

The multilayered challenges of broadband expansion

21 June 2021, by Brandon Baker



Fiber optic cables laid in a trench, to supply high-speed internet. Credit: University of Pennsylvania

In the Biden Administration's proposal to invest in the country's infrastructure, \$100 billion is carved out to address gaps in broadband access. According to the Federal Communications Commission, at least 19 million Americans remain without any access to broadband, and many more either can't afford it or have speeds below the 25 Mbps download and 3 Mbps upload standard speeds set by the FCC, last changed in 2015.

Most affected by the coverage gap: rural areas across the country; tribal areas, where only half of households subscribe to [broadband](#); and urban neighborhoods where the dominant barrier is cost or subpar service. Those affected are often [low-income communities](#) and people of color.

All of which has been made much more apparent since the COVID-19 pandemic swept the nation and forced students and employees into remote instruction or work. What once might have appeared as a niche issue has gained urgency.

"I think the pandemic has underscored the need for

broadband in a way that is very popular," says Christopher Yoo, the John H. Chestnut Professor of Law, Communication, and Computer & Information Science, and director of the Center for Technology, Innovation & Competition in the Carey School of Law. "There's been a general support for stimulus going back to the [2016] election, when both President Trump and [Hillary] Clinton supported infrastructure, and the needs for it have only increased since then. So, [the debate] is mostly about scale."

While negotiations on the broader infrastructure bill have been hot and cold for months, Yoo, who has served on the FCC's Broadband Deployment Advisory Committee, is optimistic that a bill addressing broadband will eventually get passed, citing how the pandemic has moved along the debate. The timeliness has been profoundly felt in education and with the longstanding "homework gap," a term that describes homework assignments that require broadband and are given to students who don't have access—often, realistically, forcing those students into libraries or public parking lots.

"Broadband has created what has long been known as the 'homework gap,' and with the pandemic and the shift to virtual education, the gap became a chasm," says Yoo. "The ability to access broadband became an outright barrier, and not just a matter of lower quality."

The problem of access, of course, extends beyond work and education to entertainment and social life, as has been demonstrated during the pandemic. Video streaming subscriptions increased by 32% in 2020, according to the Motion Picture Association. And social distancing has led to the so-called "Zoom boom," in which the videoconferencing platform became popular among non-business users.

"There was an era where you had to convince policymakers that broadband was an important

political issue that needs addressed, and I don't think you need to address that anymore," Yoo adds. "It's pretty self-evident."

What's less self-evident, however, is how to solve the issue—or even map out where it rears its head most.

Mapping and maximizing broadband investment

Looking at internet access more broadly, an overwhelming majority of Americans do report using the internet. A Pew Research Center survey conducted in January and February found that only [7% of those surveyed do not use the internet](#), spread among those 65 and older and people with a lower household income or lower educational attainment. Where home broadband is lacking, mobile connections are often stand-ins. The Center further found that [85% of Americans now own a smartphone](#).

Aviv Nevo, a PIK professor with appointments in the School of Arts & Sciences' economics department and the marketing department in the Wharton School, has been accumulating high-frequency residential broadband data from internet service providers. His team pores through the data to assess the value of broadband.

"We can estimate using these data how much people value having broadband, and one thing we found was that consumers put a fair bit of weight on having fast, and most importantly reliable and consistent, internet service. Indeed, there's what economists would call 'large social returns' to investment in internet," Nevo explains. "Those returns are actually larger than the private returns a company would get on its investment."

That imbalance reinforces, he says, part of the problem: that ISPs are providing a service more socially beneficial than it is to the companies' bottom line. What that means, practically speaking, is that ISPs on their own are unlikely to invest in the expansion of fiber wiring in places where population density is low and it is unlikely the ISP will receive enough of a return on infrastructure investment—especially after accounting for the cost of operations.

In short: ISPs lack incentive to invest sufficiently in broadband infrastructure.

"The problem in rural America is that consumers there value fast and reliable internet, but it's costly to get it there," Nevo says. "Getting fast internet to urban consumers is less costly, especially if you're taking a long-term view."

One solution, he proposes, is to target the laying of fiber to new construction and municipal projects already happening, to reduce costs.

But ultimately, he adds, the government might need to step in where supply is not meeting demand and internet access is inequitable. He describes it as akin to building roads.

"In some sense, that's exactly what you can think of with broadband," Nevo says. "It's the modern version of the interstate system built in the '50s—the way to facilitate commerce. The modern economy needs highways to connect just like the old economy."

But finding where, exactly, to do the digging and laying is still an obstacle. Data from the FCC is submitted by ISPs, which notoriously underestimate the scope of the problem—potentially, for example, reporting highest speeds in a region rather than the average. It also doesn't paint a full picture of who lacks broadband service altogether.

The FCC recently launched [an app that allows people to upload their broadband speeds](#), designed to help with the mapping effort. Yoo notes that the effort is flawed but "any data is better than no data."

"We need more information in about what people are getting for download speeds, but if we're talking about coverage and where people are not getting service, by definition you can't do that with data generated by an app accessible only to people already getting service," Yoo says. "And, in fact, most of the information on availability is done by subscribership, but subscribers, but whether someone subscribes depends on not just whether the service is available but the cost, ownership of an appropriate device, the digital literacy to engage

with it, and whether they perceive they need it."

Municipal and mesh

Some communities have taken matters into their own hands.

Jessa Lingel, an associate professor of communication in the Annenberg School for Communication, and core faculty in Gender, Sexuality, and Women's Studies, who studies digital culture, is part of Philly Community Wireless (PCW), a local activist group focused on developing what are known as "mesh" networks for communities with internet service that is unreliable or too expensive.

The concept recently made headlines when Amazon announced it would turn on mesh networking—ostensibly to connect smart home devices—through existing Ring and Echo products, but that's hardly the first use of the technology. A mesh network is, at its core, a DIY network in which a single internet connection is set up that is tethered to "nodes" that communicate with one another to deliver a boosted sphere of low bandwidth, but functional, internet. Locally, these nodes are installed on rooftops, and PCW is also installing nodes in public parks and on commercial properties. They partner with a single ISP for service support.

"Mesh is an opportunity for activist groups and groups historically left out of internet access to be able to get online and have more control over online networks," Lingel explains. They also, she adds, give users more control over price and privacy and empower people to learn more about how the internet actually works—a form of digital literacy.

Broadband expansion, she says, is a focus on how people get online more than it is whether they can get there, citing the penetration rates through smartphone access. Those still in need are often communities who need to connect through their laptop for work or school. Locally, Comcast has attempted to address this problem during the pandemic with the Internet Essentials Program, offering free or discounted connections for those

who qualify. And, more broadly, Microsoft has invested in what it's dubbed an "Airband" solution that uses the unlicensed TV wireless spectrum—aka, TV channels no longer in use—to deliver WiFi to [rural areas](#) and, recently, eight cities as well.

But these are all piecemeal solutions, and the mesh network approach, Lingel emphasizes, is one for basic needs, but not ideal for anyone who needs to stream. It points to the larger problem.

"It is ridiculous that in a country as wealthy as we are, that is the birthplace of so many technology companies and products, that we don't have higher rates of [broadband access](#) and that people pay as much as they do," Lingel says. "And really, the solution would be to go back to a moment when internet access was less privatized."

One suggestion, she says, is to take advantage of "dark fiber." This refers to optic fiber cables laid in excess during the dot-com boom of the 1990s and early 2000s. These are fibers that have simply gone unlit. Lingel says municipalities could use eminent domain to offer community-led broadband services. Because these wires were mostly laid in areas that already have broadband access, this would target access by way of reducing costs.

However, Yoo notes that private ISPs still might make the most sense for broadband. He says that internet technology has proven to be more entrepreneurial than some other forms of infrastructure, like electricity. In the past, he says, the U.S. Postal Service, during World War I, took over the telephone system for one year, but uncertainty around changing phone technology risked making the Postal Service behave like it was investing in risk capital.

"When you have a private venture, you get shareholders and if it's risky and turns out great, they do very well," he says. "If it turns out badly, they say 'Sorry,' and the investor eats their losses. Government tax money doesn't function that way; it's not set up for thinking about entrepreneurial investments."

Technology and the new digital divide

New technology is on the horizon—if it's not already here. 5G speeds can rival that of WiFi and, at least, improve the quality of existing access to the internet as the network expands and 5G-enabled phones become standard.

In the broadband space, SpaceX's Starlink satellites have the potential to provide low-cost internet in spaces difficult to reach through wiring. Past iterations of satellite internet have faced obstacles of low latency, but these have also been higher-orbit satellites as opposed to Starlink satellites that are lower orbit and have quicker response times. This could, potentially, allow for a sort of patchwork version of universal broadband in which a mountainous region might rely on satellite broadband, while urban and suburban areas use optical fibers.

But, Yoo says, that's a rosy scenario and there are still hurdles to jump.

"I think when veteran observers hear about a new satellite broadband system, they feel like they've seen this movie before," he says, citing a previous venture by Google and others that fell short of its goal. "And that's born from past failures rather than anything about the current attempt."

Any approach to broadband, he ultimately thinks, will need to acknowledge the evolutionary nature of broadband technology.

"I hope that any infrastructure package is technology-neutral," Yoo says. "Some past approaches have fallen in love with one particular technology. The reality is that there are times when wireless makes more sense than fixed line, and satellite makes more sense than either of those. Favoring particular technologies has limited flexibility."

"I think in a geographically diverse world, there's no one technology that will solve all problems."

Already, people who need internet have turned to the alternative internet source that lives in their pockets. Julia Ticona, an assistant professor of communication at the Annenberg School for Communication, studies digital work and is finishing

a book that compares low- and high-wage earners that conduct what she describes as "precarious, contingent work," using digital technology in similar ways to find and maintain work. Among low-wage workers, she describes scenarios of people not qualifying for programs that would give them assistance to pay for internet, a constant shopping around for better deals, and instances of running out of data or being connected for inconsistent periods of time.

"In terms of social inequality and home broadband, it's not that we have 'haves and have-nots,' necessarily," Ticona says. "We're not looking anymore at people on one side of a digital divide who've never had internet access—though that does exist and is just a smaller portion of the population. More often, it's people who have unstable access, people who pay way too much for [internet access](#) or have bad options for how to get it."

The reality is that people with unstable connections are Latinx, Black, and other racial minority groups. Those populations are also more likely to have jobs that make them more mobile and transient; given the choice, they're likely to maintain a phone plan. But not because they don't also need home broadband.

"It's exciting that the Biden Administration is paying attention to these issues, but the concern is, especially with politics and doing it quickly, that it will just be this massive investment in a system that hasn't really worked the way it is and has reinforced a lot of inequality that existed before," Ticona says. "That's the concern—that there will be all this investment and money going into a much-needed area and will make it better for some people and a lot worse for others. And that's why it's important to think these things through."

Broadband expansion: What's next

Any new broadband expansion proposal will need to carefully balance resources spent looking to the future versus learning from the past. Yoo points out that broadband expansion was previously funded in the 2009 stimulus bill, supported with \$7.2 billion in grants and loans. But because it was meant to be a fast-acting injection of stimulus into the economy,

he says the money was spent before enough analysis was done to determine where it was needed.

"Needless to say, that was backwards," Yoo says. "Moreover, there was not a lot of funding to hold the companies that received the money accountable [and ask] "Did they deliver service? Did they do it cost-effectively? In a timely manner?"

New funding, he says, should learn from these mistakes. Yoo notes, however, that the FCC has recently reexamined how it reports broadband data, relying less on providers for this information. University-based researchers have also been collecting data, he says, though it's not always representative of the whole population, as it tends to engage with people who are more tech-savvy than is the average.

"I think we're all better off with better data," he adds.

And yet, technology will keep evolving regardless of broadband progress. To use just education as an example, Ryan Baker, an associate professor of education and computer science in the Graduate School of Education, says that adaptive learning platforms, which enable students to complete homework online and receive instant feedback, are becoming increasingly adopted. While some can be used with low bandwidth, others incorporate video or other rich interactive elements that require a higher-quality connection.

"That means that you have a certain proportion of students who can't access the same things their classmates can, and a certain proportion of teachers who can't assign what they want to because of bandwidth limitations," Baker says. "There are equity issues around that."

He also adds that snow days will likely become a thing of the past, as the pandemic has served as a sort of proof of concept for remote learning. Virtual learning during these days will be expected.

How the FCC prioritizes broadband moving forward is still an unknown. At present, the five-person commission consists of two Democrats and two

Republicans, with one open seat that will require an appointment by President Joe Biden. Jessica Rosenworcel is the current acting FCC chair, hamstringing any work that would mean bold new changes. But, Yoo explains, there is longstanding bipartisan support for reform, spanning back to the Clinton Administration.

"This has been a 20-year effort to improve how we do things," he says. "And I think that is likely to continue."

Provided by University of Pennsylvania

APA citation: The multilayered challenges of broadband expansion (2021, June 21) retrieved 26 October 2021 from <https://techxplore.com/news/2021-06-multilayered-broadband-expansion.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.