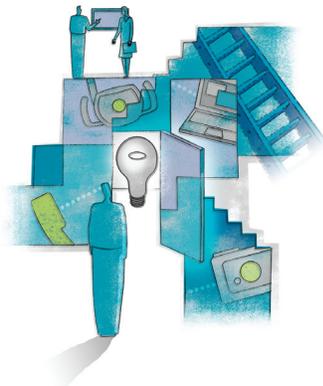


Bringing Broadband to Unserved Communities



THE “DIGITAL DIVIDE” HAS BECOME A FAMILIAR BUZZ PHRASE of the computer age, commonly used to distinguish the wealthy, who can afford Internet access, from the poor, who often cannot. But there are other digital divides as well, in particular the one between those who have easy access to broadband for high-speed Internet connections and those—mostly in rural areas—who must rely on much slower dial-up modems or satellite. This broadband divide, which excludes an estimated 10 million U.S. households from the age of high-speed Internet, has implications that stretch far beyond time wasted due to a slow Internet connection. The availability of broadband improves the ability of individuals to access information, and entire communities benefit from the positive spillover effects of increased Internet speed. However, because broadband providers often face prohibitive start-up costs in rural areas, the advantages of broadband may never materialize in these locations.

Jon M. Peha, professor of electrical engineering and public policy at Carnegie Mellon University, offers a proposal to bridge the broadband divide in a discussion paper for The Hamilton Project. In communities without broadband, firms would bid for the lowest government subsidy to complete a particular broadband project. Projects would be defined by milestones, such as the number of households and businesses to which broadband service should be offered. Importantly, both the milestones and deadlines to meet them would be tradable, and owners of milestones and deadlines could mix and match as they wish. Since Peha believes that wireless technology is likely to be the most cost-effective method to provide broadband in rural communities, he also proposes that the government make more wireless spectrum available for this purpose. Finally, Peha argues for a strong role for local governments in setting the broadband deployment strategy for their communities. In sum, his proposed measures would give firms the flexibility to complete the task of expanding access efficiently while using targeted government intervention to ensure that this goal is met.

THE CHALLENGE

The digital divide is occasionally likened to the so-called Mercedes divide—some people can afford luxury cars, but most cannot. However, this metaphor misses the mark on at least two counts. For one, access to broadband Internet depends not just on wealth, but also on whether one lives in an urban or rural area. Second, high-speed Internet is fast becoming a necessity rather than a luxury—a Chevrolet rather than a Mercedes. Increasingly, only people with fast Internet connections can fully participate in the countless ways in which we now live, work, and play in cyberspace.

The FCC defines broadband as Internet service attaining speeds of at least 786 kilobits per second, though this definition competes with other indicators of broadband. Cable modem service is the most popular form of wired broadband, subscribed to by an estimated 34 million U.S. homes in June 2007. An additional 29 million households or businesses subscribe to DSL from the local telephone company, while mobile wireless service accounts for 35 million connections. Fixed wireless, which creates a link between two sites or buildings, remains a relatively uncommon source of broadband Internet.

The numbers, however, also tell the story of a broadband divide. Almost 60 percent of rural households in the United States subscribe to the Internet at home, a figure similar to that for the United States as a whole. But this comparison hides one glaring inequality: rural Americans are twice as likely to rely on dial-up than the average American. About 20 percent of rural households, or one-third of those with Internet subscriptions, use dial-up compared with 10 percent of all Americans. Although the share of households that use broadband continues to rise, Peha estimates that 9 to 10 million households still remain without high-speed Internet access.

Closing this gap is desirable for many reasons. For rural communities in particular, high-speed Internet access puts people in contact with resources that are geographically out of reach. Internet shoppers can buy products unavailable in local stores, while students can write term papers based on books not found in local libraries, and even earn college degrees from online universities. The health of the sick and the elderly can be monitored by expert doctors a thousand miles away. Broadband access could also improve employment prospects for individuals.

Just as notably, high-speed Internet access indirectly benefits non-users as well, producing what economists call positive externalities. Entire communities prosper when they gain access to high-speed Internet. Property values increase. Businesses can operate more efficiently with Internet tools and can expand to new markets. Government services improve as officials find ways to take advantage of Internet access. And even beyond the local area, the more people that have access to the Internet, the more useful the tool becomes, creating so-called network effects.

The flip side of network effects, however, is that they make the lack of broadband Internet access in rural America doubly harmful. As broadband becomes available to the majority of households, Internet content will be designed for broadband users, full of fancy graphics that can be quickly downloaded by cable modem or DSL but that are slowly downloaded by dial-up. More than that, as more customers access information over the Internet, companies have less reason to maintain contact with those who do not.

So if broadband access is so clearly beneficial and the lack of it so detrimental, why are many areas of the United States still using dial-up? The answer is that right now it simply does not pay for firms to expand service. Providers face high costs per

subscriber in rural areas—more than 50 percent higher than urban areas—because of low population density and more rugged terrain. Cable modem and DSL use wired infrastructures, which were originally intended for other uses, and which are less prevalent in rural areas.

Given the many benefits of broadband access, Peha argues, the government must step in where the private market will not. Nevertheless, the role of government in broadband is different from its role in other types of infrastructure. Since it is easy and inexpensive to charge users for broadband, the private market would still successfully provide broadband services if the upfront costs were lower. The government should therefore focus on defraying these costs to private firms.

The government's telecommunications policy also discourages firms from deploying broadband. If the United States were starting from scratch to provide broadband to rural areas, argues Peha, fixed wireless technology would be the smartest way to go. Fixed wireless does not require the same extent of infrastructure as cable or DSL, and the closest wireless competitors have speeds comparable to cable and DSL. Despite the attraction of wireless technology, however, its potential for expanding broadband access is limited by the quantity of available wireless spectrum to carry it. As the name implies, wireless requires something besides wires—electromagnetic waves by which radio, television signals, and visible light also travel—to carry information from Computer A to Computer B. As Philip J. Weiser explains in a recent Hamilton Project paper, the government has made only a limited amount of electromagnetic spectrum available for wireless use, making it difficult for providers to deploy their infrastructure efficiently.

Despite the widespread availability of dial-up Internet, nearly 10 million households lack access to fast Internet connections that are becoming increasingly necessary in the digital era.

A NEW APPROACH

Peha proposes an innovative series of measures that the federal government, with the cooperation of local governments, could use to bring high-speed Internet to much of rural America. He notes that the United States and other countries have already experimented with what are known as reverse auctions, in which firms compete for the lowest government subsidy to complete a broadband project. The basic principle behind these auctions is to provide firms with cost-effective incentives—that is, subsidies—to increase broadband access in rural communities. Despite their theoretical appeal, traditional reverse auctions have met with limited success because high deployment costs deter sufficient competition among firms. Peha proposes a twist on the traditional reverse auction in which firms would be allowed to trade defined obligations to provide service. The flexibility of tradable obligations would help to reduce the costs of deployment, thereby encouraging more competition in the bidding process. In addition to this new system, Peha proposes two other policies necessary for successful broadband deployment: making more spectrum available for wireless services and allowing local governments to make decisions about local broadband.

Key Highlights

Challenge

An estimated 9 to 10 million American households that use the Internet still lack access to broadband, but high-speed Internet providers do not find it profitable to service these mostly rural areas.

- **Broadband Internet access benefits both individuals and communities.** Broadband greatly enhances the ability of individuals to access information they otherwise could not, and society benefits from spillover effects such as increased economic productivity.
- **Providers have little incentive to expand service to rural areas.** Because of high costs per subscriber, firms are reluctant to provide broadband services in these areas, resulting in the underprovision of services.
- **Lack of wireless spectrum poses a technical barrier.** Fixed wireless technology is the most cost-effective way to expand broadband Internet access to rural areas, but government telecommunications policy has severely limited the amount of electromagnetic spectrum available for wireless use.

A New Approach

Peha proposes that the federal government provide incentives to firms to expand broadband access in rural areas and increase the amount of spectrum available for wireless technology.

- **Hold a reverse auction.** The federal government would award a subsidy to the firm that submits the lowest bid for a project to expand broadband infrastructure to a rural community. The firm would then be responsible for making broadband available to a given area by a given date, with individual milestones and deadlines.
- **Allow milestones and deadlines to be tradable.** Firms would be allowed to trade milestones and deadlines through a system of tradable assets and liabilities similar to a cap-and-trade system for pollution permits. This flexibility would allow providers to work toward the ultimate goal of expanding access while minimizing costs.
- **Increase available spectrum for wireless communication.** Since wireless technology is the most cost-effective source of broadband Internet in rural areas, the federal government should ensure that more electromagnetic spectrum is allotted for carrying wireless signals.

Tradable Obligations for Providers

Peha first proposes a modified version of reverse auctions known as tradable service obligations. For a given rural community, the federal government would determine the maximum subsidy that it would pay to provide broadband. This amount would become the opening bid in the auction, serving as compensation for the high cost and low customer base of rural broadband. Once opened, the bidding would proceed until a minimum was reached that no participant was willing to undercut, providing firms with an incentive to minimize costs as much as possible. The lowest bidder would then win the amount of its bid as its subsidy for completing a set of obligations to provide broadband service to an area, with deadlines attached.

Unlike traditional reverse auctions, this contractual agreement would incorporate a great deal of flexibility in how the obligations can eventually be met. The winning firm would be given a series of milestones to meet along the way to making broadband available to the entire region. Importantly, the milestones would be technology neutral. For example, a milestone might be the provision of broadband service to any ten thousand homes in the region; the milestone would not be the provision of service for a particular ten thousand-home region that could be served by a single hilltop transmitter used by a particular wireless provider. The overall obligation would include as many intermediate deadlines as there were milestones, and the winning bidder could achieve the milestones in any order, just as long as the winner achieved a new one by each deadline. Penalties would be attached to missed deadlines.

Like the permits in a cap-and-trade pollution-control system, obligations and even deadlines could be sold by the low bidder to another high-speed Internet provider. Each traded milestone would have to be accompanied by a deadline. Deadlines could be thought of as potential liabilities: if a firm misses

one, it must pay a fine. Milestones could conversely be thought of as potential assets: a firm would need to meet one in order to avoid the penalty. A registry of obligations would be made available to firms to facilitate these exchanges.

The most important aspect of Peha's system of tradable obligations is that it allows providers the flexibility to exploit economies of scale and scope, and to react to exigencies as they arise. At the same time, government involvement would ensure that the milestones include quality standards in addition to providing the incentives necessary for firms to incur the significant start-up costs.

Peha also addresses how the government could fund the subsidies offered. He proposes overhauling the current universal service fund (USF), which aims to defray the price of telephone service in high-cost rural areas. The USF has been criticized by many as inefficient and financially unsustainable, and has been accused of often targeting communities that do not need help at the expense of other telephone subscribers. Part of the universal service fund's annual \$7 billion budget could be used to fund the cost-effective subsidies of tradable obligations.

Extending Spectrum for Broadband

The lack of spectrum might be viewed as another barrier to broadband deployment, this time one that government policy itself has erected. Central to Peha's proposal is a shift in government telecommunications policy to make a larger part of the electromagnetic spectrum available for wireless communication. Wireless technology is among the most promising and cost-effective ways to bring broadband to rural America because it does not require as much investment in costly physical infrastructure. Wireless technology, though, can work only if broadband providers can gain access to more of the spectrum than the FCC has been willing to auction off.

Providers face high costs per subscriber in rural areas—more than 50 percent higher than in urban areas—because of low population density and more rugged terrain.

Ideally, providers want to serve large areas with a minimum of new infrastructure—and generally, wireless requires less infrastructure in sparsely populated areas than DSL or cable. Providers of wireless broadband want to transmit at high power from towers located so that they cover the greatest possible area. Peha expects that the transition in 2009 from analog to digital television will create opportunities as broadcasters abandon their analog signals and the spectrum that carries them. He also argues that there is room to exploit the TV white spaces—a band of spectrum that is used for a given TV channel but in a location where that TV channel is not available. Currently, these white spaces serve as buffers against interference between broadcasters in adjacent television service areas, but they may be less necessary in digital than in analog television.

Another important opportunity to free up spectrum is to reduce the amount of spectrum held by the federal government. According to Peha, the first step would be for the next president to demand an inventory of how spectrum is now used. The inventory should be made public so that companies seeking spectrum would know, for the first time, exactly what opportunities are available.

The Role of Local Governments

Peha argues that local governments also have

To encourage expansion of broadband to rural areas, the government should offer cost-effective subsidies to private firms in exchange for achievement of project milestones and deadlines that firms can trade.

an important role to play in decisions regarding broadband access to their communities. Many cities with multiple forms of broadband Internet access have set up wireless metropolitan-area networks (WiMANs). These networks not only allow more efficient delivery of government services, but they also enhance the attractiveness of living in the metropolitan area. Pittsburgh has used a WiMAN set up by outside organizations as a compelling reason, in addition to enhanced entertainment and transportation, for visitors and tourists to come downtown.

In setting up these local networks, however, some cities have been criticized for meddling in territory best left to the private sector. Indeed, there have been several failures that have detracted from other programs' successes. As a result, several states have passed laws that hamstringing localities trying to play such a role. Peha urges Congress to prevent states from making blanket prohibitions and to allow communities to hold their local leaders accountable for providing the best services possible—whether that service is a local network or a private service. Though WiMAN may not make sense for all communities, local governments should have the flexibility to make decisions about this service based on local needs. Local governments can

also make decisions about technology in their communities in other ways. For example, Peha says, local governments should become involved in the tradable obligations system, conveying the particular needs of their communities and offering to become broadband customers themselves.

Questions and Concerns

What if reverse auction bidding resulted in the formation of a monopoly over a service area?

In many areas, a system of tradable obligations to provide high-speed Internet access would produce monopoly providers. If a government subsidy were necessary to attract even a single provider, it is unlikely that a second would be willing to compete without a subsidy. Monopolies have inherent risks. They may charge more than competitive providers would. But the bigger problem, says Peha, is that they could try to increase profit by limiting consumers' access to content, applications, devices, or users. A cable television company with a local monopoly on high-speed Internet could make a profitable deal with one vendor and block the content of other vendors; an Internet telephone company could forbid use of the Internet for telephony. There are also implications for free speech. A Canadian Internet service provider has been accused of blocking access to a labor union's website. To address these concerns, Peha suggests that government subsidies could be conditioned on agreement by the auction winner not to engage in practices that discriminate against certain forms of content.

How does the proposal address the possibility of firm bankruptcy?

There is a danger that companies would accumulate a fistful of obligations to provide broadband Internet access—and the government subsidy that would go with them—not with the intention of meeting the obligations, but rather of declaring bankruptcy. This could become a strategy for borrowing. A

requirement that a company have at least as many milestones as deadlines might alleviate this risk. If bankruptcies occurred anyway, the government could require that obligations revert to the previous owner. In effect, the seller of the obligations would provide bankruptcy insurance for the buyer.

CONCLUSION

In much of rural America, it simply does not pay for providers to offer broadband access. Cable television companies may not offer its customers high-speed Internet access via cable modem, telephone companies may not provide DSL, and wireless companies may be unable to connect customers to the Internet through their cell phones. As a result, the Information Age is leaving as many as 10 million households behind.

Peha has a plan that would bring broadband Internet access to many of those households. Its linchpin: government subsidies just large enough to turn the provision of broadband from a money-losing proposition into a profitable one. The recipient and size of the subsidy would be determined by a reverse auction whose winner would be the low bidder. The winner would be awarded a series of tradable milestones and deadlines to ensure efficient progress on the way to providing full high-speed Internet access.

In addition to the auction, Peha would make more spectrum available to the wireless industry so that availability of spectrum would not limit its capacity to provide Internet service. In addition, he would guarantee a role for local governments in decisions affecting their communities' connection with the prime information source of the twenty-first century.

Learn More About This Proposal

This policy brief is based on The Hamilton Project discussion paper, *Bringing Broadband to Unserved Communities*, which was authored by:

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Peha's research spans technical and policy issues of information technology, such as spectrum, broadband Internet, communications for emergency responders, universal service, e-commerce, privacy and security.

Additional Hamilton Project Proposals

An Economic Strategy for Investing in America's Infrastructure

This overview paper presents a comprehensive strategy for physical and telecommunications infrastructure policy in the United States. It emphasizes the need to use existing infrastructure more efficiently, improve the way in which infrastructure-related decisions are made, and promote infrastructure as a component of broadly shared growth.

Physical Infrastructure

Several new papers from The Hamilton Project discuss ways to make better use of physical infrastructure. These policies would encourage users to consider the full costs of their infrastructure use through better pricing mechanisms, while compensating low- and middle-income households with the revenue generated by these mechanisms. These papers include:

- *America's Traffic Congestion Problem: A Proposal for Nationwide Reform* by David Lewis
- *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity* by Jason E. Bordoff and Pascal J. Noel
- *Creating a Safer and More Reliable Air Traffic Control System* by Dorothy Robyn

Telecommunications Infrastructure

Two new Hamilton Project papers on telecommunications infrastructure aim to facilitate technological innovation and share the benefits of technology more broadly. Maximizing the value of telecommunications will require using wireless spectrum—the airwaves that allow devices to communicate—more efficiently and facilitating deployment of high-speed Internet access to rural areas. These papers include:

- *The Untapped Promise of Wireless Spectrum* by Philip J. Weiser
- *Bringing Broadband to Unserved Communities* by Jon M. Peha

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