \$7.2 billion in all, is starting to roll into the Fifth District. A North Carolina nonprofit, MCNC, which runs the North Carolina Research Education Network got \$28.2 million in broadband recovery money for middle-mile deployment in eastern and western parts of the state. The idea is to expand the optical footprint so it's faster, more robust, and more reliable, says Noah Garrett of MCNC. The nonprofit has a bigger fiber ring project on the drawing board, worth \$100 million, if money from other grants comes through. "What you'll see with the expansion, the middle-mile, you're going to start seeing more households having more affordable access," Garrett says, in the hope that commercial providers install the last mile.

The Federal Communications Commission (FCC) estimates that it could take another \$23.5 billion to bring every home in the nation up to speed, including about \$13 billion to reach the most rural areas. But is it necessary? The latest FCC report on wireless says 92 percent of the rural population has at least one mobile broadband provider already, enabling wireless Internet access via mobile phones or laptops. Wireless isn't a perfect wire-line substitute but may serve rural areas more economically. Each generation of wireless improves on the last, with fourth-generation (4G) technology upon us. If speed and customer satisfaction

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compare favorably to fixed service, nonterrestrial technologies such as 4G can bring the cost of closing the broadband gap to roughly \$10 billion.

Mobile wireless has developed in scope and sophistication, and it's also become more concentrated, with the two biggest providers, AT&T and Verizon, accounting for 60 percent of subscribers and revenue, according to a May 2010 FCC report to Congress on wireless penetration. Both firms continue to gain market share. As smart phones and mobile computing devices proliferate, wireless use grows. The iPhone, for instance, has driven data traffic on AT&T's mobile network up by 5,000 percent between mid-2006 and mid-2009.

National Network

By 2013, about 90 percent of the nation may have access to peak download speeds of more than 50 megabits per second, according to the FCC, compared to the average (actual) speed of about four megabits per second today. Advertised and actual speeds depend, however, on infrastructure, service take-up rates, and patterns of use. If everyone on a circuit logs on, then speed can slow. When all is said and done, the FCC's goal is affordable 100-megabit-per-second download speeds to 100 million homes by 2020 and one gigabit-per-second connections to institutions — libraries, schools, hospitals, military installations, and the like.

Digital Nation found that as of October 2009, 63.5 percent of U.S. households used broadband (technologies faster than dial-up); 66 percent of urban and 54 percent of rural households accessed broadband. Rural households were more likely to use dial-up, 8.9 percent, than urban ones, 3.7 percent. Also, U.S. households with children are more likely to have Internet service than those without children, so the per-household figures may understate use.

The FCC's National Broadband Plan released earlier this year outlines changes, not only to subsidize broadband extension but also to auction underused broadcast spectrum for mobile communications. The FCC wants to switch the universal service funds that telecoms currently pay to subsidize rural telecommunications, including discounts to poor households and services to schools and libraries, to fund broadband diffusion.

Wire-line services require large fixed costs, and while reducing these costs could spur competition, that's unlikely to happen over vast geographical areas. Digging and burying fiber — the dominant desired transmission method for the foreseeable future — can cost \$100,000 a mile, and so it makes sense to deploy fiber simultaneously with water or sewer pipes. Some communities have these build-out policies in place.

And more competition could emerge from wireless by cutting costs of entry and expansion through access to spectrum, according to the FCC plan. Economists Robert Crandall and Hal Singer noted in a recent Brookings Institution report that most U.S. households have at least three broadband technologies from which to choose and, in most service areas, even more suppliers.

Broadband deployment in the United States is nearly ubiquitous, with the exceptions previously noted. And competition exists in most markets, a fortuitous accident because coaxial cable for television and copper wires for telephone developed separately. Both worked to deliver broadband.

Today, most people can choose between two wire-line platforms: 78 percent of housing units are located in census tracts with two providers; 13 percent have only one, according to the FCC. However, data are inadequate to show whether price and performance offer enough competition for a variety of reasons, including the fact that many people buy bundled services from cable or telco providers.

Power Lines

When the federal government began to support power line extension in 1935, barely 10 percent of farms had electricity and 20 percent had telephone service. Private firms considered the remote investments unfeasible. Today, the U.S. Department of Agriculture loans money to rural electric cooperatives, and since 1949 the universal service fund has subsidized telephone lines in remote areas. Telephone companies often charge customers a fee to recover that cost. The idea is for customers in remote regions to receive service priced similarly as in urban regions.

In rural America, that last mile can be long. And expensive. For fixed broadband, last mile can mean trenches, and digging represents most of the cost. Exclusive of any long-term spillover benefits, broadband so far has benefited its private suppliers handsomely. Economist Shane Greenstein and his co-author Ryan McDevitt, both of Northwestern University, in a 2009 National Bureau of Economic Research paper found that private investment diffused broadband effectively. As broadband became faster, more reliable, and available, households upgraded to speedier service, paying more along the way. Internet access revenue reached \$39 billion in 2006, with broadband accounting for \$28 billion of GDP, with \$20 billion to \$22 billion associated with household use. Of that amount, broadband's deployment created approximately \$8.3 billion to \$10.6 billion of new GDP. In part, Greenstein and McDevitt found that price indices had undervalued gains to users of broadband, and yet that's what motivated upgrades. In short, the authors' recalculation of

conventional GDP estimates show that the gains to broadband suppliers from creating new revenue covered investments in urban and suburban areas.

But reaching low-density locations may not be profitable. “Once the costs exceed one or two thousand dollars per household, then the profitability gets dicey. Prices have to increase or payback periods have to increase,” Greenstein notes.

No one knows that better than Maureen Kelley, who formerly worked for Apple Computer. She now lives in rural Nelson County, Va., where she serves as economic development director. The county has gotten \$1.8 million in broadband stimulus money to install 31 miles of fiber and four wireless tower sites, ultimately connecting schools, a library, seven county facilities, and the Blue Ridge Medical Center, the local health clinic.

“What we are putting in is the infrastructure that ISPs have not deployed in our very rural area,” she says. Internet service providers will be able to lease strands from the county-owned and operated network to connect homes. Of the 8,000 households in the county, more than half now use dial-up.

The county’s electric cooperative is deploying fiber over existing power lines. “They have given us a sweet pole attachment gift,” she says, referring to the cooperative’s fee waiver. “This is so much like rural electrification.” While underground fiber installation protects wires from weather, aerial deployment is cheap by comparison.

While Nelson County is stringing fiber over telephone lines, another technology may also help diffuse broadband. After a shaky and unpredictable start, using the lines themselves still holds promise. Conceived in part to create a smart grid to monitor electricity use, the technology can transmit data with speeds comparable to DSL and cable modem. While power lines are installed everywhere, the technology has yet to be widely deployed, as it continues to evolve.

Home-Grown Fiber

Wilson, N.C., and Salisbury, N.C., are investing in fiber systems. Wilson sold bonds to finance its “Greenlight” system of cable, broadband, and telephone service. Bristol, Va., located in the southwest corner of the state, is often cited as an example of the home-grown fiber initiative. Bristol Virginia Utilities first deployed its OptiNet fiber in 1998 among substations and city offices for internal use, but soon started serving businesses and homes. Since then, Northrop

Grumman Corp., has located a 90,000 square-foot computing center in Lebanon, Va., population 3,214. Although the firm was driven to the remote region, in part, by the politics of its contract to serve as the state’s technology provider, the location would have been unworkable without broadband. A Canadian IT services company, CGI, has also put down roots in Lebanon.

Combined, the two companies employ about 700 people, according to Larry Carr, executive director of the Cumberland Plateau Co., the nonprofit formed to oversee implementation in a multicounty area. “We tried to work with the incumbents to put the fiber into these areas so we would have a chance at recruiting Internet technology companies, but they weren’t interested,” he says, adding that low-density populations in these hard-to-reach locations makes profitability uncertain. Carr says his nonprofit has applied for a piece of the federal stimulus money for middle-mile infrastructure that can bring broadband closer to residents on the last mile.

The federal dollars allocated for broadband won’t finish the job of connecting every household. Also, regulatory uncertainty hangs over FCC efforts. In April a federal appeals court found that the FCC lacks authority to regulate broadband services. The FCC had sought to ensure that all Internet content is treated equally by providers, after Comcast slowed customers’ access to BitTorrent, a program used to share large video files. Comcast then challenged FCC authority over broadband. The ruling allows providers to control access to some content or price access to it. The FCC chairman, Julius Genachowski, has proposed an alternative, but results at press time were unclear.

The ruling’s effects, if it stands, on future applications like the next YouTube are unknown. The Internet has developed over the past 20 years without interference from carriers. “That experience has yielded obvious growth,” Greenstein says. “Part of the reason [for that growth] is the Silicon Valley software developer doesn’t worry about who’s delivering it in Boston or Dallas: Everybody has been prevented from interfering with the message.”

So far, market-driven policies have diffused broadband widely and quickly despite the pockets of people who remain un- or underserved. Whether public efforts can ultimately solve that problem — and whether it actually is a problem worth solving, given the costs — remains unclear. As innovation flourishes, so does uncertainty as broadband creeps toward its final frontier.

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READINGS

Connecting America: The National Broadband Plan. Washington, D.C.: Federal Communications Commission, March 2010.

Digital Nation: 21st Century America’s Progress Toward Universal Broadband Internet Access. Washington, D.C.: National Telecommunications and Information Administration, U.S. Department of Commerce, February 2010.

Greenstein, Shane and Ryan C. McDevitt. “The Broadband Bonus: Accounting for Broadband Internet’s Impact on U.S. GDP” National Bureau of Economic Research Working Paper no. 14758, February 2009.

Hahn, Robert W., and Scott J. Wallsten. “An Economic Perspective on a U.S. National Broadband Plan.” *Policy & Internet*, vol. 1, no. 1, article 5.