BROADBAND

FOR AMERICA'S FUTURE: **A VISION FOR THE 2020s**

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Published by the BENTON INSTITUTE
for BROADBAND & SOCIETY

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A Benton Institute for Broadband & Society publication
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Please include the following attribution when citing this report:
Sallet, Jonathan. October 2019. Broadband for America's Future: A Vision for the 2020s. Evanston, IL: Benton Institute for Broadband & Society.
https://www.benton.org/publications/broadband-policy2020s

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Foreword

Broadband has quickly emerged as the most transformative technology of our generation—delivering opportunities and strengthening communities. As broadband's capability to change lives and society has grown, so too has it become the driving mission of the Benton Institute for Broadband & Society. To further expand opportunity, we offer this new vision and agenda for action.

The purpose of *Broadband for America's Future: A Vision for the 2020s* is to collect, combine, and contribute to a national broadband agenda for the next decade. Our work is built on the lessons of communities, public-interest advocates, government officials, and industry experts who have labored to expand broadband's reach to everyone in the United States. They deserve credit for their investments and innovations, and we have attempted to reflect their accomplishments and ideas while contributing Benton's own insights—insights built on a body of work stretching back to the 1980s.

Connecting our entire nation through High-Performance Broadband will bring remarkable economic, social, cultural, and personal benefits. In the Digital Age, open, affordable, robust broadband is the key to all of us reaching for—and achieving—the American Dream.

Since the mid-1990s, the U.S. has struggled with a persistent dilemma called the digital divide—the unfortunate reality that for too many people, meaningful connectivity is out of reach. As we enter a new decade, America encounters three interlocking challenges:

Closing the Geographic Divide. In both urban and rural areas, millions of people in America are waiting for the deployment of robust broadband networks. Broadband is advancing in some places, which is good, but the fact is that we don't have an accurate count of how many people are on the wrong side of the digital divide and where they live. What we know is that places without robust broadband are falling further and further behind. *We cannot let where we live determine our potential to connect.*

Harnessing Competition. Even in areas that are served by broadband networks, consumers lack choice of providers. Without competition, consumers are threatened with artificially high prices, lower-quality service, and little innovation. *We cannot let lack of choice harm consumers.*

Boosting Affordability and Adoption. For too many people, the cost of broadband is too high and the digital skills needed to use broadband effectively are absent. The result is people disconnected from continuing their education, gaining new job skills, and finding employment. *We cannot let lack of access or affordability deprive people of opportunity.*

Confronting these divides requires bold leadership and informed solutions. Community leadership is key since local governments and anchor institutions are closest to local needs and have earned Americans' confidence and trust. With the right choices, these are the people and institutions who can link broadband to broader economic and social outcomes and make the greatest impact on their communities.

Over the past year we've talked with leading experts and community leaders. Now we begin a new yearlong effort to enlist the voices of broadband leaders in an ongoing discussion on how public policy can close the digital divide and extend digital opportunity everywhere.

Please join us in this conversation.

Adrianne B. Furniss, *Executive Director*
Benton Institute for Broadband & Society

Introduction: **Broadband Is the New Railroad**

Abraham Lincoln was a railroad man. He ran for president pledging to build the first transcontinental railroad, linking East Coast to West Coast. Once in office, he put the weight of his presidency behind the passage of the Pacific Railway Act of 1862, which supported construction of that transcontinental railroad with government loans and grants of land.[1] Transcontinental service began in 1869 and, in succeeding decades, reworked the American economy. Railroads were reliable and fast, lowering the cost of shipping, which boosted manufacturing. In 1870, a railroad journey between New York and Chicago could take over 38 hours; by 1900, its elapsed time had been cut by more than one-third and the speed of those trains had jumped by 60 percent.[2] As with any new technology, not all of the outcomes sparked by the railroads were beneficial, but railroad transportation delivered cheaper goods and greater choices to consumers.

The federal role was elemental, but the path of the transcontinental railroad was also shaped by local decisions. In Lincoln's home state, Chicago wanted the railroad. Its leaders spent money and enlisted political support to ensure that the meeting place of lines to the east and lines to the west sat within its city limits. That could have been the fate of St. Louis, Missouri, but for the decision of local leaders to protect incumbent barge operators by refusing to build a railroad bridge across the Missouri River.[3] The impact for Chicago was profound: "The growth of railroads and their influence on the standard of living is synonymous with Chicago's emergence as the world's fastest-growing city between 1870 and 1930."[4]

The story of the railroads tells the story of the interdependent relationship between federal and state/local authorities in the intertwined deployment of networks and infrastructure and the creation of strategies for economic growth. It is for the federal government to make macroeconomic policy and to boost the creation and deployment of networks and communications. But, just as fundamentally, it is for state/local authorities to shape the economic strategies of those places where networks have been, or are yet to be, deployed and used.

The United States is not a single homogeneous economy. Regional, state, and local decisions, as in Chicago in the 19th century, can spur growth and economic opportunity by understanding, enlisting, and leading the constellation of talents and resources that provide the basis for local success. Consider the strategies that have boosted the growth of life sciences in the Research Triangle of North Carolina; clean-energy technology in the intersection of Pittsburgh, Akron, and Cleveland; medical devices in Minneapolis.[5] Or newer efforts that, with federal support, aid in the development of new wood-building materials in Oregon, and the creation of rural business ventures in southwest Colorado.[6]

Such state/local strategies can be thought of as harnessing "geographic concentrations of companies, suppliers, support services, financiers, specialized infrastructure, producers of related products, and specialized institutions (such as training programs) whose competitive strengths are improved through the existence of shared advantages."[7] State/local leaders can play an important role in encouraging and creating competitive strengths, for example through specialization in the curriculum of community colleges. And, across the country, these efforts add up: "Government policy at the state and local level has an important role to play in shaping national advantage."[8]

So too with advanced broadband. The federal government, of course, plays critical roles. In the last century, federal support for research and high-performance computing set the stage for broadband. Federal

management of spectrum supplies an essential element of wireless communication. The federal government has opened local markets to competition and aided wireline competition by actions as simple as guaranteeing the ability of consumers to keep their phone numbers while switching carriers.

Federal action has sped the availability and use of broadband. The Federal Communications Commission, the Department of Commerce's National Telecommunications and Information Administration, and the Department of Agriculture have worked to bring internet access to rural America and empower schools, libraries, and rural health-care facilities. The Lifeline program, originally created during the Reagan Administration to ensure that low-income people had voice telephone service, was expanded to include broadband.

There are more actions the government can take. Federal economic support for local investment, like the Community Reinvestment Act or the Appalachian Regional Commission, can boost local efforts. Federal action can knock down barriers to competition. And the federal government is in a very good position to collect information on the deployment of broadband—data needed for effective decision-making at all levels of government.

State and local leaders on the ground can knit these initiatives together with the needs of communities in order to integrate High-Performance Broadband deployment and use into regional and local economic strategies. Across the country, leaders have recognized the economic struggles now faced by so many Americans. From the challenges of adapting to the rapidly changing 21st century labor market to the increasing financial burdens resulting from education, health care, and other essentials, the range of problems cannot be addressed with any one solution.

Not every initiative will work everywhere, and, like all experiments, some may fail. But there is strength in these laboratories of the states, cities, and counties and within communities. And state/local leaders are working to improve economic opportunity by improving broadband deployment and usage.

Throughout the next four chapters, the story of state and local leadership is told through the promising and diverse strategies that are gaining steam across the country:

Deployment. In South Dakota at the beginning of 2019, Governor Kristi Noem, a Republican, emphasized the importance of rural broadband, explaining that "[g]eograhic location no longer has to be a barrier to participating in the global economy."[9] At least twenty states—including Colorado, Virginia, and Wisconsin—have statewide broadband strategies with dedicated funding to promote deployment.[10] Forty-four states have broadband offices, task forces, or legislative committees responsible for facilitating broadband deployment. State educational and research networks like those in California, North Carolina, and Michigan have vastly expanded educational opportunities.[11] Twenty-four states provide special matching grants to support the deployment of broadband to their schools.[12] Michigan, for example, is pushing the envelope with its goal of achieving symmetrical 1 Gbps speeds for all residents by 2026.[13]

Competition. Local communities—like Ammon, Idaho; Fort Collins, Colorado; Champaign and Urbana, Illinois; and Westminster, Maryland—have collaborated with private broadband providers to increase the choices available to their residents. Well-known strategies in cities such as Chattanooga, Tennessee, and Wilson, North Carolina, employ municipally-owned facilities to provide state-of-the art

broadband. San Francisco is experimenting with ways to bring broadband to public housing. States like Alabama, Georgia, Mississippi, and North Carolina enacted laws in 2019 opening opportunities for rural electric cooperatives to provide broadband service. As Robert Wack, former Common Council president in Westminster, explained in 2016: "In a world that is increasingly dependent on data every day, if you don't have good broadband, you're going to be left behind."[14]

Affordability and Adoption. Governments—with nonprofits, private broadband providers, and community support—are working to ensure that broadband is not just deployed but used. That's a multifaceted effort that depends on trust, affordability, and resources. Cities like Austin, Texas; Kansas City, Missouri; Charlotte, North Carolina; Louisville, Kentucky; and Seattle, Washington have created digital inclusion plans that, as in Louisville's case, teach coding skills, basic use of a computer, and how to use online courses. Efforts like Boston's Tech Goes Home have proved successful in teaching adult learners. Anne Schwieger, Boston's broadband and digital equity advocate, explains: "Broadband is best understood as an ecology that allows places and people to adapt, evolve, and create."

Community Anchor Institutions. Schools, libraries, and hospitals have been a traditional focus of attention. The Apache County School Consortium in Arizona collaborated with a broadband provider owned by the Navajo Tribal Utility Authority to deploy fiber and deliver broadband connectivity to seventeen schools. Urban and rural libraries alike lend Wi-Fi hotspots, which have been particularly important for African-American and Hispanic communities. Anchor institutions—including a county corrections facility in Kent County, Maryland—can be launching pads for the delivery of broadband by private providers to unserved neighborhoods. That's important in places like New Mexico where, says one local official, "Nighttime parking-lot Wi-Fi is an infrastructure" by which local residents access broadband.

Leadership does not, of course, come only from government, but from community-focused organizations as well. For example, the Blandin Foundation focuses on strengthening rural Minnesota, including by supporting and measuring the impact of broadband in rural communities—measurements that found concrete economic benefits such as income growth resulting from broadband deployment.[15] The Cleveland Foundation's Digital Excellence Initiative works to ensure that all residents of the greater Cleveland area can successfully participate in the digital world and economy,[16] including by bringing PCs for People[17] to Cleveland and deploying unlimited-data hotspots in all Cleveland public library locations.[18] About 500,000 people live along the Texas-Mexico border in "colonias," residential areas with high poverty rates, largely Hispanic or Latino, that "may lack some of the most basic living necessities such as potable water, septic or sewer systems, electricity, paved roads or safe and sanitary housing."[19] Local groups, including nonprofits and educational institutions,[20] are working together to improve critical infrastructure that includes broadband because, as Jordana Barton has explained, "internet connectivity can make a dramatic difference—particularly in residents' ability to learn about, invest in and shop for career opportunities, education, housing and financial products."[21]

Why should America commit to the deployment of High-Performance Broadband? Not for technology's sake. America faces challenges that High-Performance Broadband can help solve.

- American workers are suffering from growing income inequality—on September 26, 2019, the Census Bureau released figures showing that income inequality had reached its highest level in over fifty years of measurement.[22] The result is an economy in which workers have less ability to get ahead than did their similarly situated predecessors in the three to four decades that followed World War II.

Broadband can provide the digital skills that boost individual opportunity and the connectivity that growing businesses need. The importance of broadband for economic progress is a view we have heard directly from elected officials and one that is reflected in state and local strategies embraced across the country.

- Communities and their local democratic institutions—the mechanisms through which Americans further the public interest day by day—are strengthened by broadband. Indeed, the rise in income inequality is a threat to the trust necessary to a democracy. In mid-2019, most Americans recognized that "a shortage of trust in government and in other citizens makes it harder to solve some of the nation's key problems."[23] Like any tool, broadband can be used for good or for bad—this report concentrates on the good: the ability of broadband connections to be used to build stronger communities by bringing people and community-based institutions closer together.

The challenge is, at the end of the day, not just one of technology. Says Mayor Andy Berke of Chattanooga, "We know how to do this—we know how to build out broadband and scale it out to a community—what we lack is the political will at the state and federal level to do it at a broader scale."[24]

It comes back to leaders who can harness political will.

Consider Emporia, Kansas, which was known as a leading railroad hub in the 19th century. Local leaders have launched a business-incubator initiative that includes use of its own fiber network (built with local investment).[25] As the executive director of the local nonprofit, Emporia Main Street, explained: "Broadband is the new railroad."[26]

Chapter 1: **High-Performance Broadband Is a National Priority**

Broadband is a general-purpose technology—a tool, similar to electricity, that enables all sorts of productive activities, transforming "both household life and the ways in which firms conduct business."[27] The full value of broadband lies not just in the number of jobs it directly creates or the profits it delivers to broadband providers but also in its importance as a mechanism that others use across the economy and society.[28]

The communications revolutions of the past five hundred years have all shared this common characteristic: New technologies—from the printing press to the telephone—sparked broader social and economic change. As Tom Wheeler explains in his book *From Gutenberg to Google: The History of Our Future*,[29] it is not technology itself that transforms society. The greater impact comes from the secondary impact of using the technology: from the ability of ordinary people to read a printed Bible, to the collapse of intercontinental distances delivered by the telegraph, to the use of the telephone to reach people located anywhere, to the tweets, texts, visuals, and video of the Internet Age.

No longer a 'nice-to-have,' broadband is a necessity.

To put it in economic terms, broadband connections create positive externalities—like the bees that, in the process of collecting pollen to make honey, pollinate crops for farmers. So, too, here. Expanding the number of broadband users is valuable to all other users of the "network"—that's Metcalfe's Law—because the value of the network to each user grows by the square of the number of people connected.[30] When people in rural America are connected, everyone who uses the interconnected network of networks benefits, from Western rancher to urban hipster.

When governments consider whether to expend resources to expand broadband deployment and usage, they should ask how much their community or state or nation will gain as businesses grow, workers can get better jobs, a healthier, better-educated community grows stronger, and consumers benefit.

Think of governmental policy as anticipating the social return on broadband investment. Not just the price of bits that flow across wires or airspace but the full panoply of social and economic benefits that better broadband will engender in the next decade. Governmental action is urgently needed because the social returns are urgently needed.

Ask it this way: Why, in a world of competing problems—from climate change to economic growth to health-care costs to the delivery of services to aging populations—is broadband a pressing need for governments to confront? The short answer is: "All of the above." In other words, broadband is part of the solution for all of those challenges, and more.

To that end, let us first describe what High-Performance Broadband is and then focus on three overarching benefits that it can deliver in the next decade:

- **Growing the American Economy**, transforming industries that are basic to everyday life, from farming to education to health care to energy and more.

- **Strengthening Communities** by boosting economic growth and jobs and improving education, learning, health care, and civic participation.
- **Empowering Workers** by advancing skills training in a time of increasing income inequality and economic frustration.

As broadband becomes a part of virtually every economic and social activity, its importance only grows—and will continue to grow. David Luna, a member of the City Council of Mesa, Arizona, has written: "Broadband infrastructure is no longer a 'nice-to-have' amenity for American cities—it is a necessity."[31] This is a view echoed by leaders at the federal, state, and local levels.

I. The Goal: High-Performance Broadband for All

Everyone in America should be able to use High-Performance Broadband in the next decade.

High-Performance Broadband means that fixed broadband networks are fit for the future; they provide fast, symmetrical upload and download speeds, low latency (moving data without noticeable delay), ample monthly usage capacity, and security from cyberattacks. Networks that, once installed, can be easily upgraded as the demand for greater broadband performance continues to increase. That's a moving target that is best captured by a broad recognition of performance characteristics whenever public policy is made.

Identifying High-Performance Broadband is important because all things labeled "broadband" are not high-performance. Think of legacy DSL service from incumbent telephone companies that offer a mere 4/1 Mbps service[32] or the woefully out-of-date Federal Communications Commission (FCC) definition, which considers broadband to include speeds (25/3 Mbps) that are too low for the needs of today and tomorrow and fails to consider other critical performance attributes of a broadband connection, such as latency and how much data is practically available for a subscriber to use each month. (An accompanying sidebar in Chapter 3 discusses the various technologies in more detail.)

The next ten years will increasingly require High-Performance Broadband.

The next ten years will increasingly require that broadband be high-performance. The applications of the 2020s will increasingly demand broadband connections that are able to serve multiple data-devouring devices whose apps are gobbling gigabytes of data. People will need bigger and better broadband connections to fully participate in the next decade of the Internet Age.

That is why High-Performance Broadband should be an option that is widely available and affordable. Of course, not everyone will choose to be connected, and a competitive market will provide choices for subscribers who prefer to pay lower monthly subscription rates for lower speeds. But public resources should focus on the deployment and use of High-Performance Broadband networks that will last for a long time, are easily upgradable, and offer service to meet the likely demands of the 2020s. A fast network can deliver speeds from low to high; a slow or obsolete network cannot provide the same range of service or be easily improved.

High-Performance Broadband is the benchmark against which public policy in the next decade should be measured. America will be best served by competitive broadband connections that are "future proof" against the kind of usage patterns—including thirst for great speeds—likely to occur by 2030. Fiber-based

networks[33] are long-lasting and relatively cheap to upgrade, which supports the view that fiber will remain cost-effective and scalable through the next decade.[34] As other forms of broadband networks evolve to match the performance criteria of today's fiber-based systems, they will also be High-Performance Broadband. Even networks that are not fiber-based can provide important competitive choices.

II. Growing the American Economy

High-Performance Broadband will help grow the American economy in the next decade. After all, the combined innovations and changes that ride over broadband connections have already been responsible for a significant portion of American economic progress in this century. The U.S. digital economy has grown at an average rate of 9.9 percent over the past two decades, more than four times that of the total economy (2.3 percent).[35] Information-based industries—such as financial markets, insurance, and accounting—have significantly gained from broadband,[36] and there is widespread consensus that broadband technologies have enabled businesses across nearly all sectors to improve their productivity[37] (although, importantly, those gains have not been as evenly distributed among workers as in the past).

The full economic benefit of broadband is likely to be even larger than its impact on GDP,[38] given its potential to transform how companies operate and how business is conducted.[39] Since 1998, investment in internet-connected computers, communications equipment, and software in the digital sector has more than doubled (from $173 billion to $352 billion), but it has risen only 19 percent in the physical sector over the same period.[40] By one economic analysis, extending digital technologies into physical sectors could boost economic growth by 11 percent over the next decade or more, adding $2.7 trillion to annual U.S. economic output in 2031, and increasing wages and salary payments to workers by $8 trillion.[41]

Full adoption of a new technology (and especially an improving technology like broadband) takes time.[42] For example, it took nearly twenty years for the benefits of electrification to increase U.S. productivity noticeably.[43] Similarly, researchers in the late 1990s and early 2000s suggested that labor-productivity gains appearing in the 1990s were the result of the gradual application of computers in IT-using industries over a twenty-year period.[44] Similar impacts may appear from the deployment of High-Performance Broadband in the coming decade. As Roberto Gallardo explains, "nobody knew what electricity would bring or enable."[45]

The nature of internet usage is moving from place to person.

Importantly, the nature of internet usage is moving from place to person, which puts greater emphasis on residential connections as a mechanism of overall economic growth. Education provides a familiar example. In 1994, about the time the internet was commercialized, the federal government was focusing on the importance of connecting classrooms—but not on reaching K-12 students when they were away from their school buildings.[46] Today, it's common to see middle school students carrying school-supplied tablets that provide access to their homework and instructional materials.

Today and into the 2020s, students' ability to learn will depend not just on the bandwidth that reaches their schools but also on how well they can connect to their schoolwork when they are outside their school buildings. Personal connectivity will change how students learn, increasingly emphasizing user creation of

content (and code).[47] In places with ubiquitous High-Performance Broadband, students will be able to learn at school and at home, accessing multimedia-rich educational resources when it works best for them.

Expansion and improvement of High-Performance Broadband will deliver benefits across the economic landscape. Much of that growth will be fueled by the maturation of the internet of things (if networks and devices robustly protect privacy and security). Such advanced communications devices—think every appliance in your house that could be labeled as "smart"—are projected to grow at a rate of about 25 percent annually through the middle of the next decade.[48]

Specific applications of broadband-enabled communications will boost growth in key industrial and service sectors.

Agriculture

Benton Faculty Fellow Christopher Ali's extensive research in rural America emphasizes the plight of "farmers … for whom broadband to the farm would mean a new era of American agriculture" but to whom it is not yet available.[49] The United States Department of Agriculture (USDA) reports that 25 percent of U.S. farms have no access to the internet at all.[50]

The future of agriculture is now rooted in broadband. The advantages of connectivity can be as simple as bringing internet access to a local poultry farm that needs to monitor its chicken houses or as technologically daunting as precision agriculture's ability to collect and analyze data about variation in nutrient and moisture levels in individual fields.[51]

With access to High-Performance Broadband, farmers can take advantage of a new generation of precision-farming technologies that experts project will help boost global crop yields as much as 67 percent. With global populations rising, by 2050 farmers will need to produce 50 percent to 70 percent more food than today using the same amount of land—or less.[52] Farming devices and machinery are rapidly incorporating broadband-enabled practices. For example, every large John Deere agricultural machine now comes equipped with a touch-screen display, a GPS-based auto-steering system, a 4G LTE modem, and a Wi-Fi hotspot.[53]

When broadband-enabled precision technologies are pervasively deployed, they are predicted to cut water use by up to 30 percent,[54] reduce herbicide use by 99.99 percent,[55] reduce fuel use by 10 percent, boost yields by 70 percent, and cut food prices in half.[56]

These improvements add up. In the spring of 2019, the USDA analyzed broadband-reliant precision-agriculture methods[57] and concluded that widespread deployment "could create approximately $47–$65 billion annually in additional gross benefit for the U.S. economy."[58]

Climate Change

Research shows that the concentration of carbon dioxide (CO_2) in Earth's atmosphere has reached its highest level in 800,000 years—and is continuing to rise.[59] Many leaders are looking for solutions that can cut greenhouse gas emissions while simultaneously growing the economy.

Broadband is part of that solution. When deployed pervasively, broadband-enabled technologies have the potential to make the smart grid even smarter, renewable power more prevalent, everyday devices more efficient, and energy more affordable. Ubiquitous access to High-Performance Broadband can help us reduce overall net electricity demand by more than 25 percent,[60] cut greenhouse gas emissions by 19 percent,[61] save billions on our energy bills, help make us more energy independent, and enable a smarter electric grid that is more efficient, reliable, and resilient.

For many Americans, having fixed broadband at home gives them access to connected tools (such as broadband-enabled thermostats) that can cut energy bills by as much as 20 percent. Today we waste 20 percent of home energy by leaving lights on in empty rooms and running air-conditioning in empty houses.[62] This wasted energy costs consumers around $40 billion a year they don't need to spend while contributing to climate change. When broadband-enabled devices are widely deployed in homes to control temperature, lighting, and appliances, they could collectively help reduce total residential energy consumption by as much as 10 percent,[63] while cutting greenhouse gas emissions by as much as 19 percent.[64] Of course, broadband-enabled devices cannot be enabled in homes that lack broadband service.

Health Care

High-Performance Broadband can help solve some of health care's most enduring problems and intractable challenges: delivering massive cost-saving opportunities to slow runaway health-care cost growth,[65] enabling patients to harness a new generation of connected-care devices that help patients live longer and more productive lives, and extending connected care everywhere, closing the rural health-care gap.

Rural Americans face limited access to health-care facilities,[66] "suffer from higher rates of obesity, mental health issues, diabetes, cancer, and opioid addiction"[67]—and disproportionately lack access to broadband. But with broadband connectivity, patients with virtually any condition can now be seen by a remote specialist without having to drive anywhere at all. So it's not surprising that 52 percent of hospitals now use at least some form of telehealth, with another 10 percent just ramping up—and with more progress expected.[68]

The Economics of a Free Society

Seventy-five years ago, in October 1944, William Benton delivered a clarion call in the pages of Fortune magazine by articulating a forward-looking agenda on behalf of a coalition of business leaders ("the capitalists who cared enough about the system to save it") to deliver a more peaceful and prosperous American future in the (then-expected) wake of winning World War II.

At that moment, the American economy faced big challenges. In the previous fifteen years, the Great Depression had roiled the American economy, driving unemployment rates to almost 25 percent in 1933. Franklin Roosevelt's New Deal had restarted economic growth, but it was World War II that powered a robust recovery. It was a time for first principles and pragmatic solutions—a call for corporations to recognize that they depended on society just as consumers depended on them.

William Benton recognized that American progress rested on **the connection between economic opportunity and democracy.** "[A] free market open to the development of new, independent enterprises will continue to provide an economic basis for political freedom." Such competitive businesses "provide an element of balance that counteracts potential dangers to our democratic institutions." In other words, Benton explained, distortions of the free-enterprise system don't just harm competition; they "can pull the democratic government down on top of them."

Among the Committee for Economic Development's first principles were:

- **Enabling Innovation and Experimentation:** "Essential to a system of free enterprise is a climate in which new, small and independent businesses can be conceived and born, can grow and prosper";
- **Fostering Competition:** "Lack of competition stifles the free market." Thus, businesses do "not [have] the right to monopolize (which impedes or prevents the establishment of new businesses, creates scarcity, and imperils the spirit of enterprise)"; and

- **Boosting Jobs and Economic Opportunity:** America "can provide the maximum economic opportunity for the largest number of individuals of the community" with "the maintenance of high levels of production and employment in the U.S."

William Benton was about more than ideas; he put his money where his mouth was. He created the Benton Foundation to address tough and seemingly unsolvable problems in the field of communications—with a focus on the projects that would have the greatest impact on democracy. It is in this tradition that the newly named Benton Institute for Broadband & Society offers this vision to bring open and affordable High-Performance Broadband to all people in the United States to ensure a thriving democracy and lift our free society.

Ubiquitous High-Performance Broadband will allow more doctors and medical professionals to make more house calls without leaving their offices, improving treatment—and the quality of people's lives. For example, remote medication-dispensing systems will provide better management of drugs and adherence to prescription routines.[69] Sensors and other monitoring techniques will be more usable in patients' homes, allowing the elderly to stay in their homes more and travel for medical care less.[70]

Broadband connections are critical for bending the health-care cost curve that has too many Americans spending too much. To cut costs and improve care, hospitals today don't just send patients home with a handful of prescriptions; they are often taking advantage of broadband to send patients home with an armful of broadband-enabled devices: digital scales, blood pressure monitors, oximeters, and portable EKG monitors. These new tools help doctors discharge patients earlier, care for them better, avoid costly readmissions, and improve care. And by tackling one of the most challenging cost centers in health care—the $17 billion we spend annually on preventable readmissions—broadband-enabled devices enable patients to spend more time at home with family.

A doctor's bedside manner may soon be less important than her broadband manner, as advanced connectivity to homes empowers lag-free doctor-patient consultations. A shift to videoconferencing and an increasing range of augmented-reality and virtual-reality medical applications will allow specialists to provide consultations and even perform surgeries remotely.[71] Broadband-enabled health care has been talked about for years, but its existence is likely to increase substantially in the coming decade.[72]

Social Services to Older Americans

Telehealth represents only one form of social service important to Americans. The Census Bureau predicts that in 2035, for the first time in U.S history, there will be more Americans age 65 or older than there will be children under the age of 18.[73] This demographic shift will lead, of course, to greater use of telehealth but also greater reliance on social and personal services that older Americans can access and use at home. These services can help older Americans live independently, maintain social connections,[74] and generally improve their quality of life.[75]

III. Strengthening Communities

Without broadband connections, businesses will be disadvantaged and their growth will be stunted. Consider Sublette County, Wyoming. With minimal internet access provided by its incumbent telephone company,

in 2018 the county "identified a lack of robust broadband infrastructure as a major hurdle to economic development."[76] So the county decided to deploy fiber infrastructure itself and began to look for private internet service providers (ISPs) that would lease the infrastructure and offer broadband service to local customers. As Republican State Representative Albert Sommers explained, "Broadband may not save the community, but no broadband will certainly kill it."[77]

How can a community hope to keep up if its businesses and people don't have access to broadband? Tourism-based businesses in the eastern and western counties of Maryland have told their local leaders that they need broadband if they hope to keep customers coming to their hotels, marinas, and other vacation destinations.[78] Home prices in both remote and more densely populated areas are boosted by the availability of broadband.[79]

The connection between positive economic outcomes and broadband is strong.

The connection between positive economic outcomes and broadband is strong. The World Bank's 2016 review of the research focusing on broadband's overall impact concluded that "[a]lmost every study, despite the methodology and whether it was cross-country or single country, found a positive economic impact from fixed broadband."[80] Broadband usage can play an important role in creating new forms of economic opportunity, as opposed to simply shifting it from one part of the country to another.

American communities that were among the earliest to adopt broadband between 1998 and 2002 "experienced faster growth in employment, number of businesses, and businesses in IT-intensive sectors, as well as higher market rates for rental housing, than communities where broadband was adopted later."[81] Other studies from the beginning of this decade similarly found positive relationships between broadband availability and economic growth.[82]

Current research confirms the positive relationship between broadband usage and economic outcomes found in the earlier work. At the annual conference of the National Digital Inclusion Alliance in 2019, Karen Mossberger provided a status report on forthcoming research with Caroline Tolbert and Kellen Gracey. Analysis of the nation's fifty largest metropolitan areas over time demonstrates a significant and positive relationship between broadband subscriptions and subsequent indications of prosperity, such as wages and standard of living. For these metropolitan areas, their research found no direct relationship between broadband subscriptions alone and economic growth but found a significant positive impact on economic growth where broadband adoption interacted with other factors, which, in this study, include IT employment and the presence of millennials.

Analysis of the 320 largest counties over time similarly shows a positive impact of broadband subscriptions on median income. Mossberger's analysis reflects an important aspect of broadband strategy—it is part of a larger strategy to boost economies, not an island of strategy existing unto itself. For example, a new approach to innovation in rural towns looks not only to the presence of broadband but also to the co-existence of other factors, such as proximity to an institution of higher learning.[83]

Significant research has concentrated on rural communities specifically, which have tended to have less broadband deployment because of their lower population density.[84] Whitacre, Gallardo, and Strover (2014) found that non-metro counties with low broadband adoption had fewer new businesses and lower employment growth than non-metro counties with higher adoption; those higher-adoption counties also had higher growth in median household income and were more resilient against increasing unemployment trends.[85] Faster household income growth in communities that had increased their broadband adoption was particularly striking because

noticeable effects occurred over only four years.[86] A more recent study found that in rural counties with better access to broadband services, the millennial population increased between 2010 and 2016,[87] in stark contrast to the tendency in recent years for most rural communities to lose young people.[88]

Broadband use also correlates with a greater number of businesses and employment opportunities. As Whitacre *et al.* explain:

> In non-metro counties, … counties with residential broadband adoption rates of greater than 60% will actually have more businesses and total employees. Hypothetically, as more rural individuals adopt broadband, job or business opportunities may arise due to increased access to ideas and markets. This result offers support for the argument that improving broadband adoption in rural areas can be a boon for local employment, and refutes the idea that some jobs in rural communities might be outsourced to a nearby urban center.[89]

The experience of communities confirms the research. A well-known example comes from Chattanooga, Tennessee. An independent study published by the University of Tennessee in 2015 concluded that Chattanooga's fiber-optic network and electric smart grid, which share infrastructure, could be directly tied to the creation of between 2,800 and 5,200 new jobs and economic benefits for the city of roughly $1 billion over five years.[90]

Chattanooga began offering its residents broadband service via fiber-to-the-home (FTTH) in 2009. Within a few years, the area became the home of a new Volkswagen plant.[91] The SimCenter—the Center of Excellence in Applied Computational Science and Engineering, at the University of Tennessee at Chattanooga (UTC)—opened up new possibilities for technology jobs and innovation in the region.[92] Chattanooga's downtown "Innovation District" now features the Edney Innovation Center, "a 10-story collaborative center of startups in innovative office spaces, community events, and shared accelerator spaces," and the city continues to grow and attract new residents, with many jobs requiring greater tech skills.[93]

Similarly, Lafayette's city-owned fiber network in Louisiana has "spark[ed] positive economic development throughout the region. The network has helped grow the local economy, previously dependent on oil and gas, into a diverse ecosystem that includes several new tech companies" and helped produce more than 1,300 new jobs in the area.[94] Many other communities seek similar outcomes. For example, with its "Smart City" program, Kansas City, Missouri, has prioritized the development of a vibrant technology and entrepreneurial community.[95]

Portland, Oregon, has tied its broadband strategy to economic development, particularly to attract major businesses while fostering small-business entrepreneurs.[96] On the other side of the country, as Jennifer Roberts, former mayor of Charlotte, North Carolina, has explained:

> The lack of Internet access can also stymie potential small businesses by cutting off the resources needed for research and development as well as hamstringing sales and marketing efforts that are often conducted after hours and on weekends. With customer connectivity being king in the Internet age, far too many small businesses, particularly ones owned by women and minorities, struggle to make the connections necessary for success.[97]

Entrepreneurship has traditionally been one of the primary ways to improve economic opportunities on a local level, with new businesses responsible for nearly all net job growth.[98] However, the rate at which new businesses have formed in America decreased from a high of about 480,000 per year in 2004 to about

280,000 during the 2008 financial crisis; as of 2018, this rate had not fully rebounded.[99] Job creation by startups has been trending downward,[100] which is bad news: Successful small businesses employ nearly one third of the private-sector workforce.[101]

Economic outcomes are only part of building a stronger community. Civic engagement and the improved provision of governmental services also strengthen local institutions. In 2017, Benton published a report from Next Century Cities that highlighted innovative thinking in civic technology in Austin; Louisville; and Raleigh, North Carolina.[102] As Next Century Cities explained:

> The best civic-technology initiatives facilitate unprecedented levels of public involvement in community governance, narrow the digital divide, and improve communities. As a result, governance is more democratic and more individuals can enjoy the educational and economic benefits of internet access. Empowering citizens to make informed decisions and offer direction about who governs them—and how—is essential to improving our democracy.

Adoption efforts do more than just help people to gain skills and get jobs. More broadly, such efforts "might be understood as increased civic engagement and participation in democratic processes or more collaboration between community-based organizations and other local entities, including local government."[103] For example, broadband users are more likely to vote and to be involved in civic activities in their communities.[104]

High-performance Broadband will help communities knit themselves together.

High-Performance Broadband will help communities knit themselves together—especially important given the dramatic changes in local news coverage. Broadcast groups owning multiple television stations have the ability to substitute national content for local news, and one prominent group has been charged with doing so.[105] Just under half of Americans now believe that their "local" news reports "mostly cover another area, such as a nearby city."[106] Not surprisingly, "[c]ommunity residents who see their local journalists as connected to the area give their local news media far higher ratings than those who do not."[107]

Smaller regional and local newspapers are in decline. A 2018 report from the University of North Carolina titled "The Expanding News Desert" found that the nation has suffered a net loss of almost 1,800 newspapers since 2004,[108] leaving 171 U.S. counties without a local newspaper and nearly half with only one.[109] "Our sense of community and our trust in democracy at all levels suffer when journalism is lost or diminished,"[110] explained UNC's Penelope Muse Abernathy.

Broadband is the delivery route for those who are trying to fill the local-news gap; more than 500 "digital startups" have been founded.[111] Examples include Brentwood Home Page, a self-described "hyper-local daily online newspaper" in Tennessee;[112] Connecticut's CTNewsJunkie, which offers original reporting on state issues;[113] and the Honolulu Civil Beat, nonprofit journalism that reports the news, livestreams public events and press conferences, and works with the Hawaii State Public Library System to boost news literacy.[114]

Still, the University of North Carolina study concluded that new online media sources are clustered in more-affluent communities.[115] But not all—in Detroit, the Detroit Community Technology Project (discussed in greater detail in Chapter 6) empowers neighborhoods to build their own content on its community wireless networks. An early example is the Detroit Music Box, a neighborhood "radio" station that carries stories and media from the Cass Corridor neighborhood of Detroit.[116]

IV. Empowering Workers

A. Implications of Growing Income Inequality

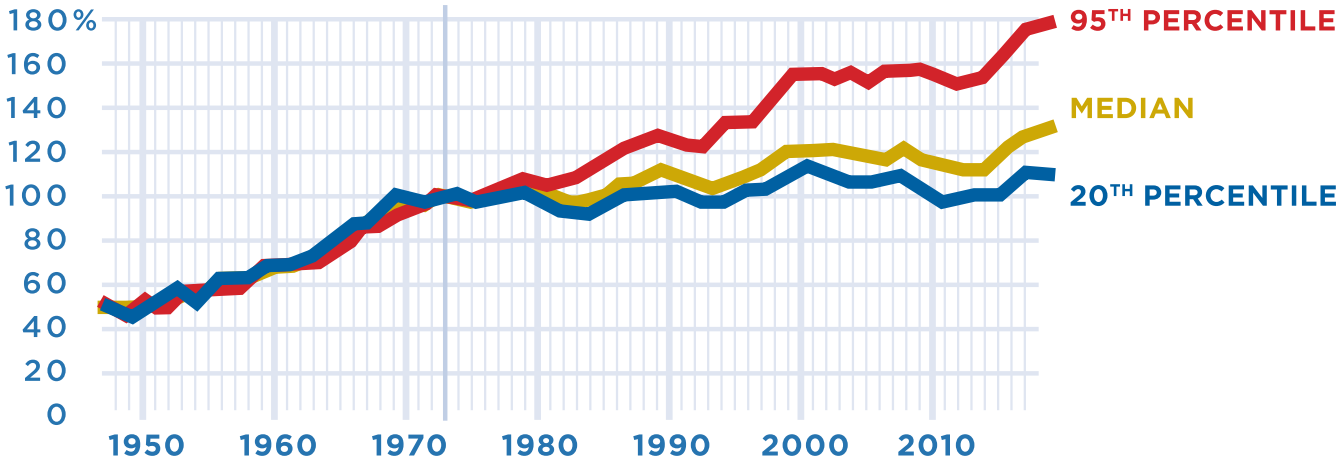
American workers face harder times than they did in the past. Communities across the nation have recognized that broadband is an important way to improve individual economic opportunity.

First, the sobering reality: Over the past forty years, American growth—and the economic opportunity that it fuels—has changed for the worse. Income inequality has taken a sharp turn upward, creating a growing rift between the economic circumstances of the top 1 percent of income earners and the 90 percent of workers who comprise the American middle and working classes.[117] Since 1980, income growth of the top 1 percent has grown faster than the economy as a whole, growth among the next 9 percent has remained just about the same as per capita GDP growth, and the bottom 90 percent have seen their income trail behind per capita GDP Growth significantly.[118]

This chart, based on the work of the Center on Budget and Policy Priorities, illustrates the story: What had been a tightly bunched grouping of income-growth lines diverged dramatically in the 1970s—and they have continued to grow further apart:

Income Gains Widely Shared in Early Postwar Decades – But Not Since Then

Real family income between **1947** and **2017**, as a percentage of **1973** level



Note: In 2014 Census split its sample of survey respondents into two groups to test a set of redesigned income questions. In 2015 (reporting on 2014 income using the new questions), Census released two estimates of 2013 incomes, one based on the old questions and one on the new. The chart uses the estimate based on the old questions, based on CBPP's judgment that, due in part to sample size, it is likely more accurate for 2013.

Source: CBPP calculations based on U.S. Census Bureau Data
Center on Budget and Policy Priorities. CBPP.org

Growth in income inequality hits some people harder than others:

Lower Intergenerational Mobility

- Adult children are less likely to outearn their parents than in past generations—a striving that has long been a hallmark of the American Dream. [119] This means less intergenerational mobility; not only is the potential to outearn lower overall, but it is specifically lower in cities in the American Rust Belt, such as Indianapolis, and cities in the southern United States, such as Atlanta, than in places like the San Francisco Bay Area and Salt Lake City.[120]

- Areas with more racial or income-based segregation and lower K-12 schooling quality suffer especially from lower social mobility.[121]

Disparate Unemployment Rates

- Since 2011, the unemployment rate in low- and moderate-income communities has remained about 5 percent to 6 percent higher than in higher-income communities.[122] African Americans with four-year college degrees or only high school degrees experienced higher unemployment rates than whites with equivalent educational credentials.[123]

- Post-recession job recovery has occurred more slowly in rural than in urban areas; rural employment has been growing at a rate of only 0.8 percent, less than half the rate of the 1.9 percent growth experienced in urban areas.[124]

Less Ability to Earn More

- The ability of workers to improve their income levels across their careers has declined.[125] A middle-class worker is now less likely to become a high-income earner than he or she was in the 1980s, an effect that holds even among college-educated workers.[126]

- Through 2017, real wages of recent college graduates had remained flat for 15 years,[127] and relative lifetime-earnings mobility for college-educated workers has been declining since the 1980s.[128]

Stagnant Family Income

- The median family income in the United States in 1999 was $63,200 (in 2018 dollars); in 2018, the median family income was exactly $63,200 as well.[129]

Geographic Concentration of Opportunity

- The economic prospects within American cities and counties are diverging dramatically: "Just 25 cities (megacities and higher-growth hubs, plus their urban peripheries) have accounted for more than two-thirds of job growth in the last decade."[130]

As of 2018, the United States ranked first among OECD nations in income inequality, just above Turkey and approximately 30 percent higher than France and Germany.[131] In 2019, the United States reached the highest level of income inequality in more than fifty years of Census Bureau analysis.[132]

It's not that some businesses aren't doing well; it's that workers are reaping less of the benefits of their employers' successes. Average worker productivity increased by 70 percent between 1979 and 2018, but the adjusted hourly income of non-supervisory workers in America increased by only 12 percent.[133] A series of

jobs—including food manufacturing, warehousing and storage, and motor vehicle and parts dealers—that do not require a college degree once paid more than the national average for non-managerial employees. These jobs have now fallen below the average.[134]

B. Necessity of Digital Skills and Broadband in the Job Market

In 2015, a majority of Americans believed that people without broadband service at home encountered "major disadvantage[s]" when they sought a new job or new skills.[135] Communities across the nation have recognized that broadband is an important way to improve individual economic opportunity.

Today workers increasingly need to be digitally literate to get the jobs that are available. Across the nation, roughly half of all job postings are for middle-skill positions, "jobs that do not require a college degree, pay a living wage, and usually require skills in dealing with technology and people."[136] Eight out of ten of these jobs require digital skills,[137] and these kinds of jobs are growing faster and pay better.[138] But there haven't been enough Americans who have the digital skills to fill these kinds of jobs.[139]

Think of it this way: Today, the mechanic who rolls under your car to change your oil is working on a vehicle that has 100 times as much code running as did the space shuttle on its first flight.[140]

Recognizing the plight of American workers, communities across the nation have focused on the importance of broadband connections and digital training to boost individual economic opportunity—both in traditional workplaces and for those working from home. (Almost a quarter of American workers work from home some of the time.)[141] For example, across eight states, Connected Nation's Digital Works program focuses on developing a workforce that can work from home by providing IT and customer support training, job placement, and additional career development support.[142] Ohio's Digital Works offers a three-week training program to prepare people for telecommuting opportunities from home.[143]

Local efforts concentrate on digital skills needed for today's jobs. Louisville's digital inclusion program, part of its overall broadband strategy, expressly prioritizes the development of competencies needed for middle-skills jobs and supports Code Louisville, which provides programmer training for Louisville residents and nearby residents in Indiana, Ohio, and Illinois.[144] The Mid-Atlantic Gigabit Innovation Collaboratory (MAGIC) in Westminster, Maryland, combines a fiber-optic network to residents and local businesses with digital skills training for more than 400 local students.[145]

Libraries are themselves an important source of job training. Eighty-four percent of libraries offer digital skills training to the young and old alike, and they have been the most widely available resource for basic digital skills assistance for decades.[146] Seventy-three percent of libraries provide programs that help people apply for jobs, create résumés, and prepare for interviews.[147] Many library systems have developed digital inclusion and digital literacy training programs of their own.[148] Libraries have also long been a primary source for adult learning: 28 percent of adult learners who lack either a smartphone or broadband at home reported using the library to learn.[149]

Teaching people how to use their broadband connections from home is critical to assisting job seekers. After all, the internet has become the top resource for most job searches in America.[150] Connect Your Community, a nonprofit based in Cleveland, provides training and computer equipment to residents of Cleveland and Detroit.[151] Research shows that roughly 40 percent of a group of people from that program who were looking

for employment opportunities had "found new or better jobs, received a promotion, entered work training programs, or started their own businesses" within 16 months.[152]

The relationship between education and broadband also plays an important role in boosting individual economic opportunity. A large body of research highlights the positive impact of broadband on educational advancement.[153] Less educational exposure to digital skills specifically leaves people without needed opportunities to gain access to higher-paying careers that require high technology and computer skills.[154]

Like economic opportunity, the opportunity to take advantage of digital learning is not evenly distributed. An estimated 15 percent of households with school-age children do not have internet access at home.[155] That percentage rises to 25 percent among African-American students and to 35 percent among students in families with less than $30,000 in annual income.[156] Homes headed by a person with only a high school degree or less are substantially less likely to have broadband access.[157] A recent study shows that in the ten American counties with the highest unemployment rates, broadband usage is about 27 percent less than in the ten American counties with the lowest unemployment rates.[158]

Job-skills efforts can make a real impact on people's lives. Survey evaluations of the Connect Your Community work discussed above showed that "54% [of participating respondents] said they were hired into a new full- or part-time job since program participation, 35% received a pay increase, 18% received a promotion at their current place of employment, and 23% started a business (i.e., created at least one new job)."[159] Of the participants who were employed, 45 percent attributed their employment to the training that they had received.[160]

The threat of growing income inequality may seem at times to be intractable, but it is not insolvable. In 2018, Gallardo and Whitacre found that "the percentage of residents teleworking from home in both salaried and self-employed jobs had a positive and significant impact on median household income."[161] Of course, working from home typically requires broadband. A recent French study found that where it has been deployed, "broadband Internet raises income at all deciles [and] lowers income inequality, particularly when the adoption rate reaches a critical mass of 30%."[162] A similar study by the same authors concluded both greater adoption of broadband and better quality broadband "raise mean income, and lower income inequality."

V. Conclusion

It all comes down to people. Rachelle Chong is a former commissioner of the Federal Communications Commission and of the California Public Utility Commission. When asked how she explains the importance of broadband, she responds,

> Broadband is a must-have tool to navigate today's modern economy; it's required to apply for most jobs because job applications are only accepted online; it's required to get an education because homework often requires Internet access; it's required to access many government services and benefits. If you don't have broadband access, you can't perform the tasks of a modern citizen. That's why people need broadband at home as well as their workplace.[163]

Indeed, low-income Americans list job-seeking and education as among the top reasons for using broadband.[164] Social benefits are also critical—to take just one example, the impact of broadband on health care is both obvious and crucial.[165]

Not using broadband has real impact. Think about education. Seventy percent of teachers now assign homework that requires internet connections, but three million children do not have broadband connections at home,[166] and at least an additional two million children live in households that rely exclusively on cellular networks.[167] Think of the child who waits for a parent to return from work to do her homework, with the family's one smartphone data plan meted out sparingly until it is exhausted each month.[168]

Think about employment, finding a job, and job skills. Online skills are important for workers, especially those who are looking for jobs that allow them to work remotely.[169] Some digital skills serve as "door openers," enabling people to find new jobs or enter new professions; other skills serve as "career advancers," providing the kind of training necessary for career advancement.[170] Think as well of people trying to get professional certifications through online programs, and homeschooled children trying to make use of online curricula. Older workers with limited digital skills may be especially disadvantaged if they are unable to use broadband to seek a job or acquire new skills.

Of course, mobile internet access is widely available, but the functionality of a smartphone does not replicate the functionality of a computer.[171] And, given the importance of mobility, both mobile and fixed broadband service will be necessary for participation in the digital society of the 2020s.[172] Without fixed broadband service, low-income job applicants may have to wait their turn at library computer terminals. Others depend upon the Wi-Fi signals at coffee shops or community centers far from home, occasionally trying to complete these tasks while huddled over smartphone screens. These are important, but more limited, points of access.[173]

Improving individual economic opportunity, growing the American economy, strengthening communities, and empowering workers are goals of immense importance. The chance for each generation to improve itself—what earlier generations called the American Dream—was originally expressed in the depths of the Great Depression as the "dream of a land in which life should be better and richer and fuller for everyone, with opportunity for each according to ability or achievement."[174] James Truslow Adams created the phrase "American Dream." He said such advancement was the "dream of social order in which each man and each woman shall be able to attain to the fullest stature of which they are innately capable, and be recognized by others for what they are, regardless of the fortuitous circumstances of birth or position."

The rise in income inequality fosters frustration that undermines the trust necessary to a democracy. Indeed, in 2019, most Americans recognized that "a shortage of trust in government and in other citizens makes it harder to solve some of the nation's key problems."[175] Economic opportunity and democracy are conjoined values. Consider Louis Brandeis, the antitrust pioneer and Supreme Court Justice, who believed that concentrated economic power and the resulting "inequality in the distribution of wealth and income" threatened both economic freedoms and the ability of Americans to "secure the moral and intellectual development which is essential to the maintenance of liberty."[176] For Brandeis, "democracy was more than just the ability to cast a vote; it rested on the ability of Americans to participate fully in the industrialized economy."[177] Indeed, Brandeis viewed "industrial liberty" as critical to political liberty. He believed that competitive markets would thus advance democratic as well as economic goals.[178]

Economic opportunity connected to democracy flows directly from the founding of the nation—after all, it is the creation of American democracy in the Declaration of Independence that extolled the unalienable rights to "Life, Liberty and the pursuit of Happiness."[179]

The relationship also runs deep between economic opportunity, democracy, and the ability of all Americans to communicate. In July 1775, a year before its adoption of the Declaration of Independence, the Continental Congress established the postal service and appointed Benjamin Franklin as the first Postmaster General. The Framers understood that a universally accessible postal service would promote commerce and the free flow of ideas, serving all Americans instead of serving just elites like the European postal services of the day.[180] Seventeen years later, the Post Office Act of 1792 "helped turn the abstract idea of democracy into a concrete reality" by expanding the postal network. In turn, "settlers and economic and civic development followed the mail."[181]

In the 2020s, economic and civic achievements will follow the pathways charted by High-Performance Broadband.

Chapter 2: **Deployment of High-Performance Broadband Networks to Unserved Areas**

Drive about 80 miles from Washington, D.C., and you can find yourself in the northern portion of Queen Anne's County, Maryland. Queen Anne's combines (i) a southern and central area, significantly suburban, with fixed-broadband connections (including DSL) used by 80 percent of the population[182] with (ii) a northern and eastern edge, rural, where fixed broadband is little deployed—and, by one measure, only 22 percent of households use it.[183] Microwave-based service reaches some farms, while other farms opt for satellite. One successful farmer spends as much as $1,000 per month to run his agricultural operations off of a mobile cellular network. Robust broadband is tantalizingly close: A farm across the Chester River in Kent County enjoys a 1 Gbps symmetrical service, and a line of dark fiber installed by the State of Maryland runs only a few feet from the front gate of a Queen Anne's County farm—accessible to broadband providers but unused.

On the afternoon of July 18, 2019, the Broadband Committee of Queen Anne's County gathered to discuss how to get more broadband to more county residents. On that day, they met with their new consultant, practiced in the art of broadband funding and deployment, and they listened to an outside speaker describe the different ways that different places in America were solving their broadband problems.

In the meeting, members of the Broadband Committee described infrastructure limitations—expensive and relatively slow microwave connections and more farmers on more cellular systems. One volunteer said that where there was no fixed broadband, there also tended to be poor wireless service—so poor that physical therapists from a regional hospital making house visits had trouble connecting back to their hospital through mobile hotspots to run their physical-therapy software. Another volunteer emphasized the importance of having the infrastructure available so that students can complete their homework assignments on school-equipped wireless devices.

At the heart of their concern was the future of their community. Said one volunteer, "When we talk about precision farming, if you don't have internet, you probably lack cell phone service. So, if you don't have that, then you don't get younger people relocating here, and then you don't get hospitals and other institutions that grow the community."[184]

The question wasn't why broadband was needed; the questions centered on how to get it: How to surmount the cost of rural deployment? How to apportion county resources among competing needs? How to overcome state legal barriers? How to find other sources of funding? How to find broadband providers willing to take on the job of additional deployment? How to figure out the right balance between supporting private investment and ensuring that public dollars deliver benefits to the public? One new possibility appeared in September 2019, when a rural electric cooperative serving Maryland's Eastern Shore (including the farm described in the first paragraph of this Chapter) announced that it would seek regulatory flexibility in order to deploy fiber to rural residents.[185]

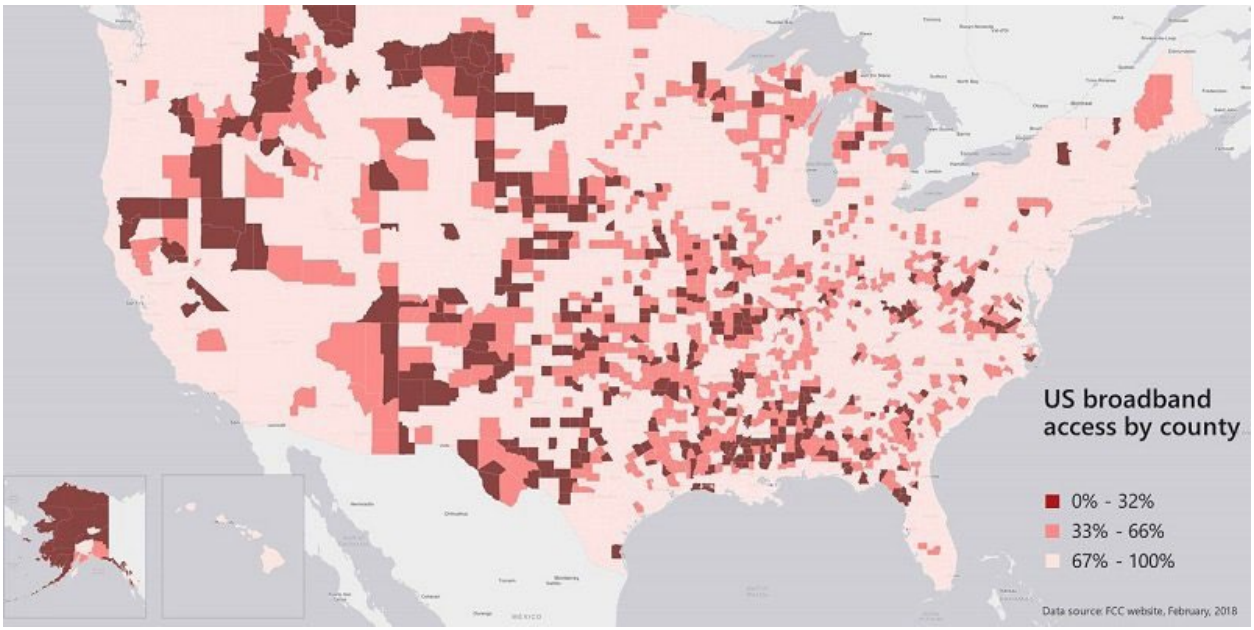
There are millions of Americans whom broadband networks do not reach—although a fierce debate ranges over exactly how big that number is. The Federal Communications Commission (FCC) calculation is that only about twenty-one million people in the U.S. do not have access to broadband service with speeds of at

least 25/3 Mbps.[186] As discussed below, that number is contested[187] and the FCC is taking steps to improve the data on which such conclusions have been reached.[188]

Our question in this chapter is: How does the United States design and implement policy that ensures robust, reliable, affordable broadband finally reaches the places that lack service today? The search for solutions leads to new entrants, rural electrical cooperatives, fixed wireless, and local governmental collaborations with private companies and more.

I. Connecting America's Broadband Deserts

Policymakers are grappling with the challenge of ensuring that broadband deployment is as successful in the next decade as the provisions of electricity and telephone service were in the 20th century. Failure to reach that goal will leave swaths of America on the wrong side of the geographic digital divide; broadband deserts separated from broadband oases.



A. Charting the Course

Effective public policy to support the deployment of broadband to unserved and underserved areas requires accurate data incorporated into accurate maps. Think about it this way: The pioneering aviator Beryl Markham once wrote about preparing to explore new lands: "It was ... disconcerting to examine your charts before a proposed flight only to find that in many cases the bulk of the terrain over which you had to fly was bluntly marked: 'UNSURVEYED.'"[189] Today, too much of America's broadband deployment has been badly surveyed and thus we don't know what should be marked UNSERVED.

Currently knowing just where broadband is and isn't available is more difficult than would—or should—be expected. The FCC's current broadband deployment data are generated by the broadband providers

themselves.[190] But what the FCC has been measuring is not what service actually exists. First, broadband providers have been asked only to identify locations where (by their own judgments) they *could* provide broadband—not just those where they are actually able to provide it.[191] Second, broadband providers supply *advertised* speeds, not the speeds they *actually* deliver. Third, the FCC asks only for a list of census blocks that could be served, rather than specific locations that are actually reached. In other words, both actual and potential service to a single household in a census block counts as service to an entire census block, even though rural census blocks may cover hundreds of square miles.

Policymakers and citizens need an accurate portrait of broadband deployment—not only *where it is* but *what it is*; not only the speeds at which it operates but its critical performance criteria, including latency, monthly capacity limits (if any), and pricing. That analysis can be built on multiple sources of data. Mapping projects can be open-source and crowdsourced. For example, in March 2019, a triad of entities focusing on rural issues launched its own app to collect data on rural broadband coverage.[192]

Without good maps, policymakers will be unable to chart the right course.

More data permits more experimentation in how best to create a map—and better maps yield better insights. No single database is perfect, nor is any individual methodology. But from many databases and methodologies can come reliable, shared, and up-to-date portraits of America's broadband networks. To put it another way, knowledge is power—and open knowledge is distributed power. As Georgia Bullen, a leader in the work of the Measurement Lab (M-Lab),[193] said, "We assume data will give us an answer, but it might give us something more to explore."[194] And that exploration moves faster with diverse data collections contributing to a more robust analysis.

In June 2019, a comprehensive portrait of Pennsylvania broadband deployment demonstrated the importance of better data.[195] Based on more than eleven million broadband speed tests in 2018, the Center for Rural Pennsylvania concluded that although the FCC maps "show 100% availability across the entire state of Pennsylvania of broadband speeds that exceed 25Mbps," the Center's data "showed that there were 0 (zero) counties in Pennsylvania where at least 50% of the populace received" 25/3 Mbps service.[196] In other words, *no* Pennsylvania county had the broadband coverage that the FCC said was enjoyed by *every* Pennsylvania county. Moreover, the Center showed that broadband speeds were "substantially slower" in rural counties than in urban ones and "may indicate a systematic and growing overstatement of broadband service availability in rural communities."[197]

Other communities around the country have discovered serious errors in current, FCC-data-generated broadband maps and have taken action. People in Louisville, Kentucky, launched a crowdsourced project to fill in the blank spaces.[198] The city government and tech community joined forces at a local hackathon to launch SpeedUpLouisville.com, self-described as "a scrappy civic tech attempt to do something well-funded institutions couldn't."[199] K-12 students across twenty schools are gathering home broadband connectivity data for Michigan's Moonshot data-collection program, a community-level measurement effort led by Michigan State University's Quello Center and Merit, Michigan's educational and research network.[200] In April 2019, *Hack for a Cause* in Eugene, Oregon, launched a set of challenges seeking innovations to solve local problems. Among them was an effort pairing tech professionals with students to gather missing data on broadband in rural Lane County, where, as County Commissioner Heather Bush explained, "[i]t's easy to speculate about what areas of our community have slow internet access, but without the data, it's nearly impossible to know who is getting good, reliable service and where opportunities exist for improvement."

In light of ongoing criticism, the FCC revised its data collection in August 2019.[201] First, it established a new Digital Opportunity Data Collection program to find "those areas where some, but not all, homes or businesses have access to modern communications services."[202] This data collection will include both "granular maps" from fixed-broadband providers of the areas where they have "broadband-capable networks and make service available" and well as data from governmental, tribal, and public sources.[203] Second, the FCC initiated a rulemaking process to consider how it can improve the accuracy and usefulness of its broadband data.[204]

The new FCC order is a useful initial step. But there is more to do.

First, broadband providers should be required by the FCC to supply accurate information about what services they actually provide and the locations where they are actually available.

Second, the FCC should collect broadband deployment data that allow for apples-to-apples pricing comparisons (explaining the impact of discounts, introductory offers, and bundled pricing, and inclusive of set-up and other charges) and reflect equivalent broadband performance tiers. Other non-price performance criteria—latency, whether symmetrical services are offered, and the applications of data caps or data de-prioritization—must also be gathered and made available.[205]

Third, residential service is provided to a home location, not to a census block, and it is the actual locations where broadband connections have to reach that the data must capture. This data, along with pricing and non-pricing terms is necessary to understand the presence—or absence of competition. Public Knowledge has advocated that the FCC's data collection also includes information on network reliability—including "network security and resiliency, outages and service denial"—because of its impact on the quality of service provided.[206]

Fourth, the FCC should present the data in segments that reflect the increasing speed of broadband connections. For example, the FCC's current practice employs only five discrete speed tiers, with the highest combining all services at or above 250/25 Mbps. This segmentation overlooks important broadband trends, such as the increasing availability of 1 Gbps service that is four times as fast as the FCC's highest download speed tier.[207] And with consumers increasingly producing and uploading content using their home connections, the FCC's approach understates the growing importance of faster upload speeds.

Fifth, the FCC should continue to report its data in combination with specific demographic characteristics. Census Bureau information on all key demographic characteristics—including income and race/ethnicity—should both inform FCC analysis and be easily available to the public for purposes of its own analyses. Broadband policy analysts—as well as researchers in health care, urban policy, and other social-science fields—depend upon the data to evaluate digital divides and propose more custom-tailored policy solutions.[208]

Sixth, the FCC should permit public access to broadband deployment data so that alternative analyses, including with other sources of data, can be created. Researchers have demonstrated the importance of access to such data, even in its current form.[209]

Finally, the FCC's process should learn from the efforts that have been undertaken by private researchers and local communities. For example, in July 2019, New America's Open Technology Institute, working with M-Lab and others, launched the United States of Broadband Map,[210] which compares the differences depicted in different data sets and finds "glaring inconsistencies" between the FCC's and other analyses.[211] In Queen

Anne's County, for example, that map depicts a consistent pattern of download and upload speeds that are significantly slower over time than those shown by the FCC data.[212]

Different views have been expressed about how to build the best maps. For example, NCTA—The Internet & Television Association, supports the use of "shapefiles," which use polygon shapes to distinguish between areas on a map with different coverage characteristics,[213] thereby resolving the inaccuracy problem of partial coverage within a census block. US Telecom has suggested an alternative approach that draws from "[m]ultiple sources of address, building, and parcel data" and location coordinates[214] to create a "Broadband Serviceable Location Fabric" (BSLF)[215] to provide more detailed deployment information. However, organizations such as Free Press are concerned that the analytic methods necessary to combine other sources of data with carriers' publicly unavailable data will make it harder for researchers to verify or actually utilize the results.[216] At bottom, the chosen mapping strategy must provide better data that will allow policymakers to understand what is needed to deploy broadband and what will it cost. For example, running fiber to a farm gate may leave it a half-mile or so from the house or office that broadband needs to reach—a small but potentially significant digital divide of its own.

Without good maps, policymakers will be unable to chart the right course.

B. Deploying High-Performance Broadband

Any effort to support broadband deployment must define the performance characteristics of the networks that receive support. This report urges the adoption of policies that provide everyone in America with the opportunity to subscribe to High-Performance Broadband—that is to say, with the performance characteristics typically achieved by a fiber-based network, among them high actual speeds and low latency. Thus, support for the capital expenditures of network construction should be limited to broadband connections that provide scalable 100 Mbps symmetrical service without usage limits. Establishment of a robust, high-performance standard is especially important because, once established, the performance standard will govern the life cycle of the build-out effort—which is measured in years. Any such standard should be updated as successive programs are implemented or expanded. (There is a place, discussed later in this report, for the interim support of operating expenses for networks that do not meet this standard.)

Broadband connections in the United States regularly deliver 100 Mbps downloads and are increasingly capable of reaching 1 Gbps symmetrical speeds. According to one speed test in 2018, the average wireline download speed for consumers was 96.25 Mbps, with several states, including Massachusetts, New Jersey, Maryland, and Delaware, averaging download speeds of 115 Mbps or more (and the average upload speed was 32.88 Mbps).[217] At the same time, fiber now passes by forty-one million homes across America, with fiber-connected households generally capable of receiving 1 Gbps service.[218] The cable industry announced at the beginning of 2019 that "10G" field trials will begin in 2020; 10G is its name for a service that will deliver a download speed of 10 Gbps, or 400 times as fast as what the FCC now considers "advanced" download speeds.[219]

There is no reason for governments to pay for the construction of new networks that may not be able to meet the performance demands of broadband usage in the 2020s.

Would the construction of High-Performance Broadband be too expensive? The use of competitive-bidding processes suggests not. In 2018, the FCC conducted a reverse auction that provided $1.49 billion over ten years to 103 bidders to support broadband deployment to more than 700,000 unserved rural locations in 45

states.[220] By one estimate, the support committed through the auction is 70 percent lower than cost models had determined—about $2,000 per location rather than the cost model's calculation of over $6,000.[221] Even fiber deployments are coming in at lower costs than expected.[222]

Estimates vary widely on the total capital expenditures needed to deploy broadband networks to all unserved areas. In the closing days of the Wheeler Administration, FCC Policy Chief Paul de Sa calculated that "future-proofed, fixed broadband networks" could be deployed to 98 percent of America with $40 billion in capital expenditures, the same amount included in proposed legislation introduced in 2019.[223] Of note, de Sa concluded that *only* capital expenditures would be needed to reach that goal because he estimated that revenues from subscriptions would cover ongoing operating costs. Federal support, de Sa proposed, could be provided through measures that include tax-related initiatives and efforts to enhance the productivity of capital expenditures, with "a small percentage of existing government funding" to be used to build out infrastructure for specific uses, such as autonomous vehicles, or anchor institutions.[224] In early 2019, Blair Levin suggested that, in light of the results of the 2018 FCC reverse auction noted previously, additional funding of $14 billion to $28 billion might get the job done, while also emphasizing the importance of prioritizing support for capital expenditures.[225] In September 2019, the Fiber Broadband Association released a study concluding that investing an additional $70 billion would ensure that 90 percent of U.S. households would have access to fiber networks by 2029.[226] Current proposals for broadband funding range from $20 billion to $150 billion—a range that itself indicates that the FCC must speed the collection and analysis of accurate data on broadband deployment.

Current federal efforts fall short of the goal of funding high-performance, future-proof networks. None of the USDA or FCC programs that support broadband construction have a minimum performance requirement faster than 25/3 Mbps. So, for example:

- The FCC provides support for deployment by rural telephone companies, but does not require the delivery of more than 25/3 service.[227]
- The FCC's newly- renamed Rural Digital Opportunity Fund (formerly the Connect America Fund, or CAF) is on track to spend $20.4 billion over the course of the next decade or so but supports service as slow as 25/3 Mbps.[228]
- The USDA's Rural Broadband Access Loan and Loan Guarantee Program provides between $20 million and $40 million annually for loans at favorable terms and other loan support for broadband service in rural areas.[229] The program currently requires that broadband program applicants provide at least but not necessarily faster than 25/3 Mbps.[230]
- The USDA's new ReConnect Program offers a total of $600 million to broadband projects that can be as slow as 25/3 Mbps.[231]

Other states are also demanding service with speeds that are higher than the FCC's minimum. Washington's low-interest loan/grant program for local governments and Indian tribes requires that cable networks supply 100/20 Mbps; fiber networks must provide 1 Gbps symmetrical service.[232] Minnesota has committed to the deployment of 100/20 Mbps by 2026.[233]

In 2018, the Michigan Consortium of Advanced Networks (MCAN) released its *Michigan Broadband Roadmap*, which seeks to establish statewide access to 25/3 Mbps service by 2022 but raises the bar to 1 Gbps in 2026.[234]

Maine's ConnectME effort takes a different approach to robust broadband. The program requires that the minimum performance criteria of broadband be reconsidered "[a]t least annually."[235] Importantly, this is not just about speed: The evaluation considers any performance criteria that are essential to real-time video communications, video streaming, interactive gaming, file-sharing, and network storage and other applications, including whether a plan's monthly data cap would unreasonably hinder these uses.[236] Funding priority goes to the projects "that provide the greatest relative improvement to existing Internet service" as measured by speed increases, number of potential subscribers, and the capital cost per subscriber. [237] Maine's efforts demonstrate how performance standards, once established, can be improved upon as build-out efforts continue.

There is no reason for governments to pay for the construction of new networks that may not be able to meet the performance demands of broadband usage in the 2020s.

Pending congressional legislation similarly recognizes that today's minimum requirement should not become the baseline for tomorrow's broadband deployment. The proposed Leading Infrastructure for Tomorrow's America Act (H.R. 2741) would provide $40 billion for deployment to unserved and underserved areas but would require participants to provide 100/20 Mbps service with low latency everywhere except the most remote areas.[238]

Similarly, the results of New York's 2018 reverse auction, in which multiple broadband providers proposed to build fiber-to-the-home networks, supports the view that at current funding levels fiber-based, symmetrical service ranging from 100 Mbps to 1 Gbps download can be available to all but the most extreme locations.[239]

C. Reaching Unserved Areas and the Claim of "Overbuilding"

Supporting the construction of networks to reach places without broadband is widely supported. For example, H.R. 2741, discussed earlier, would treat as "unserved" any place that lacks 25/3 Mbps service with low latency, and it is those places that would receive the highest priority of funding. Rightly, this kind of approach does not ask if an area is "rural"—a term for which multiple definitions exist—rather it asks whether broadband has been deployed. Although rural areas suffer from persistent and unique challenges, lack of broadband exists elsewhere and is just as much of a problem.

A more contentious issue arises when public monies are spent in areas that meet (or in areas that fall short of meeting) the FCC's current minimum standard and complaints are made about the wastefulness of what is called "overbuilding."

"Overbuilding" should be called by its more familiar name: "Competition."

Language here is important. There is a tendency to call the construction of new, competitive networks in a locality with an existing network "overbuilding"—as if it were an unnecessary thing, a useless piece of engineering. But what some call "overbuilding" should be called by a more familiar term: "Competition." "Overbuilding" is an engineering concept; "competition" is an economic concept that helps consumers because it shifts the focus from counting broadband networks to counting the dollars that consumers save when they have competitive choices. The difference is fundamental—overbuilding asks whether the dollars spent to

build another network are necessary for the delivery of a communications service; economics asks whether spending those dollars will lead to competition that allows consumers to spend less and get more.[240]

Those in favor of restricting overbuilding might say that there are places in which the economics of current network architecture support only one or two networks. Of course, the history of telecommunications regulation in the United States suggests that monopolies were a result of policy choices, not mandated by any iron law of economics. Moreover, the economics of established networks may not be the same as new forms of network architecture such as wireless or satellite. A traditional role of innovation is to incentivize entry by more efficient producers. New entrants may succeed, or they may fail, but sound competition policy views competitive entry as critical to the restraint of market-power and the delivery of consumer benefits.

The question arises whether publicly incentivized competition is somehow artificial and therefore unworthy of public support. Of course, broadband is nonexistent in some places, chiefly rural areas, and that has not kept the federal government from subsidizing build-out for more than a century (first through the cross-subsidization achieved in AT&T's rate structure and then through the transparent Universal Service Fund created in the Telecommunications Act of 1996).

And it would be odd for public policy to treat the creation of a monopoly as a success. This report treats the creation of a big, new monopoly as a failure, arguing that deployment and competition are both vitally important so that everyone in America can have the choice of competitive High-Performance Broadband. Policymakers should assiduously explore all alternatives to the governmental establishment of anticompetitive monopolies, including examining the plethora of innovative approaches implemented by communities and described in Chapter 3.

Is there now a view that public support for a monopoly is appropriate but support for viable competition is not? That, at least, was the attitude of the Bell System in the 20th century—as AT&T President John deButts famously told state regulators in 1971 in a speech in which he called upon the public to "oppose competition." Faint emanations of that approach, like the microwave echoes of the early universe,[241] can still be detected.

Such a proposition asks the wrong question from the wrong perspective. The inquiry *should not be to divine some magic number of networks that is good for networks.* It should be to determine the circumstances in which public support of deployment and competition can lead to greater, sustainable competition, the benefits of which, fully internalized, justify those efforts.

Today, federal programs are designed to avoid "overbuilding."

The FCC's 2018 CAF II auction, which supported broadband construction in high-cost areas, provided funding only to areas that were not served "with voice and broadband of at least 10/1 Mbps…. by an unsubsidized competitor or price cap carrier."[242] That means that an internet-access service of, say, 15/2 Mbps—below the current FCC definition of broadband—was sufficient to knock an area out of reverse auction.

The new USDA ReConnect program applies the same 10/1 Mbps standard but in a way that is much more restrictive than that historically applied by the USDA's Rural Broadband Access Loan and Loan Guarantee program, which provided support to areas where up to 85 percent of households had internet access.[243]

And the 2018 Farm Bill itself changes that loan and loan guarantees program so that it is not available to locations where up to 50 percent of homes are served.[244] As a result of these recent legislative chances, some areas traditionally able to access USDA support are now excluded—a symptom of the problem of treating "overbuilding" as anathema to public policy.

By contrast, Minnesota defines "underserved" as any place where "households or businesses lack access to wireline broadband service at speeds of at least 100 megabits per second download and at least 20 megabits per second upload."[245] The New York reverse auction conducted in 2018 devoted 10 percent of its available funds to improving connectivity in "underserved" areas, defined as places where broadband service is available from a wireline provider at download speeds between 25 Mbps and 99 Mbps, which helped to boost competitive choices for consumers.[246]

Governments are certainly entitled to prioritize the recipients of their funds by need. But the overbuilding restrictions seem to be built upon another, separate ground, namely that spending public dollars to "overbuild" is wasteful. The problem with that critique partly lies in the criteria these federal programs apply, namely whether there exists a network supplying 10/1 service or better. But knowing that a 10/1 provider is present doesn't explain whether consumers will benefit from the construction of another network. Instead, the restriction confuses the well-being of competitors with the well-being of consumers.

Suppose, for example, that a new network would build a 1 Gigabit symmetrical network in a place where an aging DSL network strains to crank out 10/1 service or even 15/2 Mbps. Imagine further that, given a choice, consumers would overwhelmingly choose the Gigabit network, that they would pay lower quality-adjusted prices for the 1 Gigabit service and that they would (by definition) receive higher-quality connections. (This is not a stretch—when given a choice between legacy DSL and Gigabit-capable cable broadband, consumers flock to the cable service.)[247]

The right question to ask is: "Will consumers benefit?"

The right question is to ask whether consumers would benefit from the expenditure of available funds in a manner that (capturing positive externalities) supports the public expenditure. In considering expenditures, federal (and, where applicable, state) agencies should consider factors that include (i) the benefits to consumers of increased deployment and competition and (ii) the ability of network expansion to capture the advantages of network efficiencies in reaching these areas (and passing those savings along

Rural Electric Cooperatives Deliver Broadband

Home broadband subscription rates continue to lag in rural areas, holding back local economies and access to telemedicine. The deployment of broadband networks to rural areas echoes the challenges earlier generations had ensuring that electrical networks and telephone service reached everyone. The solutions those earlier generations employed provide us lessons for today's broadband challenges.

Through the 1930s, many power companies ignored rural areas of the nation even when the federal government offered loans to serve these sparsely populated areas. As late as the mid-'30s, 90 percent of rural homes were without electric service. Working with the Rural Electrification Administration, farmer-based, consumer-owned electric cooperatives, commonly known as electric co-ops, started to bring electricity to rural farms and homes. Cooperatives are member-owned businesses. Democratically controlled and operated on a nonprofit basis, a cooperative opens membership to those who use its services.

In the years after World War II, the number of rural electric systems in operation doubled, the number of consumers connected more than tripled, and the miles of energized line grew more than fivefold. By 1953, more than 90 percent of U.S. farms had electricity.

Most of the electric co-ops still exist today, providing power to 56 percent of the U.S. landmass—and their importance is becoming clearer every day.

Nearly 100 of the 900 or so rural electric co-ops across the United States offer some form of broadband. Another 200 or so co-ops are studying whether to move in the same direction.

Electric co-ops and publicly owned municipal electric utilities have a number of natural advantages that allow them to deploy and provide fiber-based broadband service. After all, within their service areas, electric utilities basically reach everyone. They often already have access to essential infrastructure, including pole

to consumers). Policymakers should support additional deployment as funding priorities permit where the social return on broadband investment would be positive.

Thus, recent legislation proposals and state programs, like Minnesota's, target funding to any area that lacks at least 100 Mbps download (the upload numbers vary). That is a good beginning, in part because networks that provide those kinds of speeds (and associated features like low latency and capacious usage) can typically be upgraded at relatively modest costs as demand requires.[248]

D. Deploying High-Performance Broadband on Tribal Lands

The challenge of deploying broadband to tribal lands is exacerbated by poverty and low-population density as well as tough terrain that increases construction and operating costs. The U.S. Government Accountability Office (GAO) found in 2018 that "little federal funding aimed at increasing broadband service actually goes to tribal entities" even though about 35 percent of residents of tribal lands lack broadband service.[249] The GAO recommended that the Rural Utilities Service (RUS) identify and address any regulatory barriers that impede tribal access to broadband funding.

Such barriers may be far from obvious. For example, on Navajo lands in the Southwest, many people live in buildings, like converted tool sheds and traditional Navajo hogans,[250] that the federal government does not recognize as dwelling units. According to Sacred Wind Communications, a rural telco that serves Navajo lands, this single omission has led to funding discrepancies that are "staggering."[251] Explains CEO John Badal, Sacred Wind could have connected all of the residential locations formally identified by the FCC while actually "ignoring nearly 40 percent of the households" actually used by the community because of the failure to recognize these traditional Navajo houses and other kinds of buildings that people actually live in.[252]

That is one example of why particular attention should be paid to challenges on tribal lands. Sometimes special support is required, as with the tribal subsidy that is provided through the FCC's Lifeline program. But just as much, and as the GAO recognizes and John Badal illustrates, the federal government needs to pay more attention to practical difficulties and differences in order to formulate policy. The FCC has an Office of Native Affairs and Policy to focus specifically on tribal lands; it, for example, holds workshops to help Native Nations understand FCC programs. But the FCC has only partial jurisdiction over broadband policies that impact tribal lands. To do more, an Office of Broadband Coordination for Tribal Lands should be established in the Executive Branch, perhaps in the National Telecommunications and Information Administration (NTIA), to act as a counselor and ombudsman to Native Nations and service providers, focusing on providing broadband on tribal lands in order to ensure the seamless interaction of various federal efforts.

attachment points and hub facilities. They can use their pre-existing field staff and the billing, customer support, and administrative personnel. With all of these elements in place, they have lower risks and fewer entry costs.

The Tri-County Rural Electric Cooperative—based in Mansfield in north-central Pennsylvania—is starting to string a fiber-based broadband network after surveying its members to see if they wanted the co-op in the broadband business. The response was a resounding "yes."

But financing the project was "ugly," said CEO Craig Eccher, and was only possible when Tri-County received pledges of more than $32.3 million in support from the FCC, after Verizon declined FCC support to serve the same area. Pennsylvania is supporting the Tri-Co broadband deployment with funding provided through the Governor's Office of Broadband Initiatives and a grant from the Pennsylvania Redevelopment Assistance Capital Program.

The 16,000 customers who are to get lightning-quick internet are jubilant, but they comprise just a fraction of the 520,000 rural Pennsylvanians who lack high-speed internet.

Although rural electric co-ops are critical to the deployment of broadband to places without any service at all, they can also provide competitive choice where service now exists. For example, Midwest Energy & Communications (MEC) in Michigan began deploying fiber in 2014 to its rural co-op members who were widely underserved with communication technologies far inferior to MEC's fiber broadband offering.

Seventy-five years ago, electric cooperatives electrified rural America. Today, co-ops continue to energize rural economies by closing the digital divide.

The challenge needs to be addressed comprehensively. In their 2019 study, "Tribal Technology Assessment: The State of Internet Service on Tribal Lands," Brian Howard and Traci Morris explain, "[i]t is time for new authorities, new programs, and new Tribal government and technical assistance trainings that address the economic, social, and workforce needs in Indian Country."[253] Among the items in their comprehensive agenda, Howard and Morris call on Congress to prioritize universal-service funds for direct impact on Tribal Lands and establishment of "a Tribal Broadband Fund to support broadband deployment, maintenance and technical assistance training."[254]

E. Employing Reverse Auctions to Stretch Federal Dollars

Although the federal government has employed multiple methods to support broadband deployment, the FCC over the past seven years has put increasing emphasis on reverse auctions.[255] In a reverse auction, broadband providers bid against one another to establish the lowest amount of government funding necessary to deploy broadband infrastructure, rather than building to a cost model designed to estimate the costs of deployment. By minimizing the funding support allocated to each area in this manner, the reverse-action process tends to require lower levels of funding.[256]

The FCC is in the process of establishing the $20.4 billion Rural Digital Opportunity Fund designed to provide funding to deploy broadband networks in areas within price-cap territories (that is, within the traditional footprint of the larger and midsize telecommunications incumbents) that lack 25/3 Mbps service.[257] The use of reverse auctions has also been of interest to members of Congress.[258]

Reverse auctions should be designed to incentivize deployment of High-Performance Broadband technologies, for example by using successive tiers of service that begin by seeking bids to supply low-latency, 1 Gbps symmetrical service with no usage limits. (Both the FCC's 2018 CAF II auction[259] and the New York State reverse auction, which used performance tiers, were constructed to favor higher-performing service.[260])

The establishment of geographic areas in which bidding is conducted also can impact who can effectively bid; new entrants may not be able to span as large a service area as an incumbent. The creation of a consortia of providers could help solve this problem, but, in any event, auctions should be structured to promote—not discourage—innovation and new entry.

Reverse auctions are designed, of course, to get the lowest bids in the areas easiest to serve, which runs a risk that other, harder-to-serve areas may receive no bids because costs are inherently higher. Deployment funds must be sufficient to get the job done across the board. Other programs, like continuing support for operating funds, should be viewed as interim measures until High-Performance Broadband can be deployed.

Finally, monitoring and enforcing the results of reverse auctions is critical. If broadband providers fail to make promised deployment progress, then the FCC (or any governmental agency conducting reverse auctions) must act promptly to protect consumers, re-auction the area quickly, and avoid a circumstance in which the existence of an auction award to a failed project blocks the availability of other funding to a service area—the worst of all worlds.[261]

F. Establishing Eligibility for Reverse-Auction Participation

Eligibility to participate in reverse auctions should be open to a broad array of broadband providers, encouraging new entrants. In 2018, the Connect America Fund II auction allowed rural electric co-ops to place bids, and thirty-five participated in winning bids.[262]

The range of eligible applicants for USDA's ReConnect program is diverse: non-profits, cooperatives, states, local governments, smaller governmental organizations, and Indian tribes, in addition to for-profit corporations and limited liability companies (LLCs).[263] RUS has traditionally administered both grants and loans through its Rural Broadband Access Loans program, the Telecommunications Infrastructure Loans and Loan Guarantees program, and its Community Connect Grants program.[264] The eligibility criteria of these programs differ, but private companies, nonprofits, cooperatives, state and municipal governments, and Indian tribes can participate.[265]

G. Establishing Requirements for Funded Deployment

The first priority of deployment funding is to build to areas that lack broadband. Of course, recipients of government funding must meet their deployment obligations. But additional measures should be included that further the public interest.

A notable aspect of the NTIA support for infrastructure deployment undertaken in response to the Great Recession was the requirement that funded middle-mile facilities be open to multiple providers. That should be a basic requirement of governmental support to any private provider. Similarly, the appropriate suggestion has been made that federal broadband funding require winners of reverse auctions to offer wholesale service to broadband competitors, for example, in places where fiber acts as backhaul for the deployment of new wireless broadband.[266]

Recipients of federal deployment funding should be required to offer at least two standardized tiers of service to subscribers—one that is available to all and one that is available to eligible low-income individuals. To this end, the FCC should consider mandating that any customer can pay $50 per month for 50/50 Mbps with unlimited data (and other similarly important performance criteria) and, for the reasons explained in Chapter 5, consider requiring a low-income service offering eligible participants the same 50/50 Mbps service for $10 per month.[267] Any such requirements should be updated as technology advances. That is especially important if, incentivized by the high margins on broadband service, broadband providers are not offering a range of speeds to those who wish to save money or who don't use data-intensive applications.[268]

H. Supporting State Strategies

States have been active in incentivizing deployment to unserved areas and, in conjunction with such efforts, underserved areas. At least twenty states—including Colorado, North Carolina, Virginia, Maine, Michigan, Minnesota, and Wisconsin—have statewide broadband strategies with dedicated funding to promote deployments.[269] Forty-four states have broadband offices, task forces, or legislative committees responsible for facilitating broadband deployments.[270]

Minnesota has lodged its effort in its Department of Employment and Economic Development, so the state's program expressly considers the "likely economic impact" of the project alongside evidence of community

support.[271] Minnesota funds deployment in both unserved and underserved locations, and its funds can be used for both last-mile and middle-mile construction.[272] Middle-mile networks reach a community, for example by connecting schools, libraries, or hospitals, but they don't reach all the way to homes and small businesses.[273] As discussed in Chapters 3 and 5, they can serve as important launching pads for community-wide deployment because they bring fiber closer to the ultimate destination, thus lowering the costs that would be borne by last-mile providers to build out to residences.

To date, Minnesota has funded broadband service to more than 34,000 previously unserved households, 5,200 businesses, and 300 community institutions,[274] and 100/20 Mbps service is now available to nearly 75 percent of households.[275] Minnesota's efforts also illustrate the importance of broadband to advancing local economic goals.[276] For example, rural tourist destinations in Minnesota have struggled to meet guests' needs—and even process credit card purchases—because of slow internet connections.[277] In Cook County, the state's second largest county by square miles and a place that needs better broadband to satisfy the demands of tourists, the Arrowhead Electric Cooperative built a network with federal and local funding that provides roughly 95 percent of the county with access to internet with speeds of at least 100/20 Mbps over a fiber-based network.[278]

There is, of course, more to be done. Although Iowa leads the nation in the number of municipal broadband networks,[279] in 2018, by one measure, Iowa ranked 38th in the nation in terms of broadband coverage, below both Michigan (26) and Minnesota (27).[280] The implications are obvious in a heavily agricultural state:

> Corn farmers in Appanoose and Monroe counties are among the state's least productive. Some say that's due, in part, to slow connections. "We've had some of our members that want to take advantage of precision planting and spraying, but they just don't have access to high-speed internet to be able to do it," says Bryon Stilley, CEO of Chariton Valley Electric Cooperative, a member-owned utility that serves the counties. Because DSL connections in this part of Iowa are slow and satellite service is unreliable, many of the cooperative's members rely on cell phone hotspots to get online.[281]

During her first State of the State Address, Iowa Governor Kim Reynolds, a Republican, called for $20 million over two years to support broadband infrastructure;[282] subsequently the state legislature appropriated funds for this purpose.[283] By May, the first grants had been made.[284]

Blandin Foundation: Champion for Rural Minnesota

Building and revitalizing strong communities is hard work. It takes leadership, reaching across boundaries, and building lasting connections. For over 16 years, the Blandin Foundation has included broadband deployment and adoption in its efforts to build healthy and vibrant rural communities in Minnesota.

Blandin has been a trusted partner with, and advocate for, rural Minnesota since 1941. Drawing from this deep history of relationships, Blandin has partnered with dozens of rural communities and funded hundreds of projects to enhance quality of life and place.

In one of Blandin's biggest and most impactful efforts, it implemented the Minnesota Intelligent Rural Communities (MIRC) project with a combination of $4.8 million in funds from the National Telecommunications and Information Administration's (NTIA) Broadband Technology Opportunities Program (BTOP) and $1.5 million in matching funds from project partners.

MIRC was a three-year project (2010–13); a multi-sector, comprehensive approach to promote broadband adoption that targeted un- and underemployed workers, non-adopters, low-income residents, small businesses, local governments, and critical services providers.

Eleven demonstration communities brought MIRC to every corner of rural Minnesota. This cross section of cities, towns, counties, and multi-county regions—with a total population of 250,000 people and population density ranging from 4 to 1,700 people per square mile—gave the project the opportunity to test the impact of education, training, and outreach efforts within communities of varying populations, size, and social and economic profiles. Further, the communities had a wide variety of telecommunications infrastructure and services, ranging from municipally owned and operated networks to duopoly-served markets to legacy providers.

The project used a community and economic development framework, called Intelligent Communities, which establish-

I. Increasing the Effectiveness of Federal Efforts

Despite the importance of bringing broadband to everyone in America, there is neither a single nor unified federal effort designed to ensure deployment to consumers in unserved America.

Some federal efforts are focused on areas defined by the nature of the telecommunications company that has traditionally serviced that area, a regulatory categorization of limited relevance to the deployment of 21st century broadband. Other efforts may serve as a catchall for places otherwise lacking in support.[285] It is very difficult to understand how these pieces work together.

There is room for substantial improvement:

- Broadband deployment efforts should support capital expenditures of future-proof, High-Performance Broadband networks, as this chapter has discussed. But, depending on the funding level and the time needed for construction of future-proof networks, interim measures may be necessary for a while to ensure that broadband is available to everyone in America. Thus, support should be structured so long-term investments are made only in networks that are "future proof" and able to meet the performance demands of people in the 2020s. Any interim funding of operating expenses should (i) be for a limited period only, leaving government free to attempt again to fund high-performance construction if that is needed, (ii) be calculated not to displace private dollars or fail to reflect ongoing subscription revenue, and (iii) be apportioned by market share, to the extent that multiple providers are serving the same location, an approach that gives voice to consumer preferences.
- NTIA should take the lead, working with the FCC and USDA to collaborate on a comprehensive map that illustrates which areas are eligible to participate in which federal broadband programs (much as USDA already does for the ReConnect program).[286] That collaboration should also provide the foundation for policies that promote deployment and competition.
- Congress should, as part of any broadband deployment legislation, clarify the responsibilities of the distinct federal agencies—the USDA, the FCC, and the NTIA—both in connection with each other and separately. For example, Christopher Ali has described RUS as a "reluctant regulator" whose multiple roles "makes it difficult to pinpoint the responsibilities and jurisdiction of RUS vis-à-vis rural broadband."[287] RUS's application processes have been described as overly complex, burdensome, or

es five core community characteristics (broadband connectivity, digital inclusion, knowledge workforce, innovation, and marketing and advocacy). MIRC set target outcomes that could be measured and monitored—all of which were accomplished or exceeded.

In the past six years, Blandin's Broadband Communities (BBC) program has applied what it learned during the MIRC program to its two-year partnerships with other rural Minnesota communities:

Communities know best and need to engage their citizens directly in articulating and reaching broadband adoption and utilization goals.

Local leadership matters, and leaders need to be trained to frame issues, build and sustain relationships, and mobilize people to build a community's capacity to achieve its broadband goals.

Intra-community, personalized outreach works for technologically challenged small businesses and for historically marginalized populations.

Peers make great teachers and are a popular, low-cost, and easily sustainable resource to build a community's technological savvy.

Cross-community communication is key to spurring and sustaining energy and excitement for community broadband projects.

Encourage a next generation of young leaders who can bring energy and sustainability to any community initiative by serving as co-trainers, technology mentors, and partners in computer refurbishment projects—and can use video and other social media to promote their communities.

Connect the economic dots. The "whole picture" Intelligent Community framework for community and economic development used in MIRC can help community leaders see how workforce, infrastructure, inclusivity, innovation, and marketing/advocacy are mutually interdependent aspects of community vitality.

Have patience. This work takes time. Look for and celebrate early and easy "wins" along the way, but think long-term and build capacity and energy for the long haul. Money and other resources follow vision and commitment.

inexact.[288] Once an area is served by one of the programs, it often becomes ineligible for other programs at the FCC and RUS,[289] which makes it even more important that the operation of all programs be synchronized.

- The FCC provides at least $4.5 billion per year to support broadband deployment in rural areas through the Connect America Fund programs.[290] That money is collected through fees on revenues of traditional long-distance telephone service. But with widespread adoption of wireless and VoIP phone service, long-distance revenues are rapidly decreasing. Congress should find a broader funding mechanism.

Broadband infrastructure is not an end in itself. It is helpful to talk about broadband as indispensable infrastructure for achieving higher community goals such as increased economic vitality, improved quality of life, equal opportunity for all, and full participation in our democracy.

Blandin continues to champion the Intelligent Communities process and deploy its not inconsiderable financial resources to help Minnesota rural communities define their technology goals, measure current levels of broadband access and use, and seek technical assistance and other funds to meet community needs. All of this work benefits from, and builds on, Blandin's indelible sense of place, of home.

Other federal agencies, like the Department of Housing and Urban Development, the Bureau of Indian Affairs, and the Federal Reserve Banks, through their management of the Community Reinvestment Act (CRA), can spur broadband investment. For example, the Federal Housing Authority should require that all new construction subject to its minimum standards will incorporate the infrastructure necessary for High-Performance Broadband to residential units by multiple competitive providers. Where governments construct infrastructure, like highways, they should install broadband infrastructure that is available to multiple providers. Governmental procurement can spur broadband build-out, for example when the federal government connects far-flung military bases or post offices.

Finally, RUS loan projects often require additional federal support in order for recipients to pay off the loans. As the Congressional Research Service explains:

> Whereas RUS broadband loans are used as up-front capital to invest in broadband infrastructure, the Federal Communications Commission's (FCC's) Universal Service Fund (USF)— specifically, the high cost fund—has functioned as an ongoing subsidy to keep the operation of telecommunications networks in high cost areas profitable for providers. Many RUS telecommunications and broadband borrowers (loan recipients) receive high cost USF subsidies. In many cases, the subsidy received from USF helps provide the revenue necessary to keep the loan viable. The Telecommunications Infrastructure Loan Program is highly dependent on high cost USF revenues, with 99% (476 out of 480 borrowers) receiving interstate high cost USF support.[291]

It is hard to fathom why one federal program should be funding another. Programs should be constructed to stand on their own two feet.

II. Policy Recommendations to Promote Broadband Deployment

In this section, we propose principles whose use will further effective deployment of robust to unserved and underserved areas.

A. Map Broadband Oases and Deserts

1. The Federal Communications Commission (FCC) must move promptly to collect, verify, and release data that will allow policymakers at all levels of government to make real judgments on the extent to which broadband is actually available to every household location in America.

2. Broadband providers must provide accurate information, and this must include accurate data on pricing, non-pricing terms, technical performance, and quality of service.

3. The FCC should present its analysis in ways that permit users to easily understand the existence, and implications, of different tiers of broadband, at least up to 1 Gbps symmetrical.

4. The FCC should ensure that the data are publicly available and can be easily used with other federal information collections, including those maintained by the U.S. Census Bureau.

5. Users should have access to the underlying data that permit them to create their own maps with data they import from other sources. Thus, mapping can become a distributed enterprise.

6. The FCC data collection should be established to incorporate continuous learning from outside analyses.

7. The FCC must have the information in hand that is needed to make informed judgments about the design and operation of broadband deployment programs before new efforts are undertaken, including any future reverse auctions, and should accomplish that task by the end of 2020.

B. Deploy High-Performance Broadband

1. Governments should promptly scrap obsolete performance standards, such as the FCC's current 25/3 Mbps definition of advanced broadband.

2. For any new deployment funding, governments should require at least 100/100 Mbps service with no usage limits and latency low enough to run interactive video applications (like videoconferencing). Good policy demands that performance criteria—like low latency, symmetry, and the amount of data that can be received and sent each month—be treated as importantly as speed alone. Such speed and other standards should be updated as programs are implemented or expanded.

3. Competitive processes should always be used to bring down the cost of funding capital expenditures for broadband deployment.

C. Reach Unserved Areas (and Reject the Claim of "Overbuilding")

1. The focus should be on whether robust broadband is present—not on whether an area meets one of the multiple definitions of "rural."

2. Underserved rural and urban areas should be treated with equal importance. Although rural areas suffer from persistent and unique challenges, lack of broadband exists in some urban environments as well.

3. Deployment and competition are good for consumers. The question for funding is not whether there is "overbuilding" but whether funding will be well-spent. In considering expenditures, federal (and,

where applicable, state) agencies should consider among other factors:

a. the benefits to consumers of increased deployment and competition, and

b. the ability of network expansion to capture the advantages of network efficiencies in reaching these areas (and passing those savings along to consumers).

D. Deploy High-Performance Broadband on Tribal Lands

1. Congress and the federal government should determine whether the particular challenges of Indian lands that have left too many behind for too long require specialized efforts: for example, to ensure that higher costs of construction do not inevitably lead to the exclusion of tribal lands from the results of reverse auctions.

2. An Office of Broadband Coordination for Tribal Lands should be established in the Executive Branch, perhaps in the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA). The office would act as a counselor and ombudsman to Tribal Nations and service providers and focus on deployment of broadband to tribal lands in order to ensure seamless interaction of various federal efforts.

E. Employ Reverse Auctions to Stretch Federal Dollars

1. Where the federal government is spending significant sums of money—on the order of tens of billions of dollars—to support capital expenditures for broadband deployment, reverse auctions can produce the most bang for the buck.

2. Reverse auctions should be structured to incentivize and reward the highest performance bids. One approach would be to establish performance tiers, with bids accepted for lower tiers only when there is no cost-effective bid for a higher tier. The first tier could seek bids for low-latency, unlimited-capacity, and 1 Gbps symmetrical service. After this top tier, reverse auctions would proceed to lower performance tiers.

3. Reserve auctions should be structured to promote innovation and new entrants.

4. Winners of grants, loans, and/or reverse auctions must be carefully monitored to ensure they are delivering what they have promised, and prompt action, including re-auctions, should be used to ensure that the auction process serves consumers effectively.

F. Establish Eligibility for Reverse-Auction Participation

1. Provider participation should extend broadly to include new entrants like rural electric co-ops and private-public collaborations.

G. Establish Requirements for Funded Deployment

1. Governments should ensure that middle-mile and backhaul facilities constructed with government support are open and available to multiple broadband providers.

2. In addition to meeting performance standards established by the funding process (such as the minimum 100/100 Mbps symmetrical requirement), recipients of federal deployment funding should be required to offer two standardized tiers of service: one that offers a lower-priced package for all consumers and one for income-eligible individuals. To that end, the FCC (or, in the context of legislation, Congress) should consider requiring that such recipients offer all consumers 50/50 Mbps with unlimited data for $50 per month and, for the reasons explained in Chapter 5, offer eligible, low-income individuals the same service for $10 per month. Such requirements should be updated as technology and demand for broadband services advance.

H. Increase the Effectiveness of Federal Efforts

1. Federal programs should look first to fund the capital expenditures associated with fiber-based networks before spending funds on lower tiers of service and, only where necessary, to support operating expenses.

2. To the extent that interim steps are needed before the deployment of High-Performance Broadband can be funded, ongoing financial support should realistically evaluate the needs of providers while ensuring that funding streams reflect and reinforce competitive environments.

3. Broadband deployment efforts should support capital expenditures for future-proof, High-Performance Broadband networks. But, depending on the funding level and the time needed for construction of future-proof networks, interim measures may be necessary in the short term to ensure that broadband is available to everyone in America. Thus, support should be structured so long-term investments are made only in networks that are "future proof" and able to meet the performance demands of people in the 2020s. Any interim funding of operating expenses should be:

   a. for a limited period only, leaving governments free to attempt again to fund High-Performance Broadband construction if that is needed,

   b. calculated not to displace private dollars or fail to reflect ongoing subscription revenue, and

   c. to the extent that multiple providers are serving the same location, apportioned by market share, an operating-subsidies approach that gives voice to consumer preferences.

4. NTIA, the FCC, and USDA should publish a comprehensive map that demonstrates the eligibility of different areas of the country for different broadband programs, including those administered by the Department of Agriculture and the FCC.

5. Congress should provide guidance to the USDA, NTIA, and FCC efforts on how best to synergize their respective expertise. Different federal agencies have different forms of expertise. No federal agency knows rural America better than the USDA. The FCC is the government's expert on reverse auctions. Through its efforts collecting information about broadband deployment across the nation, the NTIA has developed significant expertise working with localities and states to improve broadband access and provide issues-based educational resources to the field.

6. Federal efforts should support this national broadband agenda across the board:

   a. Agencies like Housing and Urban Development, the Department of Education, the Bureau of Indian Affairs, and the Federal Reserve Banks (which manage the Community Reinvestment Act)

should focus their broadband efforts on High-Performance Broadband. For example, the Federal Housing Authority should require that all new construction subject to its minimum standards will incorporate the infrastructure necessary for High-Performance Broadband into residential units and be available to multiple, competitive providers.

b. Where governments construct infrastructure, like highways, they should install broadband infrastructure that is available to multiple providers.

c. Federal procurement can also consciously spur deployment.

7. Federal agencies should ensure that, to the extent that common information is relevant to the administration of multiple programs, simple processes, including single applications where feasible, should be used.

8. The current system of funding the FCC's Universal Service Fund programs is not sustainable over the long run, as the revenue base of telephone-service providers continues to decrease. Congress should find a broader funding mechanism.

9. There is no reason for one part of the federal government to make payments whose purpose is simply to allow a broadband provider to pay back loans to another agency. (This recommendation is distinct from permitting applicants to access multiple sources of federal support to fund deployment—an approach that can reinforce the efficacy of multiple efforts.)

I. Support State Strategies Targeted for Specific State Circumstances and Needs

1. State governments should follow the principles set forth here as they devise their own state broadband plans, to the extent that they apply (for example, if they choose to conduct reverse auctions).

2. States should continue to target their money where it will have the greatest impact. For example, a very good use of small amounts of money might be for a state to help fund the work of creating a proposal for federal funding of capital expenditures. Similarly, states could use funds effectively by prioritizing the areas that have the least fiber and fund those areas' middle-mile/backhaul construction, which should be open to multiple providers. With open connections, these networks could lower the cost of residential network construction to retail providers and likely stimulate competition.

3. State strategies have the advantage of being comprehensive and should encompass all aspects of a broadband agenda, including deployment, competition, affordability/adoption, and support of community anchor institutions.

III. Conclusion

To be without robust broadband in the 21st century will be like living without electricity in the 1930s (a time when only about 11 percent of farms were connected)[292] or without a telephone line around 1950 (when, for the first time, more than half of American households had service).[293]

Even as late as 1990, low-income Americans, African Americans, Hispanics, Native Americans, and households located in areas of lower population density were all less likely to have a telephone at home than other population groups.[294]

Rural electrification and rural access to telephone service have been largely achieved.[295] In the next decade, access to High-Performance Broadband—in rural, suburban and urban areas—must also be universal. But deployment is not enough: Competition provides concrete consumer benefits and is the best way to safeguard against monopoly abuse. It is to that issue—the cost of limited competition—that we next turn.

Chapter 3: **Promoting Broadband Competition**

At the same time that income inequality has been growing in the U.S. economy, market concentration has also been on the rise.[296] Market concentration means that there are often just a handful of large businesses in a market—consider airlines, breweries, and hospitals, for instance. Market concentration adds to the importance of promoting competition, especially given the possibility discussed in recent economic literature that growing market power actually exacerbates economic inequality—worsening the structural trends discussed in Chapter 1.[297] In other words, lack of competition not only penalizes consumers in the manner traditionally expected (higher prices, lower quality, and slower innovation) but may also add fuel to the income-inequality fire.[298]

The Communications Act of 1934 and the history of action by the Federal Communications Commission (FCC) demonstrate that good policy can spur more competition—benefiting consumers:[299]

- Telecommunications carriers are required to connect their networks to each other, which expands competitive opportunities for smaller networks and increases the choice of network providers for consumers;[300]
- Telephone numbers are portable, controlled by consumers and not telecommunications companies, in order to allow consumers to more easily switch between competitors;[301] and
- Data networks were historically kept free of monopoly control by telecommunications companies, which allowed the development of hardware, like modems, and services, such as competitive internet-access providers.[302]

Today, concerns about competition in the broadband marketplace are real. Consider this: Many Americans have access to and many subscribe to broadband service with download speeds of 100 Mbps or above.[303] According to the FCC data collection (which systematically overcounts broadband deployment[304]), competition among providers offering 100 Mbps download broadband is slight: 83 percent of the population either live in an area with no service or are served by a monopoly or a duopoly.[305]

With limited competition, it is perhaps unsurprising that Americans pay some of the highest broadband prices in the world.[306] Among the 35 OECD countries studied, America was the second most expensive in 2017.[307]

In fact, competitive choices have generally been declining over the years as broadband technologies—and consumers' bandwidth requirements—have evolved. The FCC first established the minimum-speed benchmark for broadband services at 4 Mbps in 2010. At that time, more than 80 percent of Americans lived within an area where two or more providers offered the minimum broadband speed or better.[308] For 100 Mbps service today, the FCC's overly optimistic analysis estimates that only 55 percent of Americans have a choice between two or three providers.[309]

The implications of limited competition are obvious: We can expect people with only one choice to pay monopoly prices and people with only two to pay the higher prices typically charged by duopolies. People with three or more choices typically pay less. Clearly, people who can barely afford to pay a *competitive* price, say, low-income Americans, will not have the means to pay for service with artificially high prices.

Looking at the broadband marketplace through the lens of antitrust analysis offers some perspective. Consider, for example, that a typical merger of competitors—in any sector of the economy—resulting in a market being left with only one or two sellers would be presumptively illegal under the antitrust laws. It is hard to think of a major 3-2 or 2-1 merger that has been approved.[310] Indeed, in July 2019, the Department of Justice (DOJ) announced its view of a communications market that is very closely related to fixed broadband—mobile wireless communications—and emphatically rejected the view that three competitors would provide as much competition as would four. As the DOJ explained, a diminishment of the market from four to three providers would threaten competition and make it easier for the remaining carriers "to coordinate their pricing, promotions, and service offerings," which would result in "increased pricing and less attractive service offerings for American consumers."[311] In the fixed-broadband market, to have four competitors is a rarity—even three is a noticeable improvement over a monopoly or duopoly.

People and communities who are most likely to be impacted by limited competition include:

- **Middle-Class Households:** BroadbandNow found that households in states with a median household income of less than $60,000 (approximately the national median) frequently pay more for the same 25/3 Mbps service than do households in states with a median household income of more than $60,000. Households in the lower-income states are 40 percent less likely to be obtaining that service for $60 per month or less.[312]
- **Rural America:** BroadbandNow also found that the least dense 10 percent of areas defined by zip code pay an average of 37 percent more for residential wired broadband at 25/3 than those in the 10 percent most dense areas.[313] And only 4 percent of rural households have the choice of more than two options for 100 Mbps broadband; that drops to 1 percent in tribal areas.[314]
- **People with Lower Incomes:** Wealthier communities are approximately two to three times as likely to have more than two choices as communities with lower-than-average household incomes.[315]

Adoption trends (a topic discussed in more detail in Chapter 4) are also of interest. Indeed, the broadband adoption gap between urban and rural usage has been worryingly steady, running 10 to 13 percent.[316] At the 25/3 and 50/5 service tiers, households in poorer counties used broadband at much lower rates than places with the highest median household incomes and lowest county poverty rates.[317] To the extent that lower adoption

Open-Access Networks: The Network as Virtual Marketplace

Open-access networks can create a vibrant and innovative market for private competitors to offer High-Performance Broadband services.

Internet access networks have traditionally depended on a variety of specialized hardware devices (routers and switches) to move data traffic between internet service providers (ISPs) to the humble routers in most consumers' homes. "Network virtualization" replaces some of this specialized hardware with software. This virtualization facilitates retail competition.

Let's look, for example, at Ammon, Idaho. Nestled between the foothills and Idaho Falls, Ammon is one of the fastest-growing cities in the state, with a population more than 16,000.

Ammon focused on being an infrastructure provider rather than a service provider. The city built an open-access network that lets multiple, private ISPs offer service to customers over city-owned fiber. Ammon doesn't compete with ISPs on its network; rather, it leases access to its fiber network, acting as a platform for multiple ISPs to compete against each other, including against facilities-based competitors like the local cable company.

Ammon merely connects users to a local network, and connected users can choose—with just the click of a mouse—among multiple ISPs, which offer more than a dozen no-contract, no-cap plans from which to buy access to the wider internet. Ammon essentially made a philosophical decision not to be an ISP; instead, it would leave it to the private market to provide whatever services customers might want. (The city of Ammon, however, does offer a 5 Mbps Lifeline plan for qualified residents.) In essence, the physical infrastructure is run as a public utility in order to provide a virtual marketplace for services provided by third parties. Bruce Patterson, Ammon's technology director, compares it to an app store: "The market is not created by installing competing infrastructure. The market is created by a single

rates result from the higher prices that accompany fewer choices, limited competition itself is the culprit.

Who suffers when competition is limited? What should governments do, especially at the state and local levels?

The tradition of competition policy has focused on lowering barriers to competitive entry. That tradition goes back a long way, from a piece of plastic attached to the speaking end of an old-fashioned telephone in the 1950s to the enactment of the Telecommunications Act of 1996 to protection and promotion of competition in the Open Internet Order of 2015. There is more to do in the next decade.

I. The Geography of Limited Choice: Oases and Deserts

A. The Risks of Limited Competition

To the extent that lack of competition results in artificially high prices and/or lower quality, people in some areas are paying more than people in other areas for the same service. Or getting lower-quality service. Or both.

In a handful of major U.S. cities, ubiquitous, competitive High-Performance Broadband markets in the 2020s are likely. In places like Washington, D.C., and New York City,[318] large, regional economies and a critical mass of frequent technology users may attract multiple broadband providers. These are broadband oases, places where competition between multiple networks drives the price of High-Performance Broadband lower and the features of broadband forward faster. With high population densities and intense demand, broadband providers can build networks with tremendous capacity.

infrastructure capable of supporting any number of virtual infrastructures."

Soon after the service in Ammon launched, providers started to compete. "We had 1 Gbps service available when we launched," recalls Patterson. "Some required a contract. Pricing was $99 or $109 a month depending on the provider. Today, subscribers can get 15 Mbps service for free—though with no customer support—and up to 1 Gbps for as little as $9.99 per month. And now no provider requires a contract. So deep price cuts for the service all because we created a marketplace and the providers compete." Even after Ammon's monthly $16.50 utility fee, the total cost to consumers is substantially lower than the area cable provider's prices.

"Another price-reduction story would come from the local school district," Patterson adds. "We have cut their costs by over 60 percent. Basically, the local cable company provided fiber access to the local school district. We took five of the district's key locations back in 2013–2014 because we were 60 to 70 percent less in cost. The next year the cable company slashed their prices to keep the schools they had."

Ammon is not the only open-access network, nor is it the oldest. The Grant County (Washington) Public Utility District deployed a fiber-to-the-home network that is now a platform for more than twenty ISPs.

Open-access networks spur competition and real choices, facilitate economic opportunity and development, and enable innovation and new services. And, perhaps most importantly, open-access networks ensure communities have a strong voice in deciding their broadband futures.

In these major cities (or at least portions of them), competition for consumers may be intense, which lowers the cost of services and encourages further investment and competition on price, quality, and innovation. The future of the broadband market in these major cities is likely to feature the most rapid deployment of 5G, small-cell network infrastructure and the high-fiber backhaul necessary to support it. To the extent that 5G empowers competitively priced alternatives to fiber-to-the-home (FTTH), the places where 5G is deployed may have more choices from more competitors.[319] But 5G small cells will likely be deployed first to urban areas with the highest demand, which tend to be in wealthier neighborhoods, so their targeted, short-distance signals will be unlikely to reach poorer communities that often rely more heavily on mobile access.[320]

Consider the story of Cleveland, Ohio. In 2017, the National Digital Inclusion Alliance (NDIA) reported that, unlike the local cable company that was subject to a city-wide franchising agreement,[321] the incumbent

telecommunications company had not deployed fiber to Cleveland's highest-poverty neighborhoods.[322] NDIA and Connect Your Community analyzed where the incumbent telecommunications company had deployed its fiber-to-the-neighborhood (FTTN) service and where it had not. They discovered that this incumbent had not deployed its new fiber network to a majority of Cleveland's census blocks, including "the overwhelming majority of blocks with poverty rates above 35%." That company also failed to upgrade its legacy DSL copper wire system to newer standards, instead leaving residents living in 55 percent of Cleveland's census blocks with services no greater than 6 Mbps and an additional 22 percent with speeds of no greater than 3 Mbps. The NDIA found similar patterns in Detroit, Toledo, Dallas, and Dayton.[323] These stories from these cities and others[324] bear powerful witness to the need for additional competition that offers consumers better choices.[325]

Of course, the adverse impact of supra-competitive prices is not only about money. Lack of competition decreases incentives to upgrade service, add features, abolish usage caps, or otherwise innovate. A monopolist has little reason to offer a better product—a competitor is pushed to do so.

B. More Providers, More Competitive Benefits

Public policy should rest on the proposition that more competition, especially beyond one or two providers, will benefit consumers. The practical reason to support greater competitive entry is to remove the shadow of artificially high prices (or lower quality or less innovation or all of the above) from consumers.

1. Academic Research

The available research supports the commonsense notion that consumers benefit as the number of broadband providers increases beyond zero, one, or two. In 2018, a study from Harvard's Berkman Klein Center for Internet & Society examined the pricing patterns that result from the entry of community-owned fiber networks.[326] Although careful to note the limitations of its data, the study concluded that benefits from additional competition among networks that offered at least 25/3 broadband "ranged from a savings of 2.9 percent, or $19, annually in Tullahoma, Tennessee, to more than 50 percent, or $600, annually in Lafayette, Louisiana," a figure that is likely to be atypical.[327] In twelve cases a community-owned fiber network offered entry-level prices 20 percent or more lower than its private competitors. In four cases private providers were the lowest, ranging "from a 6.9 percent, or $50, [annual] saving for users of Charter Spectrum in Jackson, Tennessee, to about a 30.5 percent, or $298, [annual] saving, also for users of Charter Spectrum, in Churchill, Nevada."[328]

Competition delivers better offers across the board and pushes rivals to up their game. Thus, Analysis Group (2016) found that "[t]he availability of high-speed plans in a [metropolitan area] increases the likelihood that other providers will introduce higher-speed plans to match speeds being offered by their competitors."[329] Using service pricing data between 2012 and 2016, that analysis found two main impacts from the presence of a 1 Gbps internet service. First, new competition from 1 Gbps service led to a decrease in the price of competitors' plans that offered less than 1 Gbps download (but at least 25 Mbps download) by between $13.28 and $29.08 per month on average.[330] Second, the presence of each additional 1 Gbps service provider reduced prices from other providers' 1 Gbps services by approximately $50 to $60 per month—between 34 percent and 37 percent of the monthly price at the time.[331]

Molnar and Savage (2017) found that each additional competitor that is added to a market with less than four participants has a notable impact on quality by improving, for example, sustained download speeds or

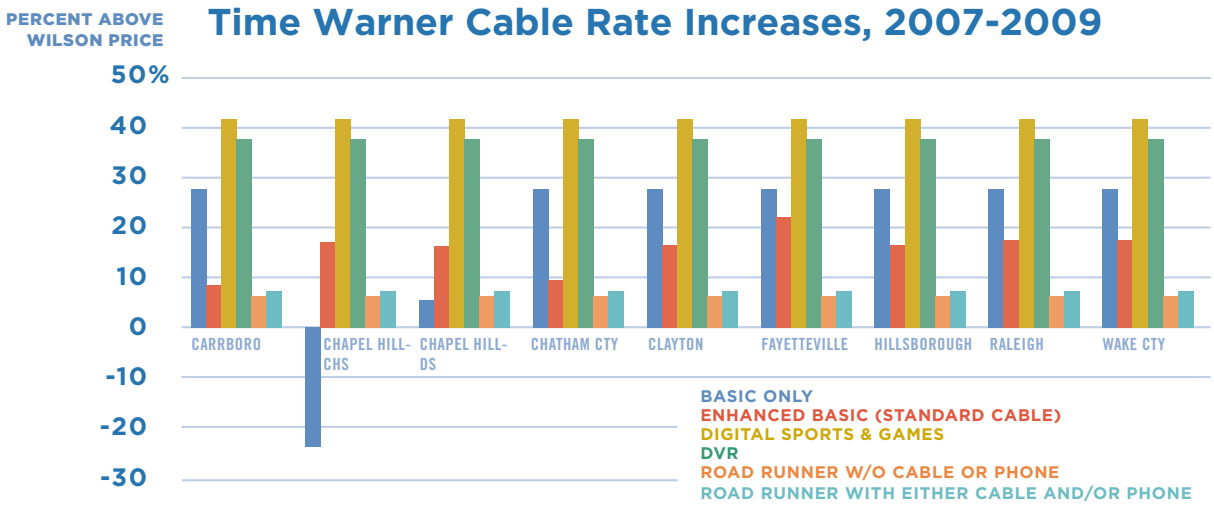
providing more reliable upload performance.[332] Earlier work similarly demonstrated that duopoly ISPs do not compete aggressively over prices,[333] with most of the significant price reductions from competition occurring in markets with at least three ISPs.[334]

2. On-the-Ground Evidence

The experience of individual municipalities offers salutary lessons. When Google Fiber rolled out service to Kansas City, the incumbent telecommunications company dropped its price to match Google's; the incumbent cable provider increased its speeds by three times, without raising its price.[335]

The FCC has found that the provision of municipal broadband in Chattanooga, Tennessee, led to lower rates, increased investment, and improved service from an incumbent broadband provider, whose download speed increased from 8 Mbps in 2008 to 106 Mbps in 2012, two years after Chattanooga's municipal broadband network began offering services to consumers.[336] And the new municipal entrant offered a better price; in 2012, Electric Power Board's (EPB) 30/30 Mbps service sold for $58, while the incumbent telecommunications company's fastest service (24/3 Mbps) was priced at $65, and the incumbent cable company's 20/3 service cost $62.85.[337] By September of that year, EPB upgraded all of its speed offerings without a price increase.[338] One year later, EPB reduced the price of its 1 Gbps symmetrical service to $70, where it essentially remains today.[339] In May 2019, the incumbent cable company was charging $100 per month for the same service in Chattanooga.[340] (In 2015, the FCC attempted to pre-empt such state laws in an order focusing on Tennessee and North Carolina, which is discussed in the next paragraph, but a federal court of appeals ruled that the agency lacked the ability to do so.[341])

Similarly, in Wilson, North Carolina, when faced with a municipal broadband entrant, an incumbent cable company held rates flat even as it raised rates in nearby geographic areas by up to 40 percent for comparable offerings.[342] By the FCC's calculation, new competition saved Wilson's approximately 50,000 residents more than $1 million per year.[343] One analysis graphically depicted the difference between rates in Wilson and surrounding locations by depicting the extent to which prices outside of Wilson increased relative to the same company's pricing in Wilson, which would be the price established at zero percent.[344]



Time Warner Cable raised rates in non-competitive areas around Wilson while holding Wilson's rates steady over 2007-2009 according to an analysis presented in committee at the State Legislature.

A similar pattern played out in Longmont, Colorado, when the municipal service NextLight fiber network began charging its early subscribers $59.99 per month for 1 Gbps service.[345] In response, the incumbent cable system lowered its prices where the two services competed, but not in nearby areas that the Longmont network did not reach. Cable customers paid between $110 and $120 for 1 Gbps service if they lived in areas surrounding Longmont, but only $70 if they lived within NextLight's service area.[346] As Chris Mitchell explains: "When a community builds its own network, it enters the market with a lower price than the incumbents had been offering. Often the incumbent then lowers their price—often even further than the municipal network is offering—so when a community starts offering a service, the prices typically drop."[347]

More robust analysis is needed of the competitive effects of entry into monopoly or duopoly broadband markets. That is made more challenging because of the difficulty of obtaining the pricing data that is offered daily to consumers. As long-time industry observer and analyst Joanne Hovis explains: "Phone and cable companies make data available on their websites, keyed to particular addresses, but comparing different packages is remarkably complex, including because of installation and equipment fees, bundling, and 'promotional' prices that may reflect short-term savings but then default to complex and, in some cases, unknown pricing at the end of a promotional period. And the complexity is increased by the fact that speeds are 'up to' rather than guaranteed, meaning that consumers may doubt whether they'll consistently get what they pay for. As a result, many consumers may struggle to compare packages."[348]

II. Bringing More Competition to More People

We must encourage competition to realize the full economic and social benefits of High-Performance Broadband.

A. Promoting Broadband Competition at the Local Level

Community-led efforts have supported new broadband entry, including from municipal-run networks and nonprofit rural electric cooperatives in more than 800 towns, cities, and counties across the nation. Many more municipalities collaborate with private providers to bring broadband to their communities.[349] Some communities have concluded that public investment justifies the assessment and assumption of financial risk.

Colorado Communities Are Doing It for Themselves

Colorado's Senate Bill 05-152 (2005) forbids local governments from providing telecommunications services or purchasing, leasing, constructing, maintaining, or operating any facilities related to providing telecommunications services either directly or indirectly. However, it provides an opt-out option in the form of a local election ballot specifying exactly what the locality would like to do; its plans cannot "make or grant any undue or unreasonable preference or advantage to itself or to any private provider of [...] telecommunications services."

Despite being burdened by delays forced by the requirement of passing referenda for municipal projects, Colorado cities have received overwhelming popular support for diverse methods of securing additional broadband deployment, which has resulted in competitive benefits for their residents.

Residents of Longmont, Colorado (population 86,000), were the first in the state to opt out of restrictions through a voter referendum. Longmont already had a 17-mile loop of fiber-optic cable installed around the city in 1997 as the result of an earlier deal with the local electric utility. Two attempts to form public-private partnerships had failed before the restrictive Colorado law passed. When the city began the ballot-initiative process in 2009, the Colorado Cable Telecommunications Association counterattacked, spending $200,000 fighting the initiative with robocalls and negative commercials. That negative campaign worked: 57 percent of the voters opposed the city's initiative.

In 2011, Longmont tried again, but this time with a better understanding of what would be needed to succeed. The city focused on community involvement and outreach, holding a series of town halls, conducting surveys, and using social media to understand local residents' concerns and educate them about the benefits of municipal broadband. The opposition was again well-funded, spending $900,000, but this time the ballot initiative was approved with 60 percent of the vote.

Here we examine:

1. efforts to facilitate private investment and deployment by lowering barriers to entry,
2. diverse forms of public-private collaboration,
3. the direct operation of municipal fiber networks, including middle-mile facilities,
4. broadband deployment by electrical utilities, including rural electric cooperatives,
5. competition in apartment buildings, and
6. pro-competitive state policies.

1. Lowering Barriers to Entry for Private Providers

Many local governments see before them new opportunities to develop High-Performance Broadband in their communities—and to reap the economic and social benefits that it will deliver to their residents and businesses.

One approach involves local governments adopting and executing policies to encourage private-sector deployment by reducing the costs incurred by broadband network providers. Here, local leaders, private industry, nonprofits, and municipal governments work together to identify community needs, local resources and assets, and steps necessary to deploy broadband networks. With planning in hand, a locality can adopt a package of economic-development incentives, redesign local administrative processes to streamline deployment logistics, or otherwise reduce barriers to entry.[350] For example, localities can provide easier access to infrastructure information.[351] Local building codes can adopt more connection-friendly standards, particularly for apartment buildings, condominiums, and cooperatives and in large planned developments.[352] The ability to access existing poles and similar infrastructure is also important for new entrants — as issue that has returned to prominence in the wake of the D.C. Circuit's October 1, 2019 opinion ruling that the FCC's order reversing the application of common-carrier provisions of the Communications Act to broadband internet-access service failed to consider the impact of that conclusion on the ability of broadband providers to gain access to poles and equivalent infrastructure.[353] As with the future of broadband service provided by Lifeline,[354] the Commission must now face directly the potential impact of reversing its prior net neutrality order on the ability of consumers to access broadband generally; an issue that, as with Lifeline, calls for congressional attention.

Rollout started in 2014, and by 2018, nearly all of the residents of Longmont could receive 1 Gbps symmetrical service from a local nonprofit, Longmont Power and Communications, which the city operates. More than 70 percent of the city's residents are subscribers, paying between $50 and $70 per month for 1 Gbps service. Benefits accrued also to the customers of the incumbent cable system, which lowered its prices to Longmont residents (but not for nearby subscribers that Longmont's system did not reach).

In 2015, Fort Collins, Colorado, won the ballot-approval process after educating the public about the benefits of fiber and public ownership. The ballot won in an 83 percent landslide. However, a second ballot initiative in 2017 was required to amend the city's charter and authorize the city to issue financing for its fiber broadband plan. In this second round, groups backed by private broadband providers spent $900,000, outspending citizen and business supporters 60 to 1. Still, the second ballot initiative passed with 57 percent of the vote.

In May 2018, the city issued approximately $142.2 million in revenue bonds in order to fund construction of the fiber network, cover the needed capital costs, and get the service on its feet. Bonds sold out in two days. The city launched the Connexion project in August 2019 and also announced that an income-qualified full-gig-speed digital equity tier would be made available. Connexion is hoping to connect all residents, businesses, and organizations within the boundaries of the city over the next 36 to 48 months.

Centennial, Colorado, was sitting on 42 miles of highly underutilized fiber that was only really being employed for the city's weather and traffic management systems. A 2014 ballot initiative asked residents to let the city offer its fiber to the public. In 2018, the city of Centennial completed construction of a 432-fiber-strand backbone that connects key city sites, including its community anchor institutions. The completion of the backbone also provides the opportunity to both existing and new broadband providers to tie into the new infrastructure with the goal of providing better and more competitive choices and services for city residents. Ken Lucas, a Centennial city council member, said that "companies such as Comcast, CenturyLink, and AT&T are not pleased with

Centennial's move because they have to compete with everyone else."

This publicly owned open-access fiber network has a long-term lease and service agreement with Ting Fiber to build out more connections to its residents and another lease agreement with Avata Networks to provide broadband service to businesses and residents. Plans for households range from 5 Megabits per second for $19 per month to symmetrical gigabit speeds for $89 per month.

"What the continued momentum of very successful SB 152 opt-out ballot initiatives demonstrates is how critical access to high-speed, affordable broadband is for every citizen in the state," said Tony Neal-Graves, executive director of the Colorado Broadband Office. "The question is no longer if we should do it but how."

Government can also facilitate access to the local infrastructure needed for deployment, including "government-owned fiber, conduit, and real estate."[355] When governments build infrastructure, they can anticipate broadband demand by installing accessible conduit for future fiber installations or simply include dark fiber within construction of roads, traffic systems, and water or electricity service installation.[356]

The impact on the costs of deployment are direct. Speeding and easing the process for approval of construction permits and providing accurate, easy-to-use infrastructure maps and a streamlined application review process reduce the length and cost of deployments. "Dig once" construction practices improve efficiency and save money, for example, by installing bigger fiber conduit to accommodate future broadband providers.[357]

Google's initial fiber deployment into Kansas City served as an early indication of how this cooperative process between a municipality and a new broadband provider could improve the economics of deployment. In February 2010, Google announced that it would build and test an ultra-high-speed broadband network of fiber-to-the-home connections that would provide 1 Gbps service to consumers, a nearly unheard-of proposition at the time.[358] Kansas City, in Kansas and Missouri, became the site of the first major deployment. Google funded the build-out,[359] while Kansas City provided its own government resources to reduce costs. For example, the Missouri side of the deployment required at least 37,000 construction permits, which would have cost approximately $2 million alone had the city not waived the fees.[360] As a result of this cooperation, financial analysts estimated that Google spent $84 million to build a fiber network to 149,000 homes, with the cost of passing each home at $500 to $674.[361] At the time, estimates for average fiber deployment were between $600 and $1,800 per home in urban and suburban areas.[362] Although Google Fiber has not met all initial public expectations, the Kansas City experience offered municipalities insight into the impact of new entry.

Fixed 5G broadband is touted as a potential competitor—and that may be true for some places. In dense urban areas, 5G will be deployed by employing small cells that send and receive signals in tightly constricted service areas. Neighborhood-by-neighborhood return-on-investment estimates will guide deployment strategy. The result could very well mean that deployment is concentrated in the wealthier parts of communities. Small-cell transmitters often require pole attachment rights or access to other infrastructure, so local governments will have a role in achieving universal coverage.

San Jose, California, confronted the challenge of 5G deployment early on. After cellular network providers reached out, the city sought to ensure that 5G would reach its unserved and underserved residents. In 2018, 28 percent of the city's total population (approximately 95,000 residents) lacked broadband access at home.[363] So San Jose negotiated separate agreements with AT&T, Verizon, and Mobilitie that addressed universal coverage concerns and more,[364] leading to the "largest small-cell deployment of any U.S. city" thus far.[365] Small cells are to be deployed on approximately 4,000 city-owned light poles throughout San Jose, with the transmitters and hundreds of miles of additional fiber requiring more than $500 million in private-sector investments.[366] Verizon agreed to deploy small cells, install fiber, and upgrade its macro-cell towers to improve its existing 4G LTE network.[367] Mobilitie's agreement with the city includes an obligation to deploy 5G wireless services to traditionally underserved areas.[368] AT&T and San Jose went one step further and formed a 10-year public-private partnership to deploy an extensive network of small cells.[369]

These deals are slated collectively to contribute about $24 million over the next decade to the city's Digital Inclusion Fund, the largest municipal effort of its kind in the country. That includes plans to connect those 95,000 unserved residents with wireline broadband and provide them with the skills training and resources necessary to use it.[370] In other words, the city focused on ensuring that 5G deployment would deliver not just broadband across the city but also broad-based community benefits. It is exactly this kind of municipal policy that provides competition and connectivity to the entire community—addressing the issue of selective deployment that has arisen in Cleveland, Dallas, Dayton, Detroit, and Toledo.[371]

However, San Jose's model for experimentation and facilitation has been disrupted by the FCC's decision in 2018 to restrict the rights of municipalities and states to play a constructive role in the deployment of broadband. The FCC imposed a nationwide limit on the fees that municipalities can charge for small-cell deployment. The decision has met fierce criticism. Blair Levin, former FCC chief of staff and executive director of the FCC's National Broadband Plan, said that "local governments have a strong recent track record of endeavoring to enable and facilitate broadband deployment." By contrast, per Levin, the FCC decision represents a "power grab," by which one "federal agency, with no expertise in municipal finance and at no cost to itself, mandat[es] that all localities have to lower the costs to all carriers, whether or not the carrier will be deploying new network facilities or whether or not the local community obtains any benefit."[372] More than thirty cities, counties, and municipal associations, including San Jose, have asked for a court review of the FCC's decision, seeking to protect their rights to play a meaningful role in the way their communities are impacted by wireless broadband deployment.[373] The case was briefed in the summer of 2019, with a decision expected late in 2020. The ability of the FCC to preempt local authority in these circumstances may also be impacted by the DC Circuit's ruling on October 1, 2019, that the FCC cannot issue a blanket preemption of state laws that protect net neutrality.[374]

2. Fostering Public-Private Collaborations

Pro-competitive collaborations need not be complex or grand in scale. For example, a municipality with extra fiber capacity can find ways to provide access to newer broadband providers. Wicked Broadband in Lawrence, Kansas, to cite one case, leased fiber from the town to develop the resources necessary for its own small-scale fiber deployment.[375] In 2005, Joshua Montgomery and Kristie Adair started building a wireless network for Lawrence.[376] After funding for their nonprofit's efforts to build a low-cost network for the city faltered, they formed "Wicked Broadband," a for-profit company, to obtain the financing necessary to provide the physical infrastructure for local services.[377] Inspired by Google Fiber's efforts to deploy a 1 Gbps network just 40 miles away, Wicked Broadband used Lawrence's existing fiber along major roads to establish 1 Gbps broadband services to a handful of locations, including several fraternities and sororities at the University of Kansas,[378] and then in 2013 to residential customers.[379]

Municipalities should carefully consider financial risks and structure any private-public agreements accordingly,[380] so that they undertake the kind of functions at which they are good and leave other tasks to private companies.[381] For example, Champaign and Urbana, Illinois, partnered with the University of Illinois "to build a middle- and last-mile fiber network to connect 250 community anchor institutions as well as 1,000 low-income homes throughout the region."[382] Because neither the university nor the two cities wanted the direct responsibility of managing further expansion,[383] the cities partnered with a private company to expand the fiber network's reach to the rest of the community.[384] After that company was purchased, the acquiring company resumed expansion plans on similar terms and continues to provide competitive fiber to the home to many residents in these cities.[385]

The experience of Westminster, Maryland, illustrates two important points. First, when municipalities bear financial risk, extra diligence is required. Second, the strength of these types of collaborations is in their flexibility, which defies easy categorization. In that city, local officials had long contemplated how they could bring additional competition to a duopoly market. In 2012, the city entered into a highly customized public-private collaboration with Ting Internet, a competitive broadband provider, to manage a local network and offer consumer internet services ranging up to 1 Gbps for at least 10 years.[386] The city assumed responsibility for all financing, construction, and maintenance of the network, owning the entire fiber-optic infrastructure, while Ting became both the network operator and a service provider, "responsible for purchasing, installing, and operating all networking equipment needed to activate the network and provide services to residents and businesses."[387] As a network operator, Ting initially pays a baseline fee of $6 per location passed and an additional $11 per active network subscriber.[388] Any debt obligations that arise are divided between Ting and the city according to a pre-established formula.[389] For this approach, Westminster and Ting were awarded "Community Broadband Innovative Partnership of the Year" by the National Association of Telecommunications Officers and Advisors.[390]

3. Owning and/or Operating Fiber Networks

Municipalities may own or build network facilities, which gives rise to three additional means of boosting broadband competition: (i) municipal networks providing service directly to residential and small-business consumers, (ii) open-access systems, and (iii) middle-mile models.

Direct Consumer Service Model

Across the nation, at least 55 municipal networks are serving more than 100 communities with publicly owned networks offering residential fiber service. In addition, some of the 70 communities with publicly owned, cable-based internet services are able to provide 1 Gbps services, which means that more than 150 communities across America have access to 1 Gbps broadband service through municipally owned networks.[391]

This approach—full municipal ownership—means that the locality owns and operates the broadband network.[392] FairlawnGig, a fiber-based broadband service owned and operated by the town of Fairlawn, Ohio, is a recent example. This town of 7,400 people found itself facing an economic conundrum. On the one hand, the town had already seen employment in traditional industries like manufacturing dry up.[393] On the other hand, more than 20,000 workers continued to work there.[394] But with this swell of commuters overwhelming networks during the day, the lack of adequate broadband service was putting pressure on many businesses to move away and leaving others, like the town's two major hotels, without sufficient connectivity.[395] Despite pleas from city officials to upgrade their services, neither of the two incumbent telecommunications companies that service different parts of Fairlawn nor the incumbent cable company were prepared to build out better broadband.[396] In January 2015, the town decided to spend $10 million to finance its own broadband deployment.[397] FairlawnGig, the municipal broadband utility operated by the City of Fairlawn, now reaches more than 1,500 homes and 250 businesses within the Akron/Bath/Fairlawn Economic Development District, turning a profit[398] and planning further expansion.[399] Residents can receive symmetrical speeds of 1 Gbps for $75 per month, and some businesses can now receive up to 100 Gbps.[400] More than half of the residents in the town had signed up by early 2018.[401] The town itself has seen an 8.7

percent rise in property values, while attracting new engineering, medical, and accounting firms and the headquarters of larger businesses.[402]

Open-Access Model

A municipality can expand its local fiber infrastructure to neighborhoods without stepping into the full-fledged role of retail broadband provider. The municipality provides open access on its network to any businesses willing to provide retail internet services to consumers. In 2017, Harvard University's Berkman Klein Center for Internet & Society published an excellent study on a notable American example: Ammon, Idaho, which is discussed in more detail in the accompanying sidebar.[403] Ammon adopted a creative approach to serve approximately 1,300 homes.[404] The critical facet of Ammon's approach is that each residential customer pays two different fees—one to the municipality to compensate for the cost of network construction and then a separate subscription fee to the broadband service provider that actually provides internet access. The economic value to Ammon is expected to be around $43.6 million over a 25-year period, compared with total municipal deployment costs estimated to be less than $10 million.[405]

Middle-Mile Model

The "middle mile" model builds networks only to some parts of a community—for example, to key community institutions—but then allows any private broadband provider to build extensions from the middle-mile network (known as "laterals") to reach residential customers. Here the municipality provides access to broadband providers but does not itself provide services to homes and businesses. Middle-mile networks do not have to be built especially for this purpose: Municipalities and other large public organizations across America have been choosing to build their own fiber networks for nearly two decades to reduce the annual costs incurred for internet services, improve their control over fiber infrastructure upgrades, and introduce smart infrastructure, like networked traffic systems. For example, Virginia Beach, Virginia, saves more than $500,000 per year on broadband subscription fees by connecting the city's government buildings, schools, libraries, and police and fire stations through its own fiber network.[406]

Across the nation, more than 190 communities use public fiber in this manner to serve parts of their business community, particularly downtown business districts.[407]

It is easy to understand why access to a middle-mile network incentivizes private residential deployment—to put it concisely, a broadband provider only needs to reach from a home to a nearby node on the middle-mile network, thus reducing its cost of infrastructure investment.

4. Utilizing Public Electric Utilities and Electric Cooperatives

Municipally-operated fiber networks and rural electrical cooperatives employ two approaches to advance their communities' access to High-Performance Broadband. First, where fiber has already been deployed to enhance the operation of the electric grid, local electric utilities enjoy economies of scope—existing assets provide the basis for new services. Second, rural electric cooperatives—member-owned organizations specializing in the deployment of electricity to rural areas[408]—are natural candidates to deploy broadband fiber themselves. Private-private collaboration can also produce greater deployment. For example, rural telephone companies and rural electric cooperatives can work together by combining assets and expertise.[409]

5. Promoting Competition (and Deployment) in Apartment Buildings

About 30 percent of Americans live in apartment buildings or similar dwellings, like townhouse rental developments or public housing.[410] Given the population density of such living arrangements, multi-tenant environments (MTEs) are a natural place to deploy broadband in ways that stimulate competition.[411]

A real obstacle to deployment in urban areas takes the form of exclusive access arrangements negotiated between landlords and ISPs. Although the FCC has policies that are supposed to allow competitors to have access to MTEs, it had allowed landlords to enter into exclusive marketing arrangements with cable operators and other ISPs. In July 2019, the FCC opened a proceeding to re-examine these rules and consider additional actions that it could take to promote competition.[412] However, at the same time, by a divided vote, it pre-empted a San Francisco city ordinance that required landlords to allow competitors to share the use of inside wiring when feasible.

The FCC should eliminate exclusive multi-unit contracts that require residents to pay for broadband services they neither want nor use. But even as the FCC proceedings play out, experiments are working at the local level.

Report co-authors Chris Mitchell and Hannah Rank labeled one example in San Francisco as a "new model" for bringing broadband to public-housing residents.[413] There, Monkeybrains, a local broadband provider, launched an effort with the City of San Francisco through which it offers up to 1 Gbps connectivity to residents in more than 400 units across two affordable-housing complexes.[414] With access to city-owned dark fiber, Monkeybrains was able to offer broadband service to residents at a cost of $10 per month—paid by the local housing development corporation, not the residents themselves. The local housing development pays an estimated $50,000 per year, roughly half of the annual cost proposed by the cable incumbent's plan to offer a single Wi-Fi hub per building.[415]

Another example comes from Starry Internet, which offers fixed-wireless broadband service.[416] Starry has focused on public and affordable housing units. Starry offers "communities free, common-area Wi-Fi and individual internet service plans for as low as $15 per month (all inclusive) for 30 Mbps down/up with no data caps or complex eligibility requirements."[417] The Starry Connect program works with building owners so that any resident can receive its broadband service.[418] By mid-2019, Starry was successfully offering its $15-per-month plan in more than 2,000 apartment units in New York City.[419]

All "Broadband" Is Not the Same

Fiber-based networks are poised to fulfill the usage demands of the next decade, warranting their treatment as High-Performance Broadband. But what about other technologies—how should policymakers regard their competitive significance? Speeds are one consideration. But other performance criteria determine what are competitive alternatives to fiber-based networks. These criteria include latency, network architecture, usage limits (hard caps or deprioritization), and pricing.

Mobile Broadband

On the basis of speeds alone, mobile broadband can match some wireline services. But the FCC's 2019 Broadband Deployment Report finds that mobile services are not currently full substitutes for fixed services. The core distinction between fixed and mobile broadband is driven by Americans' voracious appetite for data. The average wireline broadband household in 2019 uses 271 GB per month, between 55 and 110 times as much as the average mobile user. And even when they are on their smartphones, Americans primarily rely upon their fixed networks and Wi-Fi routers for the vast majority of their home data use.

Mobile broadband networks offer "unlimited" plans but, due to their architecture, deliver "unlimited" by limiting the speeds of heavy users—for example, de-prioritizing when customers use 20 to 50 GB in a month. By contrast, most wireline broadband services either do not have a monthly data cap or only begin to charge for additional data after 1 TB is used in a month. Price is also a factor. Research by Recon Analytics suggests that the price per GB of mobile data is between three and five dollars, substantially more than the 20 to 30 cents per GB that typical wireline users pay per month.

Fixed Wireless

In remote rural areas where wireline access has been more difficult to achieve, terrestrial fixed-wireless broadband systems ("fixed wireless") have been used to bridge the gap between wireline broadband and mobile, wireless systems. Fixed-wireless transmission towers connect to the internet through either fiber or, in more remote connections, micro-

Broader efforts are reaching residents of public and affordable housing across the country. In Fresno, California, the local housing authority has brought more than 1,300 mesh-network Wi-Fi connections to residents, as part of the ConnectHome initiative created by the U.S. Department of Housing and Urban Development (HUD).[420] Now leading the ConnectHome efforts, the nonprofit EveryoneOn has worked with public housing agencies, local governments, broadband providers, and other nonprofits to help provide home broadband access to 37 percent of school-age children who live in HUD-assisted housing across 27 cities.[421] Local leadership is bringing broadband to affordable housing in Kansas City, Missouri;[422] Austin, Texas;[423] and Wilson, North Carolina.[424] For example, with the help of a variety of other philanthropic and corporate partners, the Housing Authority of the City of Austin (HACA) partnered with Google to provide free basic internet access to 1,838 residential public-housing units.[425] Similarly, in coordination with the local housing authority, Wilson's Greenlight Community Broadband service provides symmetrical 50 Mbps service to North Carolina residents for $10 per month, with the modem and billing process handled by the housing authority.[426]

6. Hindering and Helping Competition—State Policies

Efforts at incentivizing broadband deployment can benefit both communities where there is no broadband (the focus of Chapter 2) and where there is limited competition (the focus of this chapter). Chapter 2 reviews the hard work of many states in promoting greater access to better broadband. In addition to those overarching efforts, there is a competition problem that exists in some state laws, which we discuss here.

From a competition viewpoint, there is a substantial problem at the state level; nineteen states currently have laws—typically passed at the urging of incumbent broadband providers—that hinder municipal broadband projects.[427] Many of these laws also prohibit a substantially broader range of public-private collaborations, without regard to actual financial risk.[428]

So, for example, some states—including Texas, Pennsylvania, and Missouri—directly prohibit localities from selling broadband services.[429] Nevada forbids municipal networks in localities with more than 25,000 people or counties with more than 50,000 people.[430] Besides placing significant restrictions on municipal financing, Florida imposes additional taxes on municipal broadband networks, placing them at a significant pricing disadvantage relative to the major broadband providers.[431]

Like plants growing through the cracks in concrete, some municipal networks are able to succeed despite these restrictions. In Florida, both

wave signals, and they have traditionally been capable of allowing subscribers to access the network at download speeds of between 5 Mbps and 50 Mbps. Each new transmission tower can currently handle a total of 5 to 10 Gbps, so it could only support 100 Mbps services to fewer than a couple hundred families at peak times. To avoid congestion problems, most fixed-wireless systems impose data caps between 10 and 300 GB per month.

The potential for 5G fixed service in some places, deployed over some time period, is real. But the uncertainty over its broad and/or speedy deployment is enough that policymakers should welcome fixed 5G as a complement to competition but not a substitute for pro-competition policies. Even T-Mobile, a fierce proponent of wireless broadband, admits that, as a matter of physics, high-frequency millimeter wave (mmWave) "spectrum has great potential in terms of speed and capacity, but it doesn't travel far from the cell site and doesn't penetrate materials at all. It will never materially scale beyond small pockets of 5G hotspots in dense urban environments."

Low- and mid-band 5G frequencies may offer additional wireless broadband capacity and speeds only incrementally better than the best 4G LTE services, but they cannot offer the performance of wireline networks. mmWave-based 5G can be effective over short distances but will require an extensive network of fiber from each closely placed node. By one estimate, providing 5G services to only the top twenty-five American metropolitan land areas will require approximately 1.4 million miles of fiber cable (in a country in which all of the roads total only four million miles). It is possible that a great deal more fiber will be deployed to all parts of America to support new, high-performance 5G services; it is more likely that 5G fixed deployment will remain a geographically limited service for much, most, or all of the next decade.

Satellite

Rural areas are not likely to receive affordable High-Performance Broadband service from satellite providers. In 2018, the satellite industry was capable of offering consumer services with download speeds up to 100 Mbps, albeit with substantially higher latency, but pricing for service is substantially more expensive than wireline services. For example, 100/3 Mbps service

for $200 per month in 2018 was roughly three times the cost of comparable wire-line service.

The next generation of low-earth-orbit satellites will be substantially cheaper to build and deploy, but their future is still uncertain. Their lower point of orbit opens up the possibility of using a broader range of deployment approaches while also reducing latency substantially. And they may be of particular value in rural areas, but they have yet to demonstrate widespread success and are limited by spectrum availability.

In conclusion, the prospect of more forms of High-Performance Broadband from any of these technologies should be encouraged, but that possibility should not be treated as lessening the need for pro-deployment and pro-competition policies.

Ocala and Bartow have offered broadband networks for some time, with revenues sufficient to overcome the additional state taxes placed on them.[432] Other municipalities in states like Colorado and Louisiana must face a costly referendum process, but as successful broadband networks demonstrate their value, the cracks in the concrete grow larger, enabling others to break through.[433] (The Colorado experience is described in an accompanying sidebar.)

Still, there are signs that the pendulum is swinging in favor of competition. For example, in 2019 Arkansas enacted new legislation that allows local governments to build broadband infrastructure,[434] overturning parts of a state law passed in 2011 that had forbidden the practice.[435] This expansion is limited in scope (a last-minute amendment severely restricts funding sources[436]), but communities in Arkansas now have another strategy to pursue in their efforts to remedy the state's lack of connectivity. Other victories are more subtle, such as New Hampshire's 2018 authorization of municipal bonds for broadband infrastructure financing.[437]

As of August 2019, legislation was also pending in North Carolina, the home of Wilson's municipal-broadband system.[438] North Carolina's FIBER NC Act would give municipalities and local government the authority to invest in publicly owned broadband infrastructure in order to work with private-sector partners, a change from North Carolina's prior restrictions on municipal financing strategies.[439] Still, the state's current law stopped Wilson's 1 Gbps fiber service from continuing to be offered in a nearby town in the wake of the FCC's unsuccessful effort to pre-empt the North Carolina statute.[440]

B. Assessment of Current Federal Broadband Programs

Federal policy has long focused on deployment of broadband to unserved areas.[441] Two areas of federal policy that impact market entry are worthy of a brief review here.

1. Limiting Deployment That Would Help Consumers

The federal government administers a number of grant programs and economic incentives designed to facilitate broadband deployment, all in slightly different ways, but they generally focus on deployment, not competition, and include work of the FCC, the U.S. Department of Agriculture's Rural Utilities Service, the U.S. Department of Commerce's Economic Development Administration[442], the U.S. Department of Housing and Urban Development, the Appalachian Regional Commission (ARC), and the Institute of Museum and Library Services.[443]

For example, the Community Reinvestment Act (CRA) can be used to improve broadband accessibility as part of a community development initiative (an approach that has been sparked by the tenacious work of Jordana Barton of the Dallas Federal Reserve Bank and her colleagues at the Kansas City Federal Reserve Bank[444]). The New Markets Tax Credit Program[445] can reduce the overall costs of broadband deployment through more beneficial financing and tax options.[446] Other strategies, such as the use of Tax Incremental Financing (TIF) or special "economic development district" options under federal law, can improve a project's cost profile.[447]

Although federal programs could support competitive entry if designed to, some are expressly planned not to do so. That arises from the so-called "overbuilding" limitations that are discussed in Chapter 2 but that also impact the entry of new competitors. So, for example, the USDA's new, $600 million ReConnect program for rural connectivity funds construction only in places deemed to be without "sufficient access" to broadband (now defined to be an area where at least 90 percent of the households lack access to services that deliver 10 Mbps downstream and 1 Mbps upstream[448]; 10/1 Mbps service is, of course, not even broadband under the FCC's current definition).

2. Adopting Pro-Competitive Spectrum Policies

Spectrum policies serve the public interest by facilitating the use of both licensed and unlicensed spectrum; the sharing of frequencies between users, including governmental and private users; the construction of auctions (as discussed in Chapter 2); the review of proposed transactions combining spectrum holdings through the use of the so-called spectrum screen to avoid excessive concentration of spectrum holdings; and experimentation. Experience shows that spectrum can provide an entry path to new broadband competition outside of the procurement of licensed (and often expensive) spectrum.

Fixed wireless broadband is already taking a variety of forms. For example, in the 2018 rural broadband auction discussed in Chapter 2,[449] wireless internet service providers (WISPs) were two of the top three winners and eight of the top thirteen.[450] In Philadelphia, where much of the city confronts a wireline broadband duopoly, Philly Whisper has been offering fixed wireless services to a handful of neighborhoods since 2015.[451] Services are modest, but so are prices, at a flat $50 for at least 25 Mbps (and substantially faster speeds at non-peak times).[452]

WISPs primarily rely on unlicensed spectrum and the coordinated sharing of unused spectrum. If more valuable mid-band spectrum is opened for unlicensed and shared use, as the FCC has proposed in two pending rulemakings,[453] WISPs and other rural providers will be able to offer fixed wireless service at far higher speeds.

Other alternatives are emerging. New companies, such as Starry and Common Networks, have recently begun to offer new last-mile fixed wireless services using mmWave spectrum, although their services are not identical. Using a grid of wireless receivers that retransmit signals to form a continuous network, Common Networks has deployed its hybrid mmWave and unlicensed microwave band (5 GHz) system to a handful of communities in Northern California, offering symmetrical 75 Mbps service for $50 per month, and it has announced plans to upgrade the service to 500 Mbps.[454]

By using targeted transmitter-receivers directed to line-of-sight antennas, Starry has begun to offer a "no-contract, no-data-caps, no-hidden-fees plan of $50 per month for 200 Mbps download/upload" internet in parts of Boston, Denver, Los Angeles, New York City, and Washington, D.C., and it is expanding to other dense urban areas.[455] Starry recently won a series of spectrum licenses through the FCC's auction process, allowing it to increase its maximum transmission capacity greatly in several cities across 25 states.[456]

The FCC should act to promote new broadband services from new competitors. As Michael Calabrese, director of New America Foundation's Wireless Future Project, explains, "5G is not the only wireless game in town."[457] Thus, the FCC can, as urged by public-interest organizations, promote spectrum sharing in critical mid-band spectrum[458] and increase capacity for Wi-Fi in order to improve broadband deployment in unserved

and underserved areas.[459] Promoting the sharing of key frequency bands would "empower a wide variety of use cases ranging from rural and small wireless internet service providers, to ports and community anchor institutions, to hotels and other venues, to utilities, factories, and critical infrastructure companies."[460]

At the same time, opening up the 6 GHz band would "bulk up" Wi-Fi networks, which already are critical conduits of connectivity to wireless devices, transporting more data traffic than mobile cellular networks.[461] Calabrese offers this prediction: "Next-generation Wi-Fi 6 will be at least as important as 5G, particularly for fast and affordable connectivity in any home or location with a fixed broadband connection."[462] The combination of spectrum sharing and increased Wi-Fi capacity can allow wireless providers to do their best to challenge broadband competitors. According to the Wi-Fi Alliance, Wi-Fi contributes $499 billion in economic value to the United States today, a figure estimated to grow to $993 billion by 2023.[463]

III. Policy Recommendations to Promote Broadband Competition

In this section, we propose policy recommendations to further broadband competition to the benefit of consumers. Many of the recommendations in Chapter 2 promote deployment generally, including by competitors. Funding should be allocated based on competitive processes, such as reverse auctions (Chapter 2, Recommendation E), and employed wherever the use of funds would advantage a community, even when this consumer benefit stems primarily from increased competition (Chapter 2, Recommendation C-3). When federal funding is used on infrastructure projects, such as highway construction, fiber should be installed and made available to multiple providers (Chapter 2, Recommendation H-7).

Many recommendations in Chapters 4 and 5 further consumer choice. Individual broadband service support for low-income families, such as the Lifeline program, should be applicable to a wide range of service providers, not just a few ISPs (Chapter 4, Recommendation A-2). Deployments made to community anchor institutions (CAIs) should be subject to competitive-bidding processes, which lower the cost of procurement (Chapter 5, Recommendation B-1), and community anchor institutions should be empowered to act as launching pads for additional connectivity options to their surrounding communities (Chapter 5, Recommendation E). In addition, the following policies would support the deployment of competitive broadband networks.

A. Promote Broadband Competition at the Local Level

1. Policymakers at all levels of government should encourage new entrants and the deployment of High-Performance Broadband to everyone in a community. For example, governments should consider:

    a. Public Electric Utilities and Electrical Cooperatives. Existing electricity providers, such as rural electric cooperatives, have a number of advantages, such as existing infrastructure, that make them prime candidates for deployment of broadband connections.

    b. Competition (and Deployment) in Multi-Tenant Environments, including Public Housing. Given the population density of apartment buildings and similar dwellings, policymakers at all levels should ensure the ability of competitive providers to reach residents, including in public and affordable housing.

c. Private-Public Collaboration. Local governments should consider a variety of private-public partnerships to increase competition. Simply starting with an inventory of available fiber infrastructure in a community can jump-start a local strategy.

d. Ownerships and/or Operation of Fiber Networks. Local governments should consider whether the operation of fiber networks would further competition in their particular circumstances, including the operation of middle-mile networks and open-access networks.

2. Remove Limits on Local Decision-Making That Spurs Competition.

a. States should repeal and, if necessary, Congress should pre-empt current state laws that restrict municipalities and counties from experimenting with various ways of increasing High-Performance Broadband deployment. Whether these local governments and the communities do so or not should be left up to them.

b. As a matter of federal and state law, municipalities should be able to negotiate pro-consumer, community-wide deployment of broadband networks as part of agreements that allow for the use of municipal resources.

B. Enact Stronger Federal Policies to Spur Broadband Competition

1. Multiple federal programs—including from the Departments of Commerce, Housing and Urban Development, and the Federal Reserve Banks through the Community Reinvestment Act—should be optimized to spur greater choices for consumers. The FCC should eliminate exclusive multi-unit building contracts that require residents to pay for broadband services they neither want nor use.

2. Pro-competition spectrum policies should be pursued.

a. To enable greater competition and maximize spectrum efficiency, the shared use of spectrum should be encouraged, including between governmental and private users, to improve broadband deployment in unserved and underserved areas and by smaller and new broadband providers.

b. More unlicensed spectrum should be provided to meet growing Wi-Fi demand.

c. Continue to use the so-called spectrum screen in reviews of mergers and acquisitions that include spectrum licenses to prevent anticompetitive concentration of spectrum holdings and/or constrain competition.

C. Execute Additional Pro-Competition Recommendations in Other Parts of This Report

1. Many of the recommendations in Chapter 2 promote deployment generally, including competitive entry:

a. Funding should be allocated based on competitive processes, such as reverse auctions (Chapter 2, Recommendation E).

b. Support for deploying competitive networks (Chapter 2, Recommendation C-3).

c. When federal funding is used on infrastructure projects, such as highway construction, fiber should be installed and made available to multiple providers. (Chapter 2, Recommendation H-6b).

2. Many recommendations in Chapter 4 further consumer choice. For example, to make Lifeline service more accessible, more entities, including community-based institutions, should be allowed to provide Lifeline services as Lifeline Broadband Providers to low-income families (Chapter 4, Recommendation A-2).

3. Recommendations in Chapter 5 also further consumer choice.

   a. Deployments made to community anchor institutions should be subject to competitive-bidding processes, which lower the cost of procurement (Chapter 5, Recommendation B-1).

   b. Community anchor institutions should be empowered to act as launching pads for additional connectivity options to their surrounding communities (Chapter 5, Recommendation E).

IV. Conclusion

Consumers and communities benefit from more competition. Right now in America, fixed-broadband competition, especially at today's speeds and performance characteristics, is very limited. Millions of American households may be paying prices that are higher than a truly competitive market would deliver. This would mean that too many pay too much and too many can't afford service at all.

That's enough to demonstrate the need to promote competition. But, of course, this report rests on the additional idea that the benefits from the use of High-Performance Broadband accrue to the broader economic and social benefit of America—those secondary impacts that arise from a communications revolution. Constricted broadband competition—without regard to its cause—therefore curbs the economic and social progress that broadband can help deliver. For example, the ability of schools to take advantage of competitive pricing to bring better broadband to their students (discussed in Chapter 5) is not just a financial saving; it feeds into the better educational opportunities that broadband enables.

Absence of competition is a brake on our economic and social progress. An economic engine fueled by competitive broadband access will accelerate us on the road to progress. A win for consumers and a win for communities.

Chapter 4: **Using High-Performance Broadband—From Networks to People**

Deb Socia, a leader in broadband adoption work,[464] recalls sitting in two different fast-food restaurants in two different American cities on two different Sunday afternoons. Both times, she saw a man enter the restaurant, approach the manager, and, in her words, "beg to be allowed to apply for a job by submitting a paper application."[465] Both times the men were turned down; one of them began to cry. "What does it mean," Socia asks, "when you can't flip a burger in America without internet access?"[466]

"What does it mean when you can't flip a burger in America without internet access?"

For many Americans, lack of broadband access means having less opportunity than their parents did. Lower-income people in America are white, African American, Hispanic—the largest group is non-Hispanic whites.[467] Low-income people, we know, live in rural, urban, and suburban America. In fact, the poverty rate is higher in rural than in non-rural America.[468] The majority of low-income people are working-age adults, but children, too, are disproportionately poor.[469] Women are more likely to be among the working poor than men.[470] The poverty rate among Native Americans is above 25 percent.[471]

This is not just a *digital* divide—this is another America.[472] An America whose finances are precarious—and disadvantaged by long-term tectonic economic trends. A place that is often isolated—especially in rural America. An America inhabited by people who rely, perhaps more than most, on community institutions—and a place where the local fast-food restaurant and the public library may offer the best choices for broadband. It is an America with less opportunity.

Broadband's fundamental value doesn't come from connecting computers to networks; it comes from connecting people to opportunity, and society to new solutions. When a network is available but a person who wants to use it can't do so, then the network is less valuable to everyone who uses it.

Expanding broadband usage can grow the U.S. economy broadly.

The benefits of broadband adoption do not flow only to the people who are new broadband users. Expanding broadband usage, from an economic perspective, can grow the U.S. economy broadly. Expanding broadband usage, from the perspective of civic engagement, can build stronger democratic institutions. Expanding broadband usage, from an individual's perspective, opens a window on the world, connecting people to people, and people to services that can improve lives.

Broadband adoption benefits people in concrete and practical ways. Children can do homework at home. Parents become more involved in their child's school. Families stream educational content. Adults can obtain digital skills training, including workforce skills, and create résumés.[473] Americans with disabilities can establish better access to education, employment, health care, and community activities.[474] Far too many people face practical barriers in using broadband service that they want and that is ostensibly available to them. Academic research has established that socioeconomic factors impact broadband usage.[475]

Again, local leadership is crucial in both identifying digital divides and combating them.[476] The focus in the near term is ensuring that everyone in America has the opportunity to use broadband at reasonable costs. But we also must set long-term goals to ensure that High-Performance Broadband is fully and realistically available to all people in the United States.[477]

I. Expanding Broadband Usage

To achieve more equitable and effective broadband use, we review (a) why cost is the primary reason that people do not subscribe to broadband, (b) what communities are doing to increase the skills that people need to be able to effectively use broadband connections when they obtain them, and (c) the critical link between digital-inclusion efforts and broader economic and social strategies.

A. Creating an Affordability Agenda

A recurrent question since the arrival of broadband networks has been why some people don't subscribe to them. Twenty years ago, perhaps there were a substantial number of people who had yet to recognize the centrality of the internet to 21st century communications.[478] But a growing stream of recent research emphasizes that, with the widespread deployment of broadband, the price of fixed-network subscriptions is now the primary reason that some people do not subscribe.[479]

Dr. Colin Rhinesmith, an assistant professor of library and information science at Simmons University and a former Benton Faculty Research Fellow, and his colleagues examined the role of price in the use of broadband in a 2019 study[480]:

> Although participants understood the value of broadband … we found that individuals in low-income communities face a complex web of cost-related challenges when it comes to home broadband access. The three most common barriers were high monthly fees, obstacles such as eligibility requirements, and other vital payments that needed to be prioritized over broadband, such as rent and food. These three barriers together make it extremely difficult for low-income people to pay for broadband.

Not surprisingly, therefore, a study of Detroit residents included in this analysis shows that people with higher incomes are much more likely to subscribe to fixed broadband.[481] And the cost of using broadband is more than just the price of a retail fixed-broadband subscription—the cost can also require acquiring hardware and software, for example. Thus, this analysis "indicated that ability to pay rather than willingness to pay was a more accurate frame for understanding barriers to fixed broadband in their communities."[482] Similarly, a study by the city government of Seattle found that people living at or below 135 percent of the federal poverty line were the most likely to report a barrier to internet usage—and the top-ranked barrier was expense.[483] A citywide digital inclusion survey of Austin, Texas, residents found that 61 percent of residents who do not use broadband found broadband access to be too expensive.[484]

Current research suggests that low-income people can only afford to pay about $10 per month for broadband. Nine focus groups of low-income residents of Kansas and Maine showed that few would subscribe to broadband service at $50 per month but many would do so at $10 per month.[485] That followed a Benton report published in 2015, which similarly suggests that $10 per month would be affordable. One set of participants told researchers that affording even $20 per month would be difficult.[486] Rhinesmith says,

"Almost everyone I spoke with in the eight low-income communities across the country where I visited for the research mentioned that they would be able to pay $10-$15/month for low-cost internet. However, anything more costly would be challenging for them to afford."[487] And for those on limited monthly incomes even a $10-15 per month price point for internet competes with other utility bills such as phone, electricity, and even the cost of food.[488] The current Lifeline subsidy for individuals, used primarily to buy wireless service, is set at $9.25 per month.[489] Low-income plans offered by broadband carriers separate from Lifeline that are used for fixed broadband range from $10 to $20 per month.[490]

To meet the challenge of providing fixed broadband at roughly $10 per month requires implementation of a variety of strategies. Here are seven ways governments can tackle the affordability challenge.

1. Spur Competition

Competition remains the most powerful tool for ensuring that everyone in America has access to affordable broadband. Competition reduces prices, enhances service quality, and incentivizes innovation. The competition principles set out in Chapter 3 are, therefore, critical for making broadband affordable to more people in the United Stated.[491] As described in much more detail in that chapter, communities across the nation are experimenting with a variety of strategies to promote competition, ranging from work with rural electric cooperatives and municipal electric utilities to the provision of access to middle-mile facilities, which allow private companies to build their own "last mile" access to customers, to the build-out of fiber to residences that supports an open-access model of internet-access competition. Successful efforts will help make broadband more affordable and thereby unleash suppressed demand for broadband services.[492]

2. Protect and Strengthen the Lifeline Program

Another way to make a product or service more affordable is to lower its costs by subsidizing it directly. In 2016, the Federal Communications Commission expanded its Lifeline program, which traditionally provided qualifying low-income Americans with subsidized telephone service, to include both fixed and mobile broadband. Lifeline providers receive $9.25 per month to supply fixed broadband service that is now required to be at least 15/2 Mbps.[493] This is important to people—people like a college student in San Francisco, who sits outside coffee houses (unable to afford a cup of coffee) to access Wi-Fi networks; a working mother and college student who uses a fast-food restaurant to do her homework with

Cleveland: Pulling Together to Solve Community Problems

Community-based leadership knits together Cleveland's efforts to ensure all residents can successfully participate in the digital world and economy. Nearly a third of Greater Cleveland households were deemed to be in "digital equity high-need areas," defined as those areas where there is a low percentage of broadband adoption and/or computers in homes, according to research conducted in 2017.

"That saying, leave no child behind? Well, we want to leave no resident behind in this new digital economy," said Leon Wilson, chief of digital innovation and chief information officer at the Cleveland Foundation.

The Cleveland Foundation and its partners are taking a holistic approach to addressing digital inclusion in these high-need areas with investments in:

1. creating a more connected community,
2. assessing needs and impact,
3. supporting digital skills development,
4. improving digital civic engagement,
5. elevating regional digital leadership, and
6. encouraging technology innovation for social good.

The foundation, with support from the Huntington Bank, is making 1,000 4G LTE unlimited-data hotspot devices available through Cleveland and Cuyahoga County libraries. Within the first six months of the program, patrons checked out hotspots more than 6,000 times. "Supporting digital literacy and equitable access to technology is an important part of Cleveland Public Library's mission," said Cleveland Public Library Executive Director Felton Thomas Jr. "By making hotspot devices available at all twenty-eight Cleveland Public Library locations, we'll have the capacity to reach a wide range of residents in need of internet access and related support."

To ensure low-income individuals and nonprofits have access to low-cost com-

her kids at her side; as well as "children, seniors and veterans stuck on the wrong side of the communications divide."[494]

Ninety percent of Lifeline's twelve million users have applied this subsidy to mobile service plans, which have their own criteria for speed and capacity requirements.[495] The importance of Lifeline justifies a brief detour from our focus on fixed broadband to explore a program that is primarily used for wireless connections because that program fits into any discussion of additional support of fixed-broadband connections.

The overwhelming majority of wireless Lifeline subscribers patronize mobile "resellers" that specialize in helping low-income customers to participate in the program.[496] The resellers in turn lease capacity from national carriers.[497] But in November 2017, the FCC proposed to effectively eliminate these resellers,[498] a policy change that could force more than seven million eligible households to either lose service or switch their Lifeline-supported service to the nationwide carriers that have largely chosen not to participate in the Lifeline program.[499] The proposal would effectively end the life of Lifeline for millions of its users. Although the FCC has not yet adopted the proposal, the threat remains. The Leadership Conference on Civil and Human Rights emphasized that the FCC proposal would roll back Lifeline support at a moment "when our educational and economic opportunities, as well as political participation, are increasingly dependent upon communications infrastructure and technology."[500]

Preservation of the Lifeline program is essential, and federal policymakers should consider three improvements to the program and, in addition, a potential expansion to close the gap for fixed-broadband adoption. Federal policymakers should also consider the implications of the recent court opinion about network neutrality.

First, in order to make Lifeline service more accessible, more entities should be allowed to provide Lifeline services. In its 2016 order, the FCC expanded the eligibility of Lifeline processes providers beyond state-determined eligible telecommunications carriers[501] and offered an alternative FCC-administered certification path to grant federal Lifeline Broadband Provider (LBP) status.[502] Some participants in the FCC process sought to expand this eligibility further, for example, to community anchor institutions,[503] but the FCC, noting a question about its legal authority,[504] opted instead to focus on the manner in which ETC eligibility is granted.[505] Since 2017, the FCC has chosen to not implement this LBP certification process.[506] Rather than reducing provider eligibility, the FCC (and/or Congress) should expand it. For example, community-based institutions such as schools and libraries (discussed in Chapter 5) should be able to serve as Lifeline Broadband

puting devices, the Cleveland Foundation brought PCs for People, a national organization with offices in Minneapolis and Denver, to Cleveland. The PCs for People model helps low-income Cleveland residents receive a computer, high-speed 4G LTE internet access (for as low as $11.25 per month), computer repair, and learning support while also providing an opportunity for the city's businesses to responsibly and securely retire their aging computing devices. PCs for People distributed 1,600 computers in just its first eight months in Cleveland. "The community's been great; there is a lot of enthusiasm around not only the computers but the internet and the access to the world that the computers provide," said Bryan Mauk, executive director at PCs for People Cleveland.

The Cuyahoga Metropolitan Housing Authority (CMHA) is aiding the effort by providing marketing, education, advocacy, and awareness around the overall initiative.

And the Cleveland Foundation and CMHA are also working with Digital C, a nonprofit focused on bringing affordable access to unserved areas. Two private companies helped CMHA avoid the prohibitive cost of laying fiber between public-housing buildings and a homeless shelter by using gigabit millimeter wave radios to bring high-speed broadband connections to the buildings and then using existing copper wire to bring service to each unit.

That allowed Digital C's "Connect the Unconnected" program to offer $20-per-month broadband service with no data caps to 800 CMHA residents—affordable for most tenants in the projects who do not qualify for Lifeline or similar programs offered by private broadband providers. Recipients of the connectivity will also be provided with the opportunity to complete a basic digital literacy training course, learning the fundamentals of computer and internet use, after which they will receive a refurbished computer to utilize at home.

Beverly Mcclintock, a 60-year-old grandmother, was one of the first recipients of a free computer after completing a six-week intensive computer training class provided by the housing authority. She's using her new skills and computing power to do coursework at Cuyahoga Community College. Mcclintock is studying to be a drug counselor.

Providers.[507] The more paths that exist to be eligible to serve low-income consumers, the more ways there will be to enter multiple broadband markets, including residential ones. Multiple Lifeline Broadband Providers offering competing services to low-income consumers should lead to more robust service offered at better prices.

Second, because the application process can be complex for many eligible consumers, the process for enrolling should be simplified. Critics of Lifeline have claimed that it is rife with waste and fraud.[508] The 2016 Lifeline Order created a new system for verifying participants' eligibility when they are signing up for service.[509] However, the National Eligibility Verifier system it established has only recently "soft" launched in a limited number of states.[510] Benton Senior Fellow and Public Advocate Gigi Sohn, a leader in the preservation of Lifeline, says, "The failure to establish the new eligibility verification system demonstrates a lack of financial commitment, technical expertise, and FCC leadership."[511] The new eligibility process needs to be promptly and effectively implemented; an even more efficient mechanism would make Lifeline enrollment automatic when people are enrolled in a qualifying federal program.[512]

Third, in order to ensure the program is meeting the needs of those who can benefit most, the scope of eligibility for people could be enlarged. In 2019, the income eligibility—135 percent of the federal poverty guidelines—is $28,796 for a family of three.[513] But there is nothing obviously magic about having an income that is 135 percent of the poverty line—indeed, eligibility for federal programs ranges between 125 percent and 185 percent of the federal poverty line, which is $39,461 as of 2019.[514] Other federal programs—including Section 8 low-income housing assistance, the earned income-tax credit, and some parts of Medicaid—do not use the poverty guidelines at all.[515] The FCC's 135 percent standard should be re-examined in light of the importance of access to broadband, the evolution of the broadband market, the cost of expanding eligibility and, of course, what people can afford. Part of that inquiry inevitably turns on what broadband providers themselves can deliver to low-income Americans, which is discussed later.

In addition, to bring the program more directly in line with the importance of fixed broadband, Congress and the FCC should consider an expansion of the program to provide the subsidies needed to make better broadband affordable for low-income households. As noted elsewhere, the current fixed standard of 15/2 Mbps is well below the FCC's current standard for an "advanced telecommunications" service (25/3 Mbps), which is itself badly out of date. The program's fixed-broadband standard is scheduled to increase to 20/3 Mbps on December 1, 2019,[516] which is simply not enough. Congress and the FCC should consider whether the problem of affordability for some Americans is so serious that Lifeline should be supplemented with additional support for robust, fixed broadband. In considering the issue, Congress and the FCC should consider the extent to which public resources are needed in light of private broadband providers' efforts, which are described later, and, if so, under what circumstances. After all, the FCC itself has noted that mobile- and fixed-broadband services are complements, not substitutes.[517] The Leadership Conference on Civil and Human Rights, the United Church of Christ, and other public-interest groups have explained that

Not only has the Cleveland Foundation funded on-the-ground projects, but it has also funded research that establishes targets of need and impact. Most recently the foundation gave a grant to the Cuyahoga County Office of Innovation & Performance for *Connecting Cuyahoga: Investment in Digital Inclusion Brings Big Returns for Residents and Administration.* This report emphasizes how increasing internet access for county clients would improve "social returns in addition to operational efficiencies" for county departments and bring about cost savings, improved health outcomes, and sustained positive economic development impacts over time. The report also makes specific recommendations for a county-led digital inclusion strategy.

Led by investments from a visionary community-based foundation, local government, community anchor institutions, a variety of nonprofits, and researchers are making important contributions to Cleveland's digital inclusion efforts. Some are providing connectivity, devices, digital literacy training, and a network of volunteers; some are helping spread the word about the opportunities being offered; others are providing needs and impact assessments. Together, they demonstrate how a community, and community leadership, can work together to solve community problems.

"it remains difficult to apply for a job, take online classes or training, or write a research paper from a mobile device over mobile service."[518]

Finally, the implications of the D.C. Appellate Court's October 1, 2019 ruling on FCC's repeal of the previous Open Internet Order may be important in preserving the ability of Lifeline to support broadband services. Although the court upheld the FCC's decision to reverse the application of common-carrier provisions of the Communications Act to broadband internet-access services,[519] it also held that the FCC erred by failing to consider adequately the impact of that decision on the ability of the Commission to continue providing Lifeline support for broadband services.[520] On remand, the FCC must consider whether it can find another basis to support the Lifeline broadband efforts.[521] If not, absent legislation, the fate of net neutrality may presage the loss of a critical means by which lower-income Americans access the Internet, an outcome contrary to the public interest.

3. Provide Assistance to Broadband Providers' Low-Income Programs

Private broadband providers recognize the difficulty low-income families have affording service.[522] Some—such as Frontier Communications, CenturyLink, RCN, and Windstream—participate directly in the Lifeline program.[523] Other programs, separate from Lifeline, are targeted toward families who have qualified for other assistance programs. For example, Comcast's Internet Essentials program provides low-income families, people with disabilities, seniors, and veterans 15/2 Mbps internet service with in-home Wi-Fi at $10 per month without an installation fee or a contract.[524] Cox, AT&T, and Spectrum sponsor similar efforts.[525]

Most of these programs (like FCC's Lifeline program) do not provide service performance sufficient to qualify as broadband under the current FCC standard of 25/3 Mbps. Some companies offer 15 Mbps downloads;[526] others are slower—for example, one major provider offers low-income service with 10 Mbps download speed.[527]

An important question is whether private companies could expand their low-income programs if it were easier to ascertain who is eligible for discounted prices—a process that has been described as time-consuming.[528] Governments, through actions like the automated electronic eligibility verification process established for Lifeline, should help lower providers' costs for offering these services by enabling them to use governmental verification systems—another reason for the prompt deployment of Lifeline's national verification system.

4. Require Affordable Tiers of Broadband Service When Supporting Deployment

Governments should require broadband providers that receive public funding to provide a minimum service tier with guaranteed low pricing. For example, the State of New York requires a recipient of broadband deployment funding to offer a standalone 25/4 Mbps plan for $60 per month (adjusted annually for inflation).[529] By contrast, in the Connect America Fund II auction, the FCC applied the less specific requirement of a service comparable to service provided in urban areas.[530] In Chapter 2, this report recommends that the FCC and Congress should consider as a requirement of funding for broadband deployment the provision of service 50/50 Mbps service (with other requisite performance criteria including unlimited usage) for $10 per month to eligible recipients.[531]

5. Educate and Protect Consumers

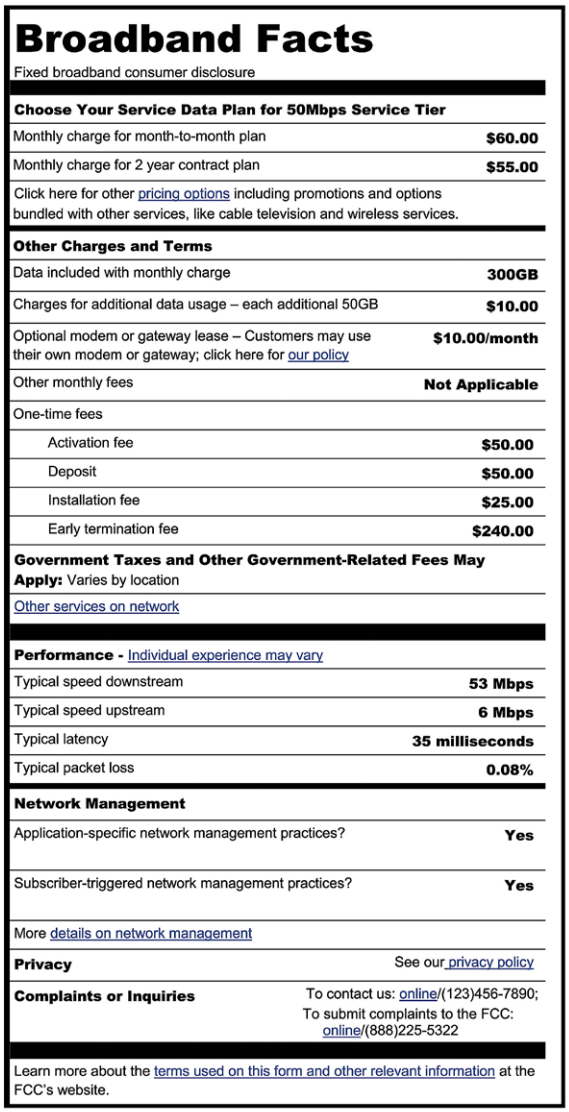
Another barrier to Lifeline participation has been lack of awareness of the program.[532] For example, first among the recommendations in North Carolina's broadband plan is the goal of educating eligible households about the Lifeline program.[533] States like Hawaii and Pennsylvania also provide information on low-cost fixed options.[534] Some states operate their own Lifeline program or related programs that subsidize connectivity and provide consumer information. For example, California's Lifeline program provides higher monthly discounts than the federal program in some instances and offers additional service connection and conversion discounts while providing additional service discounts to deaf and disabled residents.[535] California administers both programs, so it assigns these additional discounts to those who qualify through its state public-assistance programs.[536]

More broadly, access to transparent program and pricing information helps consumers make informed choices. The national nonprofit EveryoneOn provides a searchable index of discounted internet service and device offers.[537] For example, type in the zip code of one of the poorest areas of Chicago and learn that a low-income family can seek assistance from PCs for People, which provides both computers and connectivity (and is discussed later).[538] BroadbandNow's local broadband pricing information search includes information for low-income families, highlighting the specific programs offered by each of the major broadband providers.[539] Similarly, the National Digital Inclusion Alliance published its own Discount Internet Guidebook in 2018,[540] and additional information is available at BroadbandNow's listing of connections for low- and fixed-income households.[541]

Consumer protection is important for those on the economic edge who may be tempted to buy service plans that are beyond their economic means—making it harder for them to subscribe to broadband service in the future. According to the Federal Bureau of Consumer Financial Protection, consumer debt for telecommunications services, which includes internet access, ranked third behind only credit-card and medical debts as the basis for debt collection, accounting for 20 percent of debt-collection revenue.[542]

Consumers need the tools to understand the nature of introductory pricing, termination fees, and the relative costs of options that come alongside broadband, such as the ability to use over-the-air television in place of a cable TV service.[543] *Consumer Reports* offers a Telecom Service Buying Guide that reviews broadband services and offers counsel on how to get the best deal.[544] State and local governments also offer information to consumers.[545] Municipal broadband providers have generally offered transparent pricing plans, which is by itself a competitive benefit.[546]

The right approach is to restore the Fixed Broadband Consumer Disclosure Label adopted by the FCC in 2016 and then rescinded by the FCC in 2017:[547]



Broadband Facts

Fixed broadband consumer disclosure

Choose Your Service Data Plan for 50Mbps Service Tier	
Monthly charge for month-to-month plan	**$60.00**
Monthly charge for 2 year contract plan	**$55.00**
Click here for other pricing options including promotions and options bundled with other services, like cable television and wireless services.	
Other Charges and Terms	
Data included with monthly charge	**300GB**
Charges for additional data usage – each additional 50GB	**$10.00**
Optional modem or gateway lease – Customers may use their own modem or gateway; click here for our policy	**$10.00/month**
Other monthly fees	**Not Applicable**
One-time fees	
Activation fee	**$50.00**
Deposit	**$50.00**
Installation fee	**$25.00**
Early termination fee	**$240.00**
Government Taxes and Other Government-Related Fees May Apply: Varies by location	
Other services on network	
Performance - Individual experience may vary	
Typical speed downstream	**53 Mbps**
Typical speed upstream	**6 Mbps**
Typical latency	**35 milliseconds**
Typical packet loss	**0.08%**
Network Management	
Application-specific network management practices?	**Yes**
Subscriber-triggered network management practices?	**Yes**
More details on network management	
Privacy	See our privacy policy
Complaints or Inquiries	To contact us: online/(123)456-7890; To submit complaints to the FCC: online/(888)225-5322
Learn more about the terms used on this form and other relevant information at the FCC's website.	

6. Support Programs That Make Low-Cost Computing Devices Available

The availability of low-cost or free computers is often just as important as access to low-cost or free Internet options. A number of nonprofits around the country are providing them.

- PCs for People, a national device refurbisher, has repurposed at least 80,000 used computers since 1998 and distributed them to families in need.[548] The organization has also partnered with Mobile Beacon and Mobile Citizen to provide affordable internet service through 4G LTE hotspots for as low as $11.25 per month.[549] And PCs for People provides discount computer-repair services to families needing to extend the life of their devices.[550]
- Connecting for Good, in Kansas City, Missouri, has refurbished and sold more than 2,000 donated computers and installed local internet connections for low-income community partners in that city.[551]

- Louisville's digital inclusion program provides reliable computers to families by working with community partners to develop sustainable ways to repurpose used technology.[552]
- Free Geek, based in Oregon, provided almost 1,300 computers in 2018 to recipients that include community organizations, such as schools and nonprofits, and K-12 students.[553]
- E2D, a nonprofit in Charlotte, North Carolina, has partnered with 140 schools to provide refurbished laptops and computer training to more than 7,000 families in the area while also opening three new computer labs and working to connect homeless families with broadband access.[554]
- JPay, an inmate-services company, has worked with states to give inmates access to special tablets designed for the unique security needs of individual correction facilities while providing inmates with more opportunities to communicate with their families and access educational materials.[555]

Governments should support these efforts; they are, for example, an obvious source of refurbished computers.[556]

7. Provide Access Via Community Anchor Institutions

Chapter 5 details multiple ways in which community anchor institutions—including schools, libraries, and hospitals—help connect unconnected people in the United States. In the context of affordability, it is worth noting the efforts of, for example, libraries in a number of cities and towns across the nation that have been experimenting with mobile wireless hotspot programs, which allow people to "check out" broadband hotspots for home use.[557] Of course, other anchor institutions can play similar roles; schools can extend broadband access to K-12 students to access the broadband they need to complete schoolwork after hours.

Some communities are offering municipal broadband service directly in some parts of their city, usually through public Wi-Fi hotspots. New York City provides free Wi-Fi in many of the city's parks and has been replacing its street-level pay phones with Wi-Fi kiosks that can also display maps and place video calls.[558] Free Wi-Fi services on public transit have become a welcome amenity to daily commuters.[559] Other notable Wi-Fi efforts have taken place in Cleveland,[560] Austin,[561] Washington, D.C.,[562] and Boston.[563]

B. Supporting Digital-Skills: Literacy and Beyond

Even in a time of seeming ubiquitous usage, support for the acquisition of digital skills remains important. Surprisingly, even as recently as in 2016, a slight majority of Americans remained "relatively hesitant" to embrace broadband technology and devices.[564]

Successful, community-led inclusion efforts have spawned beneficial outcomes—and useful lessons. Benton Fellow Denise Linn Riedl—now the Chief Innovation Officer for the City of South Bend, Indiana—has analyzed well-designed, inclusive processes that use civic engagement to deploy more plentiful broadband options in cities like Boston, Chicago, and Kansas City, Missouri.[565] In mid-2019, John Horrigan, a leader in the study of broadband deployment and adoption, summarized lessons from cities that have fostered digital inclusion, including the importance of planning and local leadership. He noted the importance of dedicated city staff, effective community outreach, and funding.[566] Both the National Digital Inclusion Alliance[567] (NDIA) and Next Century Cities[568] have published valuable guidance on successful digital inclusion efforts. For example, the NDIA publication provides a checklist for the establishment of a digital-literacy training

program that includes items that help tailor programs with particular topics of relevance to specific users, including seniors, job seekers, adult education students, and young mothers.[569]

Cities have gone to work to improve people's digital skills—good examples can be found in Austin, Kansas City, Charlotte, Seattle, and Louisville, each of which has created an integrated digital-inclusion plan.[570] For instance, Louisville's digital-inclusion strategy recognizes that "the vast majority of current and future job openings will require basic computer skills." Louisville's efforts include teaching coding, instructing on the basic use of a computer, and helping people access online courses that teach technical skills.[571]

Rural Americans face deployment challenges, as discussed in Chapter 2. But there is more, as the USDA has explained. Rural populations are more likely to be older (and therefore less digitally literate), lower-income, and geographically isolated.[572] For example, "Rural counties make up nearly 85 percent" of those counties where more than 20 percent of the population is age 65 or older."[573] Of course, internet access is designed to erase the limitations and burdens of distance, which means that strategies to bring rural areas online should be coupled with (i) adoption programs that reach to individuals, including older people, and (ii) support for institutions that can use broadband to reach people with telehealth and similar social services.

In this section, we discuss strategies to boost adoption and usage separate from the affordability issues.

1. Harness Community Resources and Leadership

Literally defined, a "community" is a group of people with overlapping and complementary interests. Digital-inclusion plans created by local governments work in concert with coalitions, fostering coordination between nonprofits and other entities, including broadband providers. For example, the Kansas City Coalition for Digital Inclusion counts among its co-founding members Connecting for Good (discussed earlier),[574] the Kansas City Public Library, and Kansas City's local government. The coalition has grown to include the Housing Authority of Kansas City, school districts, other library systems, broadband providers, and a variety of nonprofits and foundations.[575] The coalition's website allows residents to search for "connections, computers, and training" near their homes, yielding a long list of libraries, community centers, neighborhood associations, YMCAs, and even local businesses offering digital-connectivity services, including convenient Wi-Fi hotspots.[576] Other cities, like Austin, also prioritize coordination across different community sectors to better satisfy community broadband needs.[577]

Some of the most successful local digital-inclusion programs across the country have been able to spread well beyond their original areas. Since 2000, Boston's Tech Goes Home program has provided more than 20,000 affordable computers to those in need, while also providing digital-skills training and assistance securing home internet access to more than 30,000 people.[578] The Tech Goes Home model has been successfully replicated in Chattanooga, Tennessee, and has led to digital-equity partnerships with schools in Las Cruces, New Mexico; Education Connection in Litchfield, Connecticut; and the Housing Authority of New Orleans and Loyola University in New Orleans.[579]

2. Deploy Federal and State Resources

Both the federal government and the states should provide additional assistance to digital-literacy efforts. For example, Washington Senator Patty Murray (D-WA) has introduced the Digital Equity Act to create a State

Digital Equity Capacity Grant Program within the Department of Commerce to allocate federal grant money to states to fulfill their own individualized State Digital Equity Plans.[580] The proposed law would require an analysis of how the plans' specific objectives "will impact and interact with the State's—(i) economic and workforce development goals, plans, and outcomes; (ii) educational outcomes; (iii) health outcomes; (iv) civic and social engagement; and (v) delivery of other essential services."[581]

In fact, some states are engaging in such efforts already. Maine's digital equity plan is particularly illustrative—focusing on the importance of digital-skills training in rural places. Because Maine's tourism businesses have not adapted quickly enough to the use of the internet by tourists, the plan targets digital training efforts for this industry specifically.[582] The plan also recognizes the needs of its high proportion of seniors to further develop digital skills and provides vital lists of resources for more affordable internet service, digital devices, public internet access locations, and digital literacy training.[583] Similarly, the North Carolina state broadband plan recognizes the vital central role played by the state's libraries and focuses state-level efforts on ensuring those libraries have the grant-writing assistance they need.[584]
Competitive processes that distribute federal dollars for digital-literacy programs should both incentivize the winning localities and provide lessons to the localities that do not win. The application criteria for the award of any federal or state dollars should focus on the designation of important local outcomes, the robustness of local leadership, including with private and nonprofit participants, and the manner in which outcomes will be tracked and evaluated.

3. Evaluate What Works Best

Ongoing evaluation is a critical way for communities to learn what works and what does not. In 2015, the U.S. Government Accountability Office concluded that "the benefits of broadband are substantial"[585] but emphasized that "outcome-oriented performance measures are important for helping agencies determine if their efforts are achieving their intended purpose."[586]

A good example comes from the Digital C digital-literacy program in Cleveland, which offers free instruction and career-preparedness courses to underserved people in that city, with support from The Cleveland Foundation. The need is obvious—about 30 percent of the households in Cleveland had no internet access of any kind as of 2017.[587] A January 2019 survey of participants showed that about half of the people seeking jobs said that the program helped them be better prepared for employment, and 45 percent of those who are working believed that the program helped them in their jobs; in addition, one-third said that they were using digital skills to manage health-care issues, and one-quarter reported that they took the program to improve their ability to age in place.[588] The survey results also suggest an ongoing benefit to having received training: 42 percent of the participants said that they had taught the digital skills they acquired to someone else.

Susan Corbett, who heads the National Digital Equity Center, has also emphasized the importance of ongoing evaluation.[589] For example, the 2018 Community Technology Plan for the town of Stonington, Maine, which is designed to help reverse population decline, expressly incorporates into its strategy monitoring and measuring outcomes and continuing review based on "feedback, monitoring, and community involvement."[590] The North Carolina state broadband plan also calls for improved, data-based monitoring of adoption issues.[591]

C. Incorporating Digital Skills Training in Regional Economic-Growth Strategies

Regional, state, and local economic-growth efforts have traditionally focused on finding place-specific advantages that can improve an area's prosperity and opportunity for the people who live there. (Think of the familiar "clusters" of industries—automobiles in Ohio, agriculture in Fresno, California, communications in the New York area, education and knowledge creation in Raleigh, North Carolina, and wood products in Mississippi.[592]) Governments that have implemented successful regional strategies have recognized the importance of a workforce skilled in the requirements of an industrial cluster.[593]

That's why economic-development strategies today are "riding the shoulders of what regional leaders see as some of their uncommon or even unique advantages in the digital derby."[594] As the following examples illustrate, the availability of robust broadband is recognized to be a tool to spur economic development and is, therefore, at the center of regional and local economic strategies:

- Anne Schwieger, Boston's Broadband and Digital Equity Advocate and a trained city planner, explains that "[t]hrough this lens of economic opportunity, broadband is best understood as an ecology that allows places and people to adapt, evolve, and create;" broadband strategies include "aggressive efforts to increase broadband adoption."[595]
- The Appalachian Regional Commission has recognized the importance of broadband-based education and training as part of its broader economic-development efforts.[596]
- Connected Nation's Digital Works program has linked with more than 70 corporate employers who have helped to design training programs[597] that are tailored to the needs of business looking for workers.[598]

Minnesota also features the work of the Blandin Foundation, whose Broadband-Based Development Strategy recognizes, "Broadband is essential to a thriving community—but it is not a panacea and it won't work in a vacuum"[599] and whose use of a holistic economic-development strategy is described in an accompanying sidebar.

II. Policy Recommendations to Promote High-Performance Broadband Adoption

In this section, we propose recommendations to further the ability of people to use broadband connections. Successful efforts to date demonstrate the importance of comprehensive strategies that include affordability and the strengthening of community anchor institutions.

A. Create an Affordability Agenda

1. All broadband policy should promote competition through the principles contained in Chapter 3.
2. The FCC should protect and strengthen the Lifeline program by:

a. expanding the ability of new, competitive broadband providers, including community anchor institutions, to participate as Lifeline Broadband Providers;

b. simplifying the enrollment of eligible people (an even more efficient mechanism would make Lifeline enrollment automatic when people are enrolled in a qualifying federal program); and

c. considering how best to enlarge the scope of individual eligibility.

3. Congress should consider the creation of separate support for eligible low-income people to afford fixed-broadband connections, including those in need of special in-home services, such as health care.

4. The FCC should provide technical assistance to broadband providers' low-income programs. For example, private broadband providers should be allowed to access the Lifeline national eligibility verification database or similar mechanisms of eligibility verification.

5. As recommended in Chapter 2 (Recommendation G-2), the FCC (or, in the context of legislation, Congress) should consider requiring that recipients of federal deployment funding offer eligible, low-income individuals an affordable broadband service for $10 per month. Such requirements should be updated as technology and demand for broadband services advance.

6. The FCC should educate and protect consumers, including through the use of the Fixed Broadband Consumer Disclosure Label, adopted by the FCC in 2015 but later rescinded.

7. Governments at all levels should make low-cost computing devices available, including by supporting computer refurbishers to package low-cost or free devices, connectivity, and ongoing technical support for low-income consumers. Governments are an obvious source of used computers.

8. Community anchor institutions should provide public-access computing centers that allow community residents to access technology and classes in places in which they feel comfortable and supported. That is especially valuable where community anchor institutions have helpful staff who provide them with one-on-one support with computers and broadband access.

B. Support Digital Skills

1. As local governments around the nation have demonstrated, digital inclusion efforts are most successful when they enlist the community in order to reach people in convenient, trusted places.

2. Deployment of federal and state resources takes many forms:

   a. The federal government should support digital literacy efforts run by state and local governments.

   b. State and regional digital equity plans should provide financial support and identify purposes—such as improved education, health, and civic and social engagement—to which digital skills instruction can be targeted and content can be created.

   c. Competitive processes that distribute federal dollars for digital literacy programs should both incentivize the winning localities and provide lessons to the localities that do not win. The application criteria for the award of any federal or state dollars should focus on the designation of important, local outcomes; the robustness of local leadership, including with private and nonprofit participants; and the manner in which outcomes will be tracked and evaluated.

d. Digital skills programs should measure and monitor their results on an ongoing basis, and, given the financial constraints on local programs, federal and state support for digital skills efforts should include resources needed to evaluate the ongoing impact of digital literacy programs.

C. Incorporate Digital Skills Training in Regional Economic-Growth Strategies

1. Applying the lessons of local and regional economic clusters, state and local governments should focus training on middle-skill and other jobs important to their local economies. Digital inclusion plans should recognize which local institutions (a library in one community or a local church in another) can best reach the people who need to be served.

2. Economic-development support by the federal government (e.g., the Department of Commerce's Economic Development Administration) should facilitate the inclusion of broadband deployment, adoption, and digital literacy in any regional economic strategy.

III. Conclusion

In the third decade of the 21st century, broadband is not just a lifestyle; it is a way of life. And a stronger, more-just America will be built when society ensures that High-Performance Broadband is widely available and affordable, and that everyone has the opportunity to learn how it can serve their personal and professional goals. Around the country, local communities are hard at work, and they are the best places to start.

Some decades ago, a prominent African-American leader liked to use the example of Jackie Robinson to make the point that racial integration of baseball was not merely to the advantage of black ballplayers who were able to demonstrate their abilities. It was also, he would say, to the advantage of white players who found themselves on a better team with more talent because black teammates were no longer artificially segregated from the game.[600] Whether it's the example of Jackie Robinson or Metcalfe's Law,[601] the lesson is the same: Everyone using broadband makes broadband better for everyone.

Chapter 5: **The Growing Role of Community Anchor Institutions in the Digital Age**

Gina Millsap, the chief executive officer of the Topeka and Shawnee County Public Library in Kansas, is a fierce advocate for equitable access to broadband. Today, her library offers digital-skills training, including to older readers and people with disabilities, and Wi-Fi access to the three thousand people a day who enter the library, nearly all with one device, some with two or three. How much broadband does the Topeka and Shawnee Library need? "It's like water pressure," she says. "How much water pressure can I get? I need it all!"

Schools, libraries, and hospitals are familiar examples of what has come to be known as a "community anchor institution," a term that includes "a public school, a library, a medical or health-care provider, a community college or other institution of higher education, a State library agency, and any other nonprofit or governmental community support organization."[602] In other words, community anchor institutions themselves use broadband to provide essential services to their community, such as education, information access, and telehealth services.

But in the 21st century, community anchors' missions are moving beyond their walls. Libraries no longer deliver knowledge that is housed only within their buildings or the covers of hardbound books. Public education today cannot exist separate from the ability of students and teachers to use broadband connections—both in school and out. And health-care facilities see and monitor patients both in hospitals and in their homes.

In the coming decade, policymakers should help community anchor institutions to buy competitively priced High-Performance Broadband and connect to their users wherever they are. In addition, policymakers should allow private companies to access the broadband infrastructure used by community anchor institutions at their own expense in order to lower the cost of deployment to residential customers.

Each goal is important on its own; together they form the spine of an action plan to support the works of community anchor institutions in the 2020s.

I. Supporting the Increasingly Important Missions of Community Anchor Institutions

More broadband connections are needed in order to reach more community anchor institutions. A 2018 Schools, Health & Libraries Broadband (SHLB) Coalition report authored by CTC Technology & Energy found that 60 percent or more of community anchor institutions in the United States lacked robust and scalable connections that fiber networks would provide. Even in low-density metro areas (with between 363 and 1,669 residents per square mile), the connection rate was only 50 percent.[603] CTC estimates that all unconnected community anchor institutions in the continental United States and Hawaii (outside of Alaska) could obtain fiber connections for between $13 billion and $19 billion and that major savings could be obtained through the implementation of best practices that include competitive bidding processes and aggregated purchasing.

Increasing demand will require more bandwidth even to institutions that are already connected. The Consortium for School Networking (CoSN) found that the biggest drivers for increased bandwidth demands in classrooms are the number of students' devices, the use of digital content, online assessments, and streaming content.[604]

A. Connectivity and Competition

Community anchor institutions are of many types. In this section, we concentrate on the federal E-Rate program for schools and libraries both because that program is important in its own right and because the lessons to be learned from E-Rate should be applied to support community anchor institutions of all stripes. (The federal support for broadband-enabled health care yields similar lessons, such as the importance of competitive procurement processes, and is discussed in an accompanying sidebar.)

A quarter-century ago, the idea of "educational technology" popularized the notion that children would benefit if computers in schools and libraries were connected to the internet.[605] In 1996, Congress created the Federal Communications Commission's E-Rate program, which provides discounts to libraries and K-12 schools to make broadband internet access more affordable.[606]

In 2014, the FCC modernized the program in order to bring more bandwidth, at competitive prices, to every school and library by:

- Setting a connectivity goal to meet the rising demands of instruction. The FCC established for schools the goal of 100 Mbps per 1,000 students for the 2014–15 school year and the goal of 1 Gbps per 1,000 users for the 2017–18 school year,[607] and, for libraries, "an internet access target of 100 Mbps for libraries that serve fewer than 50,000 people and 1 Gbps for libraries that serve 50,000 people or more."[608] The FCC also began to fund connectivity within schools and libraries through discounts that cover internal network connections like Wi-Fi.[609]
- Empowering schools and libraries to take advantage of competition to drive down the cost of connectivity by:
    - Endorsing so-called "special construction," which allows a school or library to obtain better prices than those set by incumbent providers through a competitive-bidding process that welcomes the construction of fiber and the use of dark fiber.[610] The FCC's decision also encouraged special construction by allowing additional support from state matching

Michigan's MERIT Network: Connectivity To and Through Community Anchors

Investment in high-performance broadband infrastructure for community anchor institutions can deliver unforeseen dividends for years to come. Take, for example, the Merit Network, which operates almost 4,000 miles of fiber-optic infrastructure in Michigan.

A nonprofit, member-owned organization governed by Michigan's public universities, Merit is America's longest-running regional research and education network – founded in 1966. Merit's management and network expertise goes back all the way to the National Science Foundation Network (NSFNet), which spawned the modern internet.

After more than fifty years of innovation, Merit continues to serve higher-education, K-12, library, government, health-care and public-sector members. Its work goes beyond connectivity to include security and community services. These have included assistance and information intended to help member organizations with technologies, policies, and practices.

To extend critical broadband service to all community anchor institutions in Michigan, including in rural and underserved communities, Merit used two grants from the Broadband Technology Opportunities Program (BTOP) to create the REACH-3MC (Rural, Education, Anchor, Community and Health Care—Michigan Middle Mile Collaborative) project. Completed in 2014, the project constructed 2,287 miles of the almost 4,000-mile, open-access, fiber infrastructure network.

Bob Stovall, vice president of network operations and engineering for Merit, said, "This project is a foundation for Michigan, much like the interstate highway system. [But] more work is needed to truly reach every community in Michigan." Although the REACH-3MC grant included sub-recipients from the private sector to make broadband readily available to households and businesses that lack adequate service,

grants, which were quickly established.[611]

- Establishing new transparency requirements that empower schools to negotiate better deals by providing information on what other schools are paying for their bandwidth.
- Encouraging the use of buying consortia to allow schools and libraries to aggregate their purchasing power.

- Expanding the E-Rate program's budget cap from $2.4 billion per year to $3.9 billion per year—a $1.5 billion increase.[612]

In the succeeding years, K-12 schools have almost met the FCC's 2014–15 short-term goal of fiber connections to every school, 100 Mbps per every 1,000 students and staff, and Wi-Fi in every classroom.[613] But 1,356 schools across the nation still do not have access to sufficient broadband to meet the FCC's short-term goal, which affects 2.3 million students.[614] Even more students are impacted by the reality that only 28 percent to 32 percent of K-12 schools meet the FCC long-term goal of at least 1 Gbps per 1,000 students and staff.[615]

The progress of libraries is less certain; as of 2014, only 18 percent of public libraries had broadband connections delivering 1,000 Mbps (1 Gbps) or more; about 41 percent had service delivering 10 Mbps or less, the great majority of which was actually 1.5 Mbps or less.[616]

1. Special Construction Offers More Competition and Lower Costs

As community anchor institutions use more broadband capacity, the importance of ensuring their access to competitively priced services becomes increasingly important. A CoSN study found that 46 percent of schools identified "funding" as a significant factor in their ability to achieve E-Rate goals and nearly half identified the "cost of monthly reoccurring ongoing expenses" as a barrier.[617] Similar cost challenges are faced by rural health-care clinics and rural libraries.[618]

More competition is the answer. The cost of K-12 internet access declined 85 percent between 2013 and 2018.[619] As EducationSuperHighway reported, the price drop came from the competitive opportunity presented by E-Rate-funded special construction, which presented alternatives beyond those supplied by incumbent providers.[620] The authorization of special construction was a significant step, moving E-Rate from primarily supporting recurring service costs delivered by incumbent providers to encouraging competition by allowing the cost-effective purchase of competitive alternatives. So, for example, the

"more laterals are needed to connect more communities to the REACH-3MC infrastructure," said Stovall.

Since 2015, the cost of broadband in Michigan has decreased and more competition has been introduced, making services more affordable and accessible.

After completing connections to most Michigan anchor institutions, Merit realized it needed to play a role and facilitate taking bandwidth to where students live because:

- 368,000 homes in rural Michigan do not have access to broadband;
- 27 percent of K-12 students do not have access to broadband in their homes; and
- Current data overestimate availability and connectivity. At the FCC-defined threshold of 25Mb/3Mb, the reported 92.26 percent coverage of Michigan is unlikely to be accurate.

Merit is in a unique position. With its deep expertise in advanced networking and more than 700 connections to Michigan's community anchor institutions, Merit has begun to catalyze broadband access to unserved communities. The organization does not plan to offer broadband services to consumers directly, but it seeks to ensure that its middle-mile connections are available. Merit is agnostic about how communities connect and with whom they partner—whether through municipally owned systems, electric cooperatives, or small rural ISPs.

Merit, Michigan State University's Quello Center, and mLab started *The Michigan Moonshot: Expanding Community Networks in Rural Michigan*, a broadband-data-measurement project, in response to the 2018 *Michigan Broadband Roadmap* plan.

To get a better picture of the speed and quality of home broadband internet connections in three different pilot communities (representing more than 6,000 students), the project begins with developing measurements to understand the gaps in internet access. K-12 students will act as "citizen scientists" to measure broadband performance in their homes and gather information to supplement FCC data. This effort will also help get community stakeholders involved and invested in outcomes.

construction of a new fiber network, when amortized over its useful life, may cost less than the monthly price charged for service by an incumbent broadband provider. And, when that happens, special construction not only delivers the best deal to schools and libraries (and the federal government) but also expands the deployment of fiber in a community.

Unfortunately, the Universal Service Administrative Company (USAC) is delaying the use of special construction, discouraging and frustrating schools as they attempt to gain the broadband connections their students need.

As explained in a 2019 Benton white paper,[621] the use of undisclosed criteria to assess E-Rate applications and the targeting of special construction applications looks to be a secret shift in policy away from the 2014 Modernization Orders, which remain the law of the land. E-Rate special construction projects, chosen through a competitive bidding process, have been rejected by USAC without meaningful explanation and apparently on the basis of an undisclosed cost model. Nothing in the FCC's policies authorize USAC to administer its duties through a hidden process, based on non-transparent criteria. This is a recipe for arbitrary outcomes and hidden preferences, especially if the rejection of special construction projects represents undisclosed and unjustified opposition to "overbuilding"—which, as discussed in Chapter 2, should be called by its real name: Competition.

With an accurate picture of Michigan's connectivity and where tech needs to go, barriers to broadband-network deployment in rural communities will be reduced and investments optimized. Merit will provide assistance and:

- Help foster public-private partnership "community connectivity teams" to provide expertise in a variety of areas,
- Leverage their expertise in federal, state, and nonprofit funding for planning grants or one-time construction subsidies,
- Develop a comprehensive partner ecosystem and solutions framework, including educational programs for communities, and
- Launch Michigan's first broadband summit conference to advance conversation and collaboration.

These are all viable steps to reach beyond Merit's community anchor institution network to address the lack of home connectivity in Michigan.

The reality is that school districts have little recourse when they are subjected to a long and opaque review of their E-Rate applications that stretches through multiple school-budget cycles. But their K-12 students understand the impact. As one third-grader in a remote Montana school that was seeking E-Rate funding wrote:[622]

> We should have the internet by now. We can't do anything without the internet. We should be able to learn important stuff, but we can't do cool stuff and cool projects on our computers.
>
> We need internet or otherwise we can't learn new things about stuff we don't know on computers. We would like to do reports about Rosa Parks and Martin Luther King, Jr. on the internet, but we can't do that.

In places where E-Rate support for special construction has arrived, local governments have realized tangible achievements. For example, the Apache County School Consortium in Arizona, working with a broadband provider owned by the Navajo Tribal Utility Authority,[623] is deploying fiber-based broadband connectivity to seventeen schools.[624] Similarly, in southern Illinois, Jefferson County's Field Community School District 3 was able to move from a 25 Mbps connection (costing $700 per month) to a 1 Gbps fiber connection (costing just $96 per month).[625]

Special construction is especially important to rural schools and libraries. In funding year 2018, schools and libraries sought $430 million for special construction; a majority of these applications came from rural communities.[626]

2. Buyer Consortia Can Lower Costs and Should Be Encouraged and Expanded

Volume purchases often lead to lower per-unit costs. That's just common sense (and familiar economics). Go into a grocery store and compare the price of eggs (in this case, store-brand, organic eggs) and discover that a half-dozen eggs go for 57 cents per egg, a dozen eggs cost 47 cents per egg, and a carton of eighteen eggs is priced at 44 cents per egg.[627] Same eggs, same brand, but you buy more and get a lower unit cost.

Through aggregated procurement and purchasing programs at the state or regional level, groups of anchor institutions can combine their purchases:[628]

- North Carolina, for example, has successfully implemented just such an effort.[629]
- Georgia's state library system analyzed the benefits and restrictions associated with various organizational options, including a statewide library consortium and a managed network, and decided "to take advantage of market changes on a statewide scale" by forming "mini-consortiums along vendor lines" while also using statewide opportunities when they would be more efficient.[630]
- The Connecticut State Library established a statewide buying consortium to enable all libraries in the state to use one request for proposal (RFP) for the purchase of leased lit fiber, leased dark fiber, or self-provisioned dark fiber.[631]
- Minnesota's Broadband Task Force Report recommends that the state prioritize funding its regional library systems so that libraries can benefit from "economies of scale providing greater effectiveness, improved quality and access to more resources."[632]

Expanding the ability of a broad range of community anchor institutions to purchase connectivity would lower the cost of broadband. One in twenty schools still pays more than $50 per Mbps per month, and another 25 percent of schools pay between $5 and $50,[633] even at a time when the median costs per Mbps for K-12 schools has fallen to $3.26.[634]

3. Improved Administration Would Expand the Reach of E-Rate and Lower Costs

E-Rate administration improvements would speed the deployment of broadband to schools and libraries across the nation. As Jennie Stapp, the State Librarian of Montana, says, only a handful of that state's libraries participate in the E-Rate program because, from their perspective, "the return on investment is just not there." For example, confusion over the approval process for special construction projects has led to excessive application evaluation delays, some of which remained unresolved by the start of the application process of the following year and, as noted previously, may be the result of undisclosed opposition to the notion of special construction that the FCC has expressly authorized.[635]

In addition, better administration would mean that more community anchors could enjoy the discounts their communities deserve. EducationSuperHighway's analysis of E-Rate efforts demonstrates that many schools eligible for E-Rate support do not seek it.[636] Smaller libraries may not have the necessary mix of administrative resources and grasp of local broadband issues and technologies to do so. Some schools and libraries believe that the administrative process is too burdensome.[637]

4. State and Local Efforts Magnify the Positive Impact of E-Rate

E-Rate is a federal program that benefits schools and libraries across the country. But states can help their schools and libraries take advantage of E-Rate by assisting with applications, providing additional funding, and creating their own research and education networks that can, for example, include local universities not eligible for the K-12 support offered by the E-Rate program.

Application Assistance. Some states—such as Virginia, New Mexico, and Nevada—provide resources and application assistance to help ensure that their local schools and libraries can better access the E-Rate program.[638] Utah provides assistance to anchor institutions that helps them qualify for funding (such as E-Rate) and aggregates their purchases to reduce the cost of broadband.[639] Georgia has worked with the University System of Georgia's Information Technology Services to provide training and assistance with E-Rate applications.[640] State E-Rate coordinators are also working together to share program strategies, provide support, and shape program development.[641]

Supplemental Funding. Numerous states provide financial resources to improve the broadband connectivity of their community anchor institutions. Twenty-four states created matching funds to assist schools and libraries seeking E-Rate support for special construction projects (as discussed later).[642] Such state efforts can remove an up-front financial barrier to fiber deployment in less-advantaged schools because the combination of E-Rate funds and a state E-Rate match can equal 100 percent of the up-front costs of construction.[643] Georgia encourages its libraries to participate in E-Rate by funding expenses that remain after E-Rate discounts are applied to broadband connectivity costs.[644] In 1999, Maine created its own subsidy program to support broadband services for its schools and libraries.[645] Several other states—Wisconsin, Missouri, Oklahoma, Arizona, and Montana—have similar funding programs.[646]

State Research and Education Networks. States are also supporting their own research and education networks designed to boost academic research and promote digital access through collaboration in research and coordination that yields "reduced costs, shared expertise, shared services, advanced security, increased buying power, and economies of scale."[647]

- In Michigan, the Merit Network (discussed in more detail in an accompanying sidebar) provides broadband services to educational institutions spanning K-12 schools, universities, libraries, and government and health-care facilities across the state.[648] The organization prides itself on developing customized solutions for

Imperial County: Closing the Homework Gap in a California Desert Community

In communities where too many people have no access to broadband infrastructure, investing in connections to community anchor institutions is an intermediate step that can pay huge public dividends. Imperial County, located in the sparsely populated desert region of southeastern California, is an exciting example.

When relying on a single telecommunications provider and its outdated technology, Imperial County school districts, higher-education institutions, and government agencies had limited access to broadband infrastructure. So they joined forces, forming the Imperial Valley Telecommunications Authority (IVTA) to create a high-performance data network for a fraction of the cost of standard telecommunications lines.

IVTA entered into an agreement with the local power and water district to use shared fiber-optic cable between communities, along with poles, towers, and other resources, to create the fiber-optic communications network. Today, IVTA provides connectivity to 120 total sites, including thirty community anchor institutions in twelve communities.

With this infrastructure, not only can Imperial County's Office of Education (ICOE) fulfill its mission of providing "exemplary support and leadership in technology to schools, districts, and the community, [which] is critical to student success," it is able to connect to the California Research and Education Network (CalREN), a high-speed, high-bandwidth network linking county offices of education, school districts, K-12 schools, community colleges, and institutions of higher learning throughout the state of California.

But the benefits of the infrastructure go well past just connecting buildings. In a region where 74 percent of families

the organizations, including the community anchor institutions, it serves.[649]

- The Corporation for Education Network Initiatives in California (CENIC) offers similar services to the state's libraries and K-20 educational institutions over its 8,000 miles of optical fiber.[650]
- Connecticut's State Library Board has contributed more than $3.6 million in grants to more than 90 libraries to enable them to connect to the high-speed fiber Connecticut Education Network (CEN).[651]
- Arkansas's 2019 Broadband Plan focuses on the roles played by its research and education network, telemedicine network, and K-12 network.[652]

Forty research and education networks have formed "The Quilt," a national coalition whose purpose is to further scientific knowledge at academic institutions.[653]

B. From Places to People—Connecting Individuals to the Institutions

The Middle Rio Grande Consortium (discussed in more detail in the accompanying sidebar) provides broadband to libraries in four pueblos in New Mexico. At night, students can be seen in cars at those library parking lots using the new broadband network to do their homework. Indeed, a local IT manager said, "Nighttime parking-lot Wi-Fi is an infrastructure in our state."[654] Such *ad hoc* methods are all too common. The Department of Education's Institute of Education Sciences found that 14 percent of children between 3 and 18 years of age have no internet access at home.[655]

Broadband needs to reach users wherever they are. For example, of students who access the internet, approximately a quarter use libraries, community centers, and other public places,[656] while nearly one-eighth of all K-12 students use the internet at coffee shops and other businesses that offer access.[657] Indeed, lack of connectivity may not only disadvantage students but may also lead to a change in teaching techniques: Teachers are less willing to assign homework or projects relying on broadband in the home when even a relatively small portion of their students lack connectivity.[658]

One short-term answer to the lack of in-home broadband can be found in libraries across the nation that are experimenting with the lending, not just of books, but of Wi-Fi hotspots. Dr. Sharon Strover has studied the New York Public Library's Wi-Fi lending program, which is the oldest in the nation. She has concluded that such efforts "may have important roles for the constituencies lacking reliable access and the opportunity to spend more time learning the skills useful to navigating and exploiting the internet."[659] Libraries in other cities—including Chicago, Detroit, Seattle, Los Angeles, Boston, Minneapolis, Houston, Kansas City, St. Paul, Tulsa, and Bellingham, Washington—also have successful hotspot programs, and libraries in a handful

qualify for the free and reduced lunch program, thousands of kids do not have internet access once they leave the classroom. Low-income students disproportionately feel the impact of the "homework gap," and this disadvantage jeopardizes students' performance, grades, and graduation rates.

To close that gap, the Imperial County Office of Education teamed up with local school districts to start the BorderLink project, which relies on LTE technology to bring wireless internet connectivity to students in eleven communities, including Brawley, Calexico, Calipatria, El Centro, Heber, Holtville, Imperial, Niland, Seeley, Winterhaven, and Westmorland. Students, teachers, and others are provided devices to ensure broadband access follows them home. And IVTA and ICOE partner with a host of community organizations on computer literacy as well.

In 2018, the United States Department of Agriculture awarded IVTA eight Community Facilities Grants totaling $840,000. IVTA allocated an additional $360,000 for a total of $1.2 million toward BorderLink, which was the focus of the grant proposals. "These grants will allow us to expand access in some of our most underserved communities. It's exciting to think of the possibilities that this access will bring to students and families," said Imperial County Superintendent of Schools Todd Finnell.

of rural communities in Kansas, Maine, Texas and Oklahoma, among others, are beginning to experiment with the technology.[660]

In an article co-written with Brian Whitacre and Colin Rhinesmith, Strover found, based on studies of twenty-four rural communities in Kansas and Maine, that internet connectivity provided by libraries' hotspot-lending programs aided users in connecting to "the broader information environment; for families, it proved immensely helpful for children's education."[661] To this point, John Horrigan and Jason Llorenz have found that public libraries were the most common public Wi-Fi access point for African Americans and Latinos.[662] Jon Peha and Ning Guan have concluded that library Wi-Fi use is growing more rapidly in areas with a higher proportion of African Americans, lower median incomes, and higher unemployment rates. [663]

Schools have recognized the same need. At least 60 percent of schools surveyed by CoSN have adopted strategies to increase student broadband access outside of school, such as providing hotspots or helping students participate in provider-sponsored discounted broadband services.[664] For example, the public school district in Green Bay, Wisconsin, has lent mobile hotspots to students, providing internet access that is confined to appropriate sites.[665] Two school districts in Virginia have used TV white spaces to offer access to students without regard to their family income.[666] Approximately 3 percent of the schools have begun to offer Wi-Fi on school buses, and nearly 4 percent have stated that they are planning to in the near future.[667] Proposed legislation would provide federal funding for Wi-Fi-enabled school buses, giving students the ability to get online to study and do homework assignments while they're on the bus.[668]

In July 2019, the Government Accounting Office proposed that the FCC consider the "potential benefits, costs and challenges" of providing off-site wireless access to students using E-Rate funds.[669] As the GAO noted, the FCC has already run pilot projects to test the concept and, as of the time of the report, had received two requests from school districts seeking funding for wireless connections to students.[670] In the course of its analysis, the GAO confirmed that lower-income children are less likely to use the internet at home and that affordability was the main barrier. But, significantly, the GAO also parsed the suitability of using wireless connections available at other locations, including businesses like coffee shops or community centers, and found a series of reasons they are less impactful than in-home broadband, including the need for transportation, concerns about safety, the cybersecurity threats of using public Wi-Fi, and limited hours of availability.[671]

We should provide wireless internet access for students in low-income families.

There is no reason to wait any longer. Congress and the FCC should expand E-Rate to provide wireless access to students of lower-income families who do not have broadband at home. At current prices, $100 million would support the full cost of LTE service to between and two million and three million K-12 students.[672] (Such efforts should be affordable given that the E-Rate program is currently running about $1.3 billion below its $3.9 billion budget cap.)[673]

In addition, the possibility of lowering the cost of fixed broadband connections to K-12 students or to vulnerable populations (for example, for the purpose of providing health care) should be explored. For example, the aggregation of buying power by school districts might allow the subsidy of in-home broadband for educational uses by lower-income students at prices below normal residential retail rates.

Policymakers should recognize that the mission of community anchor institutions is to improve lives. Broadband is a key element in fulfilling that mission. Baltimore's public school system has created a classroom in a community center to offer training in internet access.[674] Librarians note that the provision of skills training is a natural fit with the historic missions of their institutions—offering a trusted space in which people of all ages can learn in the ways that best suit them.[675] Some prisons are confronting the 21st century needs of their inmates by developing digital literacy skills programs and utilizing broadband to further educational opportunities.[676] Thus digital equity efforts of the kind discussed in Chapter 4 should include institutions trusted by the community, including community anchor institutions.

C. Community-Wide Connectivity: Institutions as Launching Pads for High-Performance Broadband Deployment

In the 2020s, public policy should recognize that bits are books, bits are blackboards, and bits are basic tools of medical practice. In other words, broadband networks that run to schools or libraries or health-care facilities are not built to carry only scholastic or literary or medical information.

Community anchor institutions can serve as a launching pad for community-based broadband access and, in places where broadband has already been deployed, more broadband competition. As Joanne Hovis, author of the CTC report, has explained:

> By their nature, most government networks to anchor institutions will reach deep into neighborhoods that house schools, libraries, public health offices, and government facilities such as water towers and fire stations. Many localities then lease excess capacity to private sector providers to enable service provision and last-mile build-out in the neighborhoods. This trend is fast accelerating as hundreds of localities make available spare fiber-optic capacity to private carriers at rates designed to catalyze new private sector investment and opportunity.[677]

Congress has already provided that past funding recipients of middle-mile networks, like the connections to community anchor institutions that reach into a community but do not reach to residences within a community, must operate on a non-exclusive basis.[678]

Broadband networks that link to schools and libraries are natural candidates for expansion into nearby neighborhoods.

Publicly funded middle-mile networks should be open to other broadband providers because "building 'open middle-mile' networks to anchor institutions could make it easier for other competitive providers to build out last-mile networks, not only to the anchor institutions, but also to the rest of the community, including residential users."[679] The following examples demonstrate different ways that middle-mile connections can support deployment into residential neighborhoods.[680]

- Merit Network in Michigan has begun to partner with municipalities and community anchor institutions "to facilitate community-provided internet to local organizations and residents"[681] by using its expertise to ensure that middle-mile connections are available for local community efforts.[682]
- In Kent County, Maryland, a government-funded network that serves anchor institutions ran fiber to the county detention center, bringing High-Performance Broadband close enough to an unserved

neighborhood that a private broadband provider could bring Gigabit service to those residents.

- In South Bend, Indiana, local leaders dissatisfied with the prices charged by the single local broadband provider formed Metronet, an alternative, open-access broadband provider.[683] The nonprofit's financing strategy was particularly novel. Seven of the city's major anchor institutions, including the University of Notre Dame and the city's three hospital systems, each contributed more than $2 million to fund the first stage of the network's deployment in exchange for ten years of access to the network.[684] The city expanded a pre-existing fiber network that ran its traffic monitoring system.[685] Savings have been substantial: the St. Joseph County Public Library, which serves more than 125,000 patrons, cut its annual broadband spending by two-thirds—a demonstration of the power of competition.[686] In addition, recognizing the needs of lower-income people, Metronet has made a point of bringing broadband connectivity to community centers and other anchor institutions where half or more of the surrounding population have incomes under $30,000.[687]

But a challenge to this strategy comes from the administration of the E-Rate program. Broadband networks that link to schools and libraries are natural candidates for expansion into nearby neighborhoods. However, a shadow has been cast over such efforts by the legal question as to whether E-Rate participants can share their networks for other uses, even where E-Rate is not paying for the expansion of a network to reach residential customers.[688] The current cost-allocation rules are not sufficiently clear to facilitate experimentation and legitimate support for further build-out, which leaves schools and libraries fearful of losing funding. For example, the General Accounting Office in July 2019 noted that cost-allocation issues had adversely impacted efforts by schools in California, Colorado, and Virginia to offer students remote wireless access; in California a school district bought separate internet access in order to avoid the cost-allocation process entirely.[689] And application of the standard is uneven—some projects including municipal entities have been treated differently than others.[690]

This uncertainly should be erased. Broadband deployment would be most advantaged if all make-ready costs—such as trenching and conduit—are fully allocable to the FCC's E-Rate, Rural Health Care, or similar efforts, along with any fiber strands and electronics that will be used for service to the school.[691] In this scenario, a new build to a community anchor institution would have almost all of its capital costs paid for by E-Rate. Then private funds could be used to add additional fiber strands at incremental cost that could serve other customers.

Libraries and Schools Join Hands to Connect New Mexico Pueblos

Slightly over half of Native Americans living on tribal lands (53 percent) have access to broadband internet service, according to the U.S. Census Bureau's 2018 American Community Survey, far below the national average (78 percent) and well below even the average rate in rural counties (65 percent). Many factors limit the deployment of broadband infrastructure on tribal lands, including rugged terrain, low population density, and complicated rights-of-way agreements and easements. All of these drive up costs, increase uncertainty, and often cause delays when deploying advanced communications infrastructure.

Because Indian country has some of the highest levels of unemployment and poverty in the United States, the inability to afford broadband service also limits its adoption on tribal lands.

A forthcoming case study by the American Library Association (ALA) examines how tribal libraries and schools in north-central New Mexico came together to address their own broadband connectivity challenges. As Kimball Sekaquaptewa, now chief technology director at Santa Fe Indian School, said, "If the incumbent providers weren't willing to build out in our area, we were willing to own and operate our own internet infrastructure."

Forming two separate consortia, tribal libraries and schools in six pueblos were able to aggregate their demand for broadband and build two 60-mile fiber-optic networks. Applying together through consortia applications and pursuing a regional approach yielded greater results than operating alone. Over 90 percent of the $4.2 million project was funded directly by the largest E-Rate award in the state of New Mexico in 2016 and the first tribal project of its kind since the FCC's E-Rate modernization order in 2014.

Key takeaways from these efforts include:

Other alternatives are also available. The use of wireless technologies may be able to expand the reach of community institutions into their communities. For example, when television spectrum was assigned in the 600 MHz band, the FCC designated frequencies to be left unused, called "white spaces" (TVWS), in order to protect TV broadcasts from interference.[692] But it turns out that internet-access service can operate in these white spaces without interfering with the use of licensed TV spectrum next to it.[693] A grant from the federal Institute of Museum and Library Services (IMLS) is supporting new efforts to create easy-to-use TV white space base stations for libraries that can send Wi-Fi signals into communities in Georgia, Maine, Nebraska, and Washington, reaching seniors, students who lack home broadband, and local merchants.[694] Another IMLS grant is working to empower tribal libraries to "leverage TVWS to provide convenient Wi-Fi access for the community in new places never before served" such as parks, shelters, playgrounds, senior centers, and post offices.[695] Such public Wi-Fi access can serve as a short-term mechanism of offering broadband services to low-income residents,[696] although the goal should always remain High-Performance Broadband.

Consistent with the capacity requirements of community anchor institutions, federal spectrum policy should recognize the importance of community uses. Spectrum is a resource, like a national park, and public access to a national park is a well-established and bipartisan goal. The same policy should apply to use of spectrum, which should be made available for licensed and unlicensed use, for private deployment and the public interest.

Finally, communities may be able to share infrastructure in order to help bring better commercial services to unserved or underserved areas. Researchers at Carnegie Mellon University led by former FCC Chief Technologist Jon Peha are exploring how local governments can provide "smart city" services, including ways to collect and use data to reduce rush-hour congestion on busy roads, improve police and firefighter response times, and warn residents if air quality could pose a health risk. By working with local governments in urban and rural communities,[697] they have shown that much of the cost of these services comes from improving communications infrastructure.

They are investigating new ways for local government to share infrastructure with commercial operators to simultaneously reduce costs incurred by government and improve the commercial broadband services available to the public, especially in areas that need broadband improvements most. For example, after the U.S. Department of Transportation proposed a plan to improve roadway safety that required deploying broadband-connected roadside units that use wireless

Leadership, Cooperation, and Coordination. Because librarians, education directors, tribal administrators, and IT staff came together to navigate the application process, engage pueblo leadership, and coordinate with broader New Mexico state efforts, they were able to advocate and move the project forward. Tribal librarians played a pivotal role in educating their tribal leadership about the importance of broadband access and services. And they will continue to play a vital role in digital inclusion and digital literacy efforts, bridging generational divides and integrating new technologies to support their traditional communities.

Consortium Approach. The impetus for the effort was language preservation. The broadband network facilitated distance learning by connecting tribal libraries to the Santa Fe Indian School, which is owned and operated by nineteen New Mexico pueblos. The collaboration of neighboring tribes aggregated the demand for broadband and made it possible to build a higher-quality network.

State Government Support. Working with the State of New Mexico, the consortia gained insight into the E-Rate program as well as garnering assistance with filing its E-Rate application. The consortia also obtained state funding that delivered additional discounts through the E-Rate program.

Design of Self-Provisioned Networks. The consortia combined its own network with leased dark fiber and connected to a regional network to dramatically increase capacity (from 3Mbps to 100 Mbps) and decrease costs (from $106 per Mbps to $7 per Mbps). The design of the network opens countless opportunities for new services and next-generation educational networks in tribal libraries and schools.

There are nineteen pueblos in New Mexico. The Middle Rio Grande and Jemez-Zia Pueblo Tribal Consortia project, which connects six of these pueblos, continues to meet and plan connections to other pueblos and tribal networks. These tribally owned and operated networks provide the capacity needed for the foreseeable broadband needs of these communities, thus furthering the affordability and adoption of broadband in Indian country.

technology to communicate with cars,[698] the Carnegie Mellon researchers found that if state and local governments shared infrastructure with cellular operators, it could reduce the cost of this plan by hundreds of millions of dollars nationwide.[699]

II. Policy Recommendations to Promote the Missions of Community Anchor Institutions

In this section, we propose policy recommendations to improve community anchor connectivity and strengthen these institutions and their communities.

A. Governments should establish connectivity goals fit for the rising demands of the next decade, including periodically re-examining the current goals set by the FCC for federally funded connectivity to schools and libraries and establishing connectivity goals for other community anchor institutions.

1. Such goals should recognize the changing nature of applications, including the increasing use of higher and higher quality video, and the proliferating number of devices that must be supported by on-premises broadband.

2. Governments should ensure that such broadband is high-performance in every sense of the term, including the needs of community anchor institutions for redundancy, network security, and scalability.

B. Governments should support and promote competition to drive better broadband at lower prices for community anchor institutions.

1. Competitive-bidding processes both yield the best terms for community anchor institutions and can bring more fiber-based deployment into a community. Cost-efficient new entry by broadband providers should be encouraged, and the results of competitive-bidding processes should be respected.

2. Enhancing the ability of community anchor institutions to work together to aggregate their broadband needs through buyer

Broadband for a Healthier America

Advances in telemedicine are transforming health care. Once delivered solely at traditional brick-and-mortar facilities, broadband increasingly delivers connected care options to patients at home and on the go.

About half of all U.S. hospitals currently employ at least some telehealth and telemedicine techniques. Early evidence suggests that telemedicine can result in shorter hospital stays, lower mortality while recovering at home, and less frequent need for follow-up appointments. Telehealth connections allow certain at-risk populations, including the elderly and patients with chronic health conditions, to stay at home longer. People with disabilities also benefit from the convenience of telehealth. Patient programs that include home telehealth have also demonstrated significant cost savings.

But full-blown telehealth requires bandwidth—in medical facilities and in patients' homes. In 2017, the Congressional Research Service found that hospitals require at least 1 Gbps to share medical records, perform virtual consultations, and connect first responders. Medical imaging and testing devices have taken advantage of the rapidly decreasing digital-information storage costs and more plentiful bandwidth, with 20-megabyte 2-D high-resolution images giving way to 3-D images composed of hundreds of megabytes of data. As do schools and libraries, health-care providers need to develop more robust local area networks and Wi-Fi systems to meet the rapid proliferation of digital devices. One hospital estimated that its network should be able to support 10,000 wireless devices at any one time.

The critical problem is the absence of broadband connectivity in lower-income and rural areas. Rural America is facing a physician shortage, yet low-income and rural populations are less likely to have robust broadband choices. A new study from the University of Pittsburgh illustrates the problem that where there are fewer doctors, there is also less broadband: "[C]ounties with adequate access to primary care physicians and

consortia can lower the price of connectivity and can incentivize entry by new competitors.

3. State and local governments should provide direct funding to community anchor institutions, including matching funds, so that the anchor institutions themselves can choose the broadband providers and services that best serve their needs.

C. The administration of broadband programs supporting community anchor institutions must be transparent, rely on competitive outcomes, and provide reasoned (and thus reviewable) analysis for administrative decisions.

1. Anchor institutions require broadband with performance characteristics and terms (such as pricing) distinct from residential users.

2. Application processes should be simple and straightforward and, to the maximum extent possible, consistent across different federal programs.

D. Federal and state programs should empower community members—particularly K-12 students—to access community anchor institution broadband and crucial applications ubiquitously. These policies should include:

1. Supporting hotspot lending programs and outfitting transportation, such as school buses, with broadband. (To the extent the E-Rate and federal health-care programs can be used, they should be expanded to accomplish these results.)

2. Expansion of E-Rate funding to support wireless, off-premises access such as through LTE subscriptions or use of unlicensed TV white spaces for lower-income students.

3. Consideration of volume purchasing by school districts, backed by public funding, of fixed-broadband connections for lower-income students to enhance educational opportunity at home.

4. Providing low-cost, fixed-broadband connections to people who need to access broadband to receive critical social services, including health care. Outreach to vulnerable communities,

psychiatrists had 62 percent broadband coverage; counties with inadequate access to primary care physicians had 39 percent broadband coverage; and counties with inadequate access to psychiatrists had 49 percent broadband coverage."

State and local governments recognize the importance of broadband-supported health care in rural areas. For example,

- California and Idaho fund telehealth efforts that connect rural locations to medical providers.
- Arizona's 2018 Broadband Strategic Plan specifically calls for broadband expansion to rural health-care providers to assist in the treatment of health issues that include diabetes and opioid addiction.

While state programs to improve connectivity for telehealth programs are relatively scarce, their acceptance by state medical support programs like Medicaid is becoming more common. For example, forty-nine states provide some form of reimbursement for live video-based services, while twenty states currently provide Medicaid reimbursements for remote patient monitoring. Some states, such as Kansas, have passed laws that require reimbursements over a relatively wide range of telehealth methods.

Federal efforts to date have tended to focus on rural health care. Thus, the Federal Communications Commission operates programs to subsidize the cost of broadband to rural health-care providers with prices that, like E-Rate, are established through a competitive process. Eligible costs include up-front charges for deployment of new or upgraded broadband facilities and lit- or dark-fiber leases.

In July 2019, the FCC adopted a Notice of Proposed Rulemaking (NPRM) that would establish for areas lacking adequate health care "a three-year, $100 million Connected Care Pilot program that would support bringing telehealth services directly to low-income patients and veterans."

In his press statement thanking Federal Communications Commissioner Brendan Carr for his willingness to work with him on this NPRM, Commissioner Geoffrey Starks said, "Gaining access

especially older Americans, should include digital skills training, in concert with the principles recommended in Chapter 4.

5. Governments should also maximize the opportunities to leverage telemedicine networks to improve health-care delivery to consumers, especially in rural markets where hospital closures and a shortage of doctors have made access to health care even more expensive and less available to consumers. Telehealth spending should be sufficient to achieve national results.

to the benefits of quality health care still depends, as it always has, on connecting doctors with patients. For many Americans, in-person visits just aren't possible, either because they live too far away, because their chronic health conditions make it difficult for them to leave the home, or because there just aren't enough doctors to go around. Broadband is bringing back the 'house call.' Thanks to connected care technology, doctors and mental-health professionals have the ability to provide care and treatment in the home through video visits and remote monitoring. This is a game changer."

E. Governmental support for High-Performance Broadband deployment to community anchor institutions should leverage those networks to spur competition and greater connectivity for nearby residents.

1. As with earlier federal efforts, government-supported middle-mile networks should be available to all broadband providers on a non-exclusive basis so that these networks can act as launching pads for community-wide residential service.

2. Federally funded deployment of broadband connections to community anchor institutions should permit any extra capacity (such as additional fiber strands) to be used by residential providers so long as federal funding does not go to any non-shared costs of the residential network.

3. Make-ready costs—such as trenching and conduit—should be fully allocable to programs supporting community anchor institutions, along with any fiber strands and electronics that will be used for service to the community anchor institution.

4. Community anchor institutions should be allowed to share unused wireless capacity with their communities.

F. Spectrum policy should allow community anchor institutions to be full or even favored participants in shared and tiered access.

G. State and local governments should facilitate comprehensive broadband strategies, including encouraging the creation and growth of state research and education networks and bringing institutions together to learn from one another.

III. Conclusion

Governments should take a comprehensive approach toward support for community anchor institutions. Robust, competitively priced broadband to community anchor institutions can promote individual economic opportunity and stronger civic engagement while also spurring competition and lowering the cost of broadband deployment generally to the users of the community anchor institutions as well as to unserved and underserved places more broadly.

Community anchor institutions should be at the center of any comprehensive national strategy to promote the availability and use of High-Performance Broadband.

And in the next decade of the 21st century, ubiquitous broadband and the special role of community anchor institutions will continue to evolve as ubiquitous broadband increasingly empowers such institutions where they are, and where their users are. Public-housing authorities can use broadband to increase education and prevent crime. Community centers can use broadband to promote voting registration and democratic debate. Prisons can use broadband to teach inmates digital skills that they can use to find jobs and thereby reduce recidivism. Churches and houses of worship can create broadband-enabled computer labs to attract young people to religious leaders who can serve as mentors and role models for serving others.

Even more, the work of community anchor institutions can join together the key goals of this report: deployment, competition, affordability, and adoption.

An anchor is a source of stability and strength for a boat on the water, which would otherwise drift away in the ever-moving flow of tides. A community anchor institution is a source of stability and strength for a community in flux—sometimes rapid, sometimes tumultuous flux. These are the community institutions that can help America navigate its broadband future in the coming decade.

Chapter 6: **Stronger Communities and Democracy**

Democracy is not just the act of voting; it is the act of believing. Democracy thrives when people believe in their chance to succeed, when they trust civic and governmental institutions, when optimism fuels the belief that the future is bright—for themselves and their children.

The Benton Institute for Broadband & Society has worked for almost four decades to increase access to communications networks because we believe communication is a critical element for advancing a healthy democracy. As our founder, Charles Benton, explained, "We have championed communications as the bedrock of democracy."

Today the American Dream is increasingly out of reach for many, and the link between economic success and strong democracy is broken.[700] Economic frustration born of the belief that the deck is stacked against workers, fueled by popular feeling that government is out of touch, corrodes support for democratic institutions. As one commentator observed, "When you have been struggling for decades, you tend to lose faith in society's institutions and their sober-minded experts."[701]

High-Performance Broadband can play a role in economic renewal.

There is no single solution to reverse the economic trends of the past decades nor to strengthen belief in democratic institutions. This report has strived, however, to demonstrate that High-Performance Broadband can play a role in economic renewal, particularly as part of state/local economic strategies designed to increase employment opportunities and boost economic growth. In that way, the use of High-Performance Broadband will help America achieve positive economic and social outcomes, further connecting broadband usage, economic success, and the future of American democracy.

As Chapter 1 explains, the American economy over the past four decades has become increasingly unequal, as family incomes have remained stubbornly stagnant, eroding the full promise of the American Dream. The top 1 percent have prospered, but, increasingly and steadily, the bottom 90 percent have fallen further and further behind. In fact, it has been a startling 46 years since average hourly wages reached their historic peak in January 1973.[702]

High-Performance Broadband will help America achieve positive economic and social outcomes.

Traditionally, Americans have taken solace in the belief that advancing widespread prosperity throughout the country, in ways that were inclusive, was also an essential enabler for strengthening and lifting our democracy. We think of our country as the land of opportunity. Early observer Alexis de Tocqueville, who praised the equality he observed in American society in the early part of the 19th century, saw U.S. economic performance as a bulwark of American democratic institutions and principles.[703]

Fifteen years ago, the American Political Science Association sounded a warning: "Our country's ideals of equal citizenship and responsive government may be under growing threat in an era of persistent and rising

inequalities."[704] It's only gotten worse since then. As described in Chapter 1, the rate of income inequality continues to increase.[705] And public sentiment follows. In 2016, almost two-thirds of Americans believed that the economy was not operating fairly.[706] And, despite a resilient residue of optimism, Americans expect income inequality to increase by 2050.[707]

High-Performance Broadband in the next decade can be a vital engine for economic growth—a tool for increasing individual opportunity. It can enable economic opportunities to increase—regardless of geography or income. It can help Americans rediscover the pathways for upward economic mobility that have long characterized the American Dream. In doing so, we can empower a new generation of people in the United States with the tools they need to fulfill their potential. But the importance of broadband extends far beyond its considerable economic potential, to the very fabric of American democracy.

The ideas of a competitive market and the idea of democracy are woven from the same fabric of truth-seeking.

This report has stressed that one important means of improving access to broadband is to give consumers more and better choices by promoting greater competition. At a fundamental level, the ideas of a competitive market and the idea of democracy are woven from the same fabric of truth-seeking—the same idea from which science, technology, democracy, and competition all emerge.[708] That is because competition and democracy are themselves products of the belief that people are—and should be—empowered to discover the truth; whether that is the truth about which dish soap to buy or the truth about which person on whom to bestow political power.

Schoolchild after schoolchild has stood and pledged liberty and justice for all. Liberty includes economic opportunity. Justice, by one religious tradition, "shows no favor and takes no bribe, but upholds the cause of the fatherless and the widow, and befriends the stranger."[709] And yet in times of economic frustration and discontent, the quality of mercy can be so strained that it is easier to blame, rather than befriend, the stranger.

High-Performance Broadband is a tool that can help support democratic society and the social justice it engenders because increasing economic growth and individual opportunity are the means for securing a foundation of support for democratic institutions.

How can we extend broadband's reach to those who can benefit most, and how can we ensure that its potential can be harnessed to help more

Taking Hold of Their Digital Futures: Civic Engagement in Detroit and Philadelphia

In two of America's least-connected cities, Detroit and Philadelphia, two innovative projects are empowering community members to take their digital futures into their own hands. Each project combines low-cost broadband service with critical digital literacy training and content that is relevant to their communities.

The Detroit Community Technology Project (DCTP) and Allied Media Projects have created the Equitable Internet Initiative (EII) to ensure that more Detroit residents can leverage digital technologies for social and economic development. To achieve its goals, DCTP partners with three community anchor organizations that implement EII programs in their respective neighborhoods.

EII trains community organizers, people with construction skills, and techies to design and deploy their own fixed-wireless communications infrastructure as Digital Stewards. They have built autonomous community networks in three Detroit neighborhoods, and one in neighboring Highland Park. Costing between $10 and $20 a month, with service speeds between 500 and 800 Mpbs, connections are prioritized to people who don't have internet access and households with children and/or seniors, those pursuing an education, or people with disabilities.

The networks can also act as a local network or "intranet" over which neighbors can communicate and share information without the internet, using the community wireless network to house applications, including The Detroit Music Box, a neighborhood radio station that broadcasts stories and media from the Cass Corridor, which is undergoing gentrification and revitalization.

An additional DCTP program trained young people to create other applications, including one that raised awareness about the impact of air pollution, particularly from an incinerator in Detroit's North

people in America climb up the economic ladder in a more fulfilling and sustainable way?

We can answer that question in multiple ways. Start with education and learning. From an economic perspective, education increases economic mobility and boosts economic advancement.[710] Indeed, "the original public-school movement in the U.S. emphasized preparing students for participation in democracy."[711]

But education does more than prepare students to work. What one learns improves what one earns. And the combination of new technologies is transforming the "future of work" with new industries creating new jobs we can't yet imagine, that require skills we can't yet foresee. That is why education is increasingly important for teaching us how to learn throughout our lives, how to think more critically, and how to qualify for new jobs.

Public libraries are similar forces for democracy—serving all parts of a community, offering access to knowledge to those who might otherwise struggle to discover it. As Nancy Kranich, past president of the American Library Association, explained, "Since their inception, libraries have served as pivotal community institutions upholding, strengthening, and realizing some of the most fundamental democratic ideals of our society."[712] As described in Chapter 5, community anchor institutions serve larger societal, including democratic, goals. Such institutions—which include schools, libraries, health-care providers, and community colleges, to name just a few—are what the Schools, Health & Libraries Broadband Coalition has described in detail as institutions that can boost learning and education and elevate civic engagement.[713]

There are other ways in which the use of High-Performance Broadband can help build a more robust democratic society. Consider access to health care—a fundamental human concern but also an essential ingredient to a healthy workforce. In 2018, then–FCC Commissioner Mignon Clyburn spelled out her vision for "intentionally meeting the health needs of *every* single American, regardless of where they live, and [leveraging] broadband technology to do so."[714] Why? Because broadband deployment can "be an oasis in a health care and wellness desert."[715]

High-Performance Broadband can transform industrial sectors, helping farmers feed the next billion people and helping the nation address our climate challenges. Similarly, municipal officials have discovered "the importance of the many linkages between deploying such information networks and other municipal policies, including those affecting construction, transportation, housing, and economic development."[716]

End neighborhood. The incinerator's operations came to an abrupt close nearly a year after the app launched, seemingly due to public pressure.

EII and its partners also created a "resilience strategy" that combines solar charging stations, internet hotspots, and portable network kits that extend the network. In this way, the three EII neighborhoods are covered with a communications system that can be used in an emergency to exchange resources and organize.

Finally, EII is creating an open-source online learning platform—a space for community technologists to effectively learn and share best practices. This is a testament to DCTP's mission to help other communities and individuals transition from consuming other people's technology to becoming builders, producers, and decision makers of their own.

In Philadelphia, the CAP (Corporate Accountability Project) Comcast campaign focused on securing a variety of community benefits from the cable and broadband company as it negotiated a franchise agreement with its hometown. Comcast's franchise agreement, renegotiated every fifteen years, gives the company permission to use public rights-of-way to operate its services.

Building awareness among city residents and other constituents, holding public hearings, and involving the city council, the campaign—led by Media Mobilizing Project, in collaboration with a broad coalition of activists, residents, policymakers, media producers, and public-sector workers—was able to gain commitments that Comcast would:

- Expand affordable internet to low-income communities across Philadelphia through its Internet Essentials program,
- Provide free Wi-Fi service at municipal buildings,
- Increase customer service commitments,
- Underwrite the expansion of Career and Technology Education at the Philadelphia Public Schools, and
- Give $500,000 in seed funding to the Digital Literacy Alliance (DLA), which grants funds to local groups

promoting digital literacy, targeting the gaps that Philadelphia libraries cannot address.

The campaign also helped deliver equity to wage workers and women- and minority-owned businesses.

A key element of democracy is the active participation of people in politics and civic life. In Detroit and Philadelphia, these deployment and digital inclusion projects illustrate how public engagement can lead to more equitable communities.

The adoption efforts described in Chapter 4 do more than just help people to gain skills and get jobs. More broadly, such efforts "might be understood as increased civic engagement and participation in democratic processes or more collaboration between community-based organizations and other local entities, including local government."[717]

The strength of High-Performance Broadband is that it will—if fully accessible to all in America—help us solve some of our most critical societal challenges, meet people wherever they live and work, and help them overcome key barriers regardless of their background, community surroundings, or demographic characteristics. Imagine each community enabled to identify and build on its strengths and employ technology accordingly. That is a profoundly democratic vision. As César Chávez said, "We cannot seek achievement for ourselves and forget about progress and prosperity for our community."[718]

Chapter 7: **High-Performance Broadband Policy Recommendations**

Everyone in America should be able to use competitive, High-Performance Broadband. But how do we accomplish that goal? Broadband policies, driven by competition, must ensure that consumers and communities benefit from advanced networks of the next decade.

An effective broadband policy for the 2020s must cover all of the aspects of broadband usage—not simply the deployment of networks themselves. The agenda is therefore built on four pillars: Deployment, Competition, Affordability and Adoption, and Community Anchor Institutions. These topics are interwoven and they strengthen each other. A successful broadband agenda must include them all.

I. Deployment of High-Performance Broadband Networks to Unserved Areas (Chapter 2)

In this section, we propose policy recommendations to encourage effective deployment of High- Performance Broadband to unserved and underserved areas.

A. Map Broadband Oases and Deserts

1. The Federal Communications Commission (FCC) must move promptly to collect, verify, and release data that will allow policymakers at all levels of government to make real judgments on the extent to which broadband is actually available to every household location in America.
2. Broadband providers must provide accurate information, and this must include accurate data on pricing, non-pricing terms, technical performance, and quality of service.
3. The FCC should present its analysis in ways that permit users to easily understand the existence, and implications, of different tiers of broadband, at least up to 1 Gbps symmetrical.
4. The FCC should ensure that the data are publicly available and can be easily used with other federal information collections, including those maintained by the U.S. Census Bureau.
5. Users should have access to the underlying data that permit them to create their own maps with data they import from other sources. Thus, mapping can become a distributed enterprise.
6. The FCC data collection should be established to incorporate continuous learning from outside analyses.
7. The FCC must have the information in hand that is needed to make informed judgments about the design and operation of broadband deployment programs before new efforts are undertaken, including any future reverse auctions, and should accomplish that task by the end of 2020.

B. Deploy High-Performance Broadband

1. Governments should promptly scrap obsolete performance standards, such as the FCC's current 25/3 Mbps definition of advanced broadband.

2. For any new deployment funding, governments should require at least 100/100 Mbps service with no usage limits and latency low enough to run interactive video applications (like videoconferencing). Good policy demands that performance criteria—like low latency, symmetry, and the amount of data that can be received and sent each month—be treated as importantly as speed alone. Such speed and other standards should be updated as programs are implemented or expanded.

3. Competitive processes should always be used to bring down the cost of funding capital expenditures for broadband deployment.

C. Reach Unserved Areas (and Reject the Claim of "Overbuilding")

1. The focus should be on whether robust broadband is present—not on whether an area meets one of the multiple definitions of "rural."

2. Underserved rural and urban areas should be treated with equal importance. Although rural areas suffer from persistent and unique challenges, lack of broadband exists in some urban environments as well.

3. Deployment and competition are good for consumers. The question for funding is not whether there is "overbuilding" but whether funding will be well-spent. In considering expenditures, federal (and, where applicable, state) agencies should consider among other factors:

   a. the benefits to consumers of increased deployment and competition, and

   b. the ability of network expansion to capture the advantages of network efficiencies in reaching these areas (and passing those savings along to consumers).

D. Deploy High-Performance Broadband on Tribal Lands

1. Congress and the federal government should determine whether the particular challenges of Indian lands that have left too many behind for too long require specialized efforts: for example, to ensure that higher costs of construction do not inevitably lead to the exclusion of tribal lands from the results of reverse auctions.

2. An Office of Broadband Coordination for Tribal Lands should be established in the Executive Branch, perhaps in the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA). The office would act as a counselor and ombudsman to Tribal Nations and service providers and focus on deployment of broadband to tribal lands in order to ensure seamless interaction of various federal efforts.

E. Employ Reverse Auctions to Stretch Federal Dollars

1. Where the federal government is spending significant sums of money—on the order of tens of billions of dollars—to support capital expenditures for broadband deployment, reverse auctions can produce the most bang for the buck.

2. Reverse auctions should be structured to incentivize and reward the highest performance bids. One approach would be to establish performance tiers, with bids accepted for lower tiers only when there is no cost-effective bid for a higher tier. The first tier could seek bids for low-latency, unlimited-capacity, and 1 Gbps symmetrical service. After this top tier, reverse auctions would proceed to lower performance tiers.

3. Reserve auctions should be structured to promote innovation and new entrants.

4. Winners of grants, loans, and/or reverse auctions must be carefully monitored to ensure they are delivering what they have promised, and prompt action, including re-auctions, should be used to ensure that the auction process serves consumers effectively.

F. Establish Eligibility for Reverse-Auction Participation

1. Provider participation should extend broadly to include new entrants like rural electric co-ops and private-public collaborations.

G. Establish Requirements for Funded Deployment

1. Governments should ensure that middle-mile and backhaul facilities constructed with government support are open and available to multiple broadband providers.

2. In addition to meeting performance standards established by the funding process (such as the minimum 100/100 Mbps symmetrical requirement), recipients of federal deployment funding should be required to offer two standardized tiers of service: one that offers a lower-priced package for all consumers and one for income-eligible individuals. To that end, the FCC (or, in the context of legislation, Congress) should consider requiring that such recipients offer all consumers 50/50 Mbps with unlimited data for $50 per month and, for the reasons explained in Chapter 5, offer eligible, low-income individuals the same service for $10 per month. Such requirements should be updated as technology and demand for broadband services advance.

H. Increase the Effectiveness of Federal Efforts

1. Federal programs should look first to fund the capital expenditures associated with fiber-based networks before spending funds on lower tiers of service and, only where necessary, to support operating expenses.

2. To the extent that interim steps are needed before the deployment of High-Performance Broadband can be funded, ongoing financial support should realistically evaluate the needs of providers while ensuring that funding streams reflect and reinforce competitive environments.

3. Broadband deployment efforts should support capital expenditures for future-proof, High-Performance Broadband networks. But, depending on the funding level and the time needed for construction of future-proof networks, interim measures may be necessary in the short term to ensure that broadband is available to everyone in America. Thus, support should be structured so long-term investments are made only in networks that are "future proof" and able to meet the performance demands of people in the 2020s. Any interim funding of operating expenses should be:

    a. for a limited period only, leaving governments free to attempt again to fund High-Performance Broadband construction if that is needed,

    b. calculated not to displace private dollars or fail to reflect ongoing subscription revenue, and

    c. to the extent that multiple providers are serving the same location, apportioned by market share, an operating-subsidies approach that gives voice to consumer preferences.

4. NTIA, the FCC, and USDA should publish a comprehensive map that demonstrates the eligibility of different areas of the country for different broadband programs, including those administered by the Department of Agriculture and the FCC.

5. Congress should provide guidance to the USDA, NTIA, and FCC efforts on how best to synergize their respective expertise. Different federal agencies have different forms of expertise. No federal agency knows rural America better than the USDA. The FCC is the government's expert on reverse auctions. Through its efforts collecting information about broadband deployment across the nation, the NTIA has developed significant expertise working with localities and states to improve broadband access and provide issues-based educational resources to the field.

6. Federal efforts should support this national broadband agenda across the board:

    a. Agencies like Housing and Urban Development, the Department of Education, the Bureau of Indian Affairs, and the Federal Reserve Banks (which manage the Community Reinvestment Act) should focus their broadband efforts on High-Performance Broadband. For example, the Federal Housing Authority should require that all new construction subject to its minimum standards will incorporate the infrastructure necessary for High-Performance Broadband into residential units and be available to multiple, competitive providers.

    b. Where governments construct infrastructure, like highways, they should install broadband infrastructure that is available to multiple providers.

    c. Federal procurement can also consciously spur deployment.

7. Federal agencies should ensure that, to the extent that common information is relevant to the administration of multiple programs, simple processes, including single applications where feasible, should be used.

8. The current system of funding the FCC's Universal Service Fund programs is not sustainable over the long run, as the revenue base of telephone-service providers continues to decrease. Congress should find a broader funding mechanism.

9. There is no reason for one part of the federal government to make payments whose purpose is simply to allow a broadband provider to pay back loans to another agency. (This recommendation is distinct

from permitting applicants to access multiple sources of federal support to fund deployment—an approach that can reinforce the efficacy of multiple efforts.)

I. Support State Strategies Targeted for Specific State Circumstances and Needs

1. State governments should follow the principles set forth here as they devise their own state broadband plans, to the extent that they apply (for example, if they choose to conduct reverse auctions).
2. States should continue to target their money where it will have the greatest impact. For example, a very good use of small amounts of money might be for a state to help fund the work of creating a proposal for federal funding of capital expenditures. Similarly, states could use funds effectively by prioritizing the areas that have the least fiber and fund those areas' middle-mile/backhaul construction, which should be open to multiple providers. With open connections, these networks could lower the cost of residential network construction to retail providers and likely stimulate competition.
3. State strategies have the advantage of being comprehensive and should encompass all aspects of a broadband agenda, including deployment, competition, affordability/adoption, and support of community anchor institutions.

II. Promoting Broadband Competition (Chapter 3)

In this section, we propose policy recommendations to further broadband competition to the benefit of consumers.

A. Promote Broadband Competition at the Local Level

1. Policymakers at all levels of government should encourage new entrants and the deployment of High-Performance Broadband to everyone in a community. For example, governments should consider:
   a. Public Electric Utilities and Electrical Cooperatives. Existing electricity providers, such as rural electric cooperatives, have a number of advantages, such as existing infrastructure, that make them prime candidates for deployment of broadband connections.
   b. Competition (and Deployment) in Multi-Tenant Environments, including Public Housing. Given the population density of apartment buildings and similar dwellings, policymakers at all levels should ensure the ability of competitive providers to reach residents, including in public and affordable housing.
   c. Private-Public Collaboration. Local governments should consider a variety of private-public partnerships to increase competition. Simply starting with an inventory of available fiber infrastructure in a community can jump-start a local strategy.
   d. Ownerships and/or Operation of Fiber Networks. Local governments should consider whether the

operation of fiber networks would further competition in their particular circumstances, including the operation of middle-mile networks and open-access networks.

2. Remove Limits on Local Decision-Making That Spurs Competition.

   a. States should repeal and, if necessary, Congress should pre-empt current state laws that restrict municipalities and counties from experimenting with various ways of increasing High-Performance Broadband deployment. Whether these local governments and the communities do so or not should be left up to them.

   b. As a matter of federal and state law, municipalities should be able to negotiate pro-consumer, community-wide deployment of broadband networks as part of agreements that allow for the use of municipal resources.

B. Enact Stronger Federal Policies to Spur Broadband Competition

1. Multiple federal programs—including from the Departments of Commerce, Housing and Urban Development, and the Federal Reserve Banks through the Community Reinvestment Act—should be optimized to spur greater choices for consumers. The FCC should eliminate exclusive multi-unit building contracts that require residents to pay for broadband services they neither want nor use.

2. Pro-competition spectrum policies should be pursued.

   a. To enable greater competition and maximize spectrum efficiency, the shared use of spectrum should be encouraged, including between governmental and private users, to improve broadband deployment in unserved and underserved areas and by smaller and new broadband providers.

   b. More unlicensed spectrum should be provided to meet growing Wi-Fi demand.

   c. Continue to use the so-called spectrum screen in reviews of mergers and acquisitions that include spectrum licenses to prevent anticompetitive concentration of spectrum holdings and/or constrain competition.

C. Execute Additional Pro-Competition Recommendations in Other Parts of This Report

1. Many of the recommendations in Chapter 2 promote deployment generally, including competitive entry:

   a. Funding should be allocated based on competitive processes, such as reverse auctions (Chapter 2, Recommendation E).

   b. Support for deploying competitive networks (Chapter 2, Recommendation C-3).

   c. When federal funding is used on infrastructure projects, such as highway construction, fiber should be installed and made available to multiple providers. (Chapter 2, Recommendation H-6b).

2. Many recommendations in Chapter 4 further consumer choice. For example, to make Lifeline service more accessible, more entities, including community-based institutions, should be allowed to provide Lifeline services as Lifeline Broadband Providers to low-income families (Chapter 4, Recommendation A-2).

3. Recommendations in Chapter 5 also further consumer choice.

   a. Deployments made to community anchor institutions should be subject to competitive-bidding processes, which lower the cost of procurement (Chapter 5, Recommendation B-1).

   b. Community anchor institutions should be empowered to act as launching pads for additional connectivity options to their surrounding communities (Chapter 5, Recommendation E).

III. Using High-Performance Broadband—From Networks to People (Chapter 4)

In this section, we propose recommendations to further the ability of people to use broadband connections. Successful efforts to date demonstrate the importance of comprehensive strategies that include affordability and the strengthening of community anchor institutions.

A. Create an Affordability Agenda

1. All broadband policy should promote competition through the principles contained in Chapter 3.

2. The FCC should protect and strengthen the Lifeline program by:

   a. expanding the ability of new, competitive broadband providers, including community anchor institutions, to participate as Lifeline Broadband Providers;

   b. simplifying the enrollment of eligible people (an even more efficient mechanism would make Lifeline enrollment automatic when people are enrolled in a qualifying federal program); and

   c. considering how best to enlarge the scope of individual eligibility.

3. Congress should consider the creation of separate support for eligible low-income people to afford fixed-broadband connections, including those in need of special in-home services, such as health care.

4. The FCC should provide technical assistance to broadband providers' low-income programs. For example, private broadband providers should be allowed to access the Lifeline national eligibility verification database or similar mechanisms of eligibility verification.

5. As recommended in Chapter 2 (Recommendation G-2), the FCC (or, in the context of legislation, Congress) should consider requiring that recipients of federal deployment funding offer eligible, low-income individuals an affordable broadband service for $10 per month. Such requirements should be updated as technology and demand for broadband services advance.

6. The FCC should educate and protect consumers, including through the use of the Fixed Broadband Consumer Disclosure Label, adopted by the FCC in 2015 but later rescinded.

7. Governments at all levels should make low-cost computing devices available, including by supporting computer refurbishers to package low-cost or free devices, connectivity, and ongoing technical support for low-income consumers. Governments are an obvious source of used computers.

8. Community anchor institutions should provide public-access computing centers that allow community residents to access technology and classes in places in which they feel comfortable and supported. That is especially valuable where community anchor institutions have helpful staff who provide them with one-on-one support with computers and broadband access.

B. Support Digital Skills

1. As local governments around the nation have demonstrated, digital inclusion efforts are most successful when they enlist the community in order to reach people in convenient, trusted places.

2. Deployment of federal and state resources takes many forms:

   a. The federal government should support digital literacy efforts run by state and local governments.

   b. State and regional digital equity plans should provide financial support and identify purposes—such as improved education, health, and civic and social engagement—to which digital skills instruction can be targeted and content can be created.

   c. Competitive processes that distribute federal dollars for digital literacy programs should both incentivize the winning localities and provide lessons to the localities that do not win. The application criteria for the award of any federal or state dollars should focus on the designation of important, local outcomes; the robustness of local leadership, including with private and nonprofit participants; and the manner in which outcomes will be tracked and evaluated.

   d. Digital skills programs should measure and monitor their results on an ongoing basis, and, given the financial constraints on local programs, federal and state support for digital skills efforts should include resources needed to evaluate the ongoing impact of digital literacy programs.

C. Incorporate Digital Skills Training in Regional Economic-Growth Strategies

1. Applying the lessons of local and regional economic clusters, state and local governments should focus training on middle-skill and other jobs important to their local economies. Digital inclusion plans should recognize which local institutions (a library in one community or a local church in another) can best reach the people who need to be served.

2. Economic-development support by the federal government (e.g., the Department of Commerce's Economic Development Administration) should facilitate the inclusion of broadband deployment, adoption, and digital literacy in any regional economic strategy.

IV. The Growing Role of Community Anchor Institutions in the Digital Age (Chapter 5)

In this section, we propose policy recommendations to improve community anchor connectivity and strengthen these institutions and their communities.

A. Governments should establish connectivity goals fit for the rising demands of the next decade, including periodically re-examining the current goals set by the FCC for federally funded connectivity to schools and libraries and establishing connectivity goals for other community anchor institutions.

1. Such goals should recognize the changing nature of applications, including the increasing use of higher and higher quality video, and the proliferating number of devices that must be supported by on-premises broadband.

2. Governments should ensure that such broadband is high-performance in every sense of the term, including the needs of community anchor institutions for redundancy, network security, and scalability.

B. Governments should support and promote competition to drive better broadband at lower prices for community anchor institutions.

1. Competitive-bidding processes both yield the best terms for community anchor institutions and can bring more fiber-based deployment into a community. Cost-efficient new entry by broadband providers should be encouraged, and the results of competitive-bidding processes should be respected.

2. Enhancing the ability of community anchor institutions to work together to aggregate their broadband needs through buyer consortia can lower the price of connectivity and can incentivize entry by new competitors.

3. State and local governments should provide direct funding to community anchor institutions, including matching funds, so that the anchor institutions themselves can choose the broadband providers and services that best serve their needs.

C. The administration of broadband programs supporting community anchor institutions must be transparent, rely on competitive outcomes, and provide reasoned (and thus reviewable) analysis for administrative decisions.

1. Anchor institutions require broadband with performance characteristics and terms (such as pricing) distinct from residential users.

2. Application processes should be simple and straightforward and, to the maximum extent possible, consistent across different federal programs.

D. Federal and state programs should empower community members—particularly K-12 students—to access community anchor institution broadband and crucial applications ubiquitously. These policies should include:

1. Supporting hotspot lending programs and outfitting transportation, such as school buses, with broadband. (To the extent the E-Rate and federal health-care programs can be used, they should be expanded to accomplish these results.)

2. Expansion of E-Rate funding to support wireless, off-premises access such as through LTE subscriptions or use of unlicensed TV white spaces for lower-income students.

3. Consideration of volume purchasing by school districts, backed by public funding, of fixed-broadband connections for lower-income students to enhance educational opportunity at home.

4. Providing low-cost, fixed-broadband connections to people who need to access broadband to receive critical social services, including health care. Outreach to vulnerable communities, especially older Americans, should include digital skills training, in concert with the principles recommended in Chapter 4.

5. Governments should also maximize the opportunities to leverage telemedicine networks to improve health-care delivery to consumers, especially in rural markets where hospital closures and a shortage of doctors have made access to health care even more expensive and less available to consumers. Telehealth spending should be sufficient to achieve national results.

E. Governmental support for High-Performance Broadband deployment to community anchor institutions should leverage those networks to spur competition and greater connectivity for nearby residents.

1. As with earlier federal efforts, government-supported middle-mile networks should be available to all broadband providers on a non-exclusive basis so that these networks can act as launching pads for community-wide residential service.

2. Federally funded deployment of broadband connections to community anchor institutions should permit any extra capacity (such as additional fiber strands) to be used by residential providers so long as federal funding does not go to any non-shared costs of the residential network.

3. Make-ready costs—such as trenching and conduit—should be fully allocable to programs supporting community anchor institutions, along with any fiber strands and electronics that will be used for service to the community anchor institution.

4. Community anchor institutions should be allowed to share unused wireless capacity with their communities.

F. Spectrum policy should allow community anchor institutions to be full or even favored participants in shared and tiered access.

G. State and local governments should facilitate comprehensive broadband strategies, including encouraging the creation and growth of state research and education networks and bringing institutions together to learn from one another.

V. Broadband Connectivity Best Practices

Much of the work to realize a better broadband future will depend upon the ability of local broadband leaders to develop deployment and digital equity strategies that solve their specific challenges. Hundreds of cities and towns across the nation have already facilitated broadband deployments, and many more have adopted policies that encourage new broadband competition within their communities. Listed below are some of the excellent resources that have analyzed the lessons learned through these local experiences to provide guidance and best practices.

These resources recognize that broadband infrastructure is indispensable to achieving higher community goals such as increased economic vitality, improved quality of life, equal opportunity for all, and full participation in our democracy.

A. Expanding Broadband Networks

1. Next Century Cities' web-based Becoming Broadband Ready toolkit provides community leaders with a comprehensive guide to all stages of broadband project planning and deployment, along with links to detailed examples, case studies, and additional resources. This broad strategic resource is updated as current issues unfold.

2. The Emerging World of Broadband Public-Private Partnerships: A Business Strategy and Legal Guide by Joanne Hovis, Marc Schulhof, Jim Baller, and Ashley Stelfox. This Benton and Coalition for Local Choice publication reviews the legal, financial, and strategic issues of public-private partnerships and other municipal broadband models. This resource is essential to municipalities that may need to develop a custom-tailored solution within a more complex state regulatory environment.

3. The World Bank's Innovative Business Models for Expanding Fiber-Optic Networks and Closing the Access Gaps reviews and provides guidance on innovative business models and approaches to the deployment of high-speed broadband networks and highlights global trends related to terrestrial spectrum resources that can be leveraged to meet expected future demand and close existing internet access gaps.

4. Blair Levin and Denise Linn Riedl's Next Generation Connectivity Handbook is a guide for city officials seeking the affordable, abundant bandwidth their communities will need to thrive in the decades ahead. Designed for local decision makers, it outlines best practices, summarizes existing

models, and presents a framework through which community leaders might begin preliminary project steps given their city's specific strengths and circumstances.

5. The National Telecommunications and Information Administration's BroadbandUSA organizes information, detailed guides, and links to other federal and state broadband programs and hosts monthly recorded webinars covering current broadband issues. The Planning a Community Broadband Roadmap toolkit provides a step-by-step process to create broadband deployment plans, while the Guide to Federal Funding of Broadband Projects organizes a long list of programs that provide funding for broadband deployment and/or digital inclusion projects of different sizes.

6. Patrick Lucey and Christopher Mitchell's Successful Strategies for Broadband Public-Private Partnerships provides examples of some of the more novel public-private business relationships formed to bring fiber competitors into communities.

7. The Columbia Telecommunications Corporation published the Technical Guide to Dig Once Policies, surveying the approaches adopted or proposed by jurisdictions across the country to develop best-practices guidance for local governments.

B. Expanding Digital Inclusion and Digital Skills

1. The National Digital Inclusion Alliance and the Brookings Institution's Metropolitan Policy Program partnered to create the Broadband Research Base, a searchable collection of reports, studies, and journal articles that address the impact of broadband and digital inclusion on community and individual well-being.

2. Digital Inclusion and Meaningful Broadband Adoption Initiatives, by Dr. Colin Rhinesmith, presents findings from a national study of digital inclusion organizations that help low-income individuals and families adopt high-speed internet service.

3. Dr. Colin Rhinesmith and Angela Siefer's Digital Inclusion Outcomes-Based Evaluation describes the challenges facing community-based organizations and other key stakeholders in using outcomes-based evaluation to measure the success of their digital-inclusion programs and offers recommendations toward addressing these shared barriers.

4. The National Digital Inclusion Alliance's The Digital Inclusion Start-Up Manual provides guidance to individuals looking to increase access and use of technology in disadvantaged communities through digital literacy training, affordable home broadband, affordable devices, and tech support.

5. In Digital Skills and Job Training: Community-driven Initiatives Are Leading the Way in Preparing Americans for Today's Jobs, John Horrigan writes that there are well-paying job opportunities for those on the lower end of the socioeconomic spectrum for so-called middle-skill jobs. These are jobs that generally do not require a college degree and pay a living wage. Roughly half of all job openings in the United States fall into the middle-skill category, and most (82 percent) of them require digital skills—and wages are better as a result.

C. Improving Affordability: The Discount Internet Guidebook from the National Digital Inclusion Alliance and Public Knowledge describes affordable broadband plans for disadvantaged American households offered by commercial internet providers.

D. Empowering Community Anchor Institutions and Civic Engagements

1. The Department of Housing and Urban Development offers the ConnectHome Playbook, a toolkit that includes specific best practices about developing a housing authority broadband team, evaluating local needs through surveys and events, reaching out to potential community partners, and developing an action plan.

2. Connecticut Commission for Educational Technology's State Educational Technology Plan reflects research-based best practices, national and international standards, and the expert guidance of thought leaders from across the state who represent a diversity of constituents. The document includes both broad, long-term goals as well as detailed initiatives already underway.

3. The Schools, Health & Libraries Broadband (SHLB) Coalition's Connecting Anchor Institutions: A Broadband Action Plan observes that the future belongs to those with access to high-speed broadband. In the 21st century, anyone seeking to launch a business, exchange medical records, conduct a research project, obtain a college degree, engage in community activities, or create his or her own path will need both a high-capacity internet connection and the digital skills necessary to navigate the online world.

4. Five Lessons for Tech-Powered Civic Engagement by Next Century Cities notes that municipalities across the country are increasingly using technology to ensure that government is accessible and responsive to citizens, while simultaneously creating forward-looking programs to increase internet access so more residents can experience the benefits of connectivity.

5. The Merit Network Michigan Moonshot Broadband Framework is a crowdsourced regional network primer meant to provide an understanding of the community network lifecycle from start to finish. The framework includes overviews on policy and technology, community success stories, links to myriad resources and planning tools from national broadband leaders, and a phased plan for building a regional network.

E. Learning from States

1. The Pew Charitable Trusts' state broadband policy explorer lets visitors learn how states are expanding access to broadband through laws. Categories in the tool include broadband programs, competition and regulation, definitions, funding and financing, and infrastructure access.

2. The Georgia State Broadband Plan highlights the objectives and activities of the Georgia Broadband Deployment Initiative. The purpose of the Georgia Broadband Deployment Initiative is to coordinate efforts to deploy high-speed broadband connectivity so that all Georgians have access to healthcare, education, economic growth and expansion, and other quality of life essentials.

3. The Indiana Office of Community and Rural Affairs is helping rural communities to understand their current broadband conditions and needs, create a long-term vision of broadband in their

community, and identify options for achieving that vision. The Broadband Readiness Pilot awards $50,000 grants with funding from Federal Community Development Block Grant (CDBG) dollars from the U.S. Department of Housing and Urban Development (HUD). The Indiana Department of Transportation launched the Broadband Corridors program which removes barriers preventing broadband providers from accessing right-of-way along Indiana interstates and limited access highways.

4. The State of Maine's Broadband Action Plan, published by the state's Department of Economic and Community Development (DECD) in June 2018, proposes a strategy for deploying broadband in rural areas.

5. The Michigan Broadband Roadmap, published by the Michigan Infrastructure Commission in August 2018, identifies gaps in broadband service coverage and capacity, current efforts underway to address connectivity issues, and key strategies and recommendations for the public and private sectors to pursue over the coming years to achieve ubiquitous connectivity.

6. The Minnesota Broadband Infrastructure Plan began in 2008 and is reassessed on an annual basis by the legislature as it considers adjustments to the elements codified into law.

7. Stories throughout Nevada about the lack of local expertise have led the Governor's Office of Science, Innovation, and Technology (OSIT) to engage consultants from E-rate Central, a national leader in building community connectivity, to assist in developing and implementing Whole Community Connectivity programs tailored to unique rural communities across rural Nevada.

8. Connecting North Carolina, the state's 2017 broadband plan, directed by the North Carolina General Assembly, includes an assessment of the current status of broadband availability, adoption, and use. The plan provides recommendations for how best to address the challenges the state faces to enhance broadband's access and impact.

9. The Oregon Broadband Advisory Council periodically reports to state lawmakers on the affordability and accessibility of broadband technology in all areas of the state, and on broadband technology use in healthcare, energy management, education and government. The 2018 Broadband in Oregon also presented information on the role of broadband in local, regional and state economies, economic development, public policy issues, and key broadband related challenges and opportunities and facing the state.

10. Wisconsin's Broadband Plan builds upon the success of the state's broadband expansion initiatives and focuses on public-private partnerships to close the digital divide. The plan's overarching goal is for every Wisconsinite to have affordable access to broadband service, if they so choose, by January 1, 2025. The plan is based upon Governor Evers' proposed investments in broadband as outlined in his 2019-2021 biennial budget.

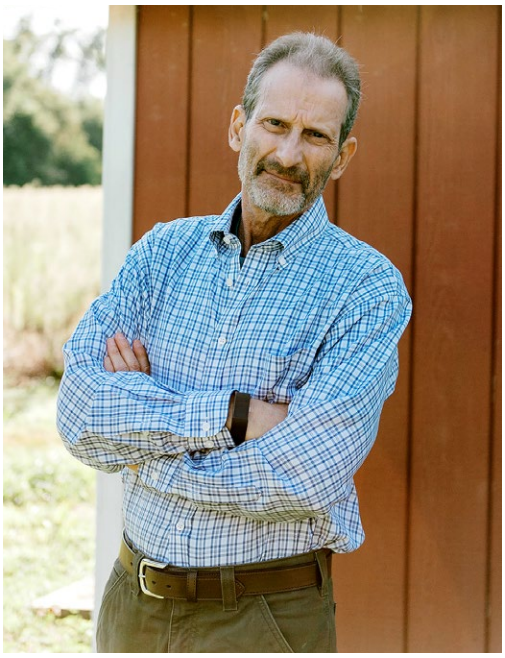
F. Learning from Cities

1. Cleveland-based nonprofit Connected Insights wrote Connecting Cuyahoga: Investment in Digital Inclusion Brings Big Returns for Residents and Administration, a report on the ways digital inclusion could improve the operational efficiency of several of its departments while making county services more accessible to a large number of citizens.

2. Seattle's Technology Access and Adoption Study set out to understand how the city's residents are using information and communications technology and uncover the barriers that prevent true digital equity from being achieved in Seattle.

3. Seattle Information Technology Department's Digital Equity Efforts cover three strategic areas: skills training, connectivity, and devices and technical support.

4. John Horrigan wrote Smart Cities and Digital Equity, examining several cities that have sought to embrace smart city technology while keeping equity in the forefront.



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Acknowledgements

I would like to extend a special thanks to all those who made this work possible: To Marjorie Craig Benton, Trustee, for her foresight in pursuing the Benton mission for almost four decades and, of course, for her warm and personal hospitality; to Executive Director Adrianne B. Furniss for her leadership of Benton's work as it takes on new challenges and, of course, for her decision to let me lend Benton a hand; to Executive Editor Kevin Taglang for his continuing insights in both the substance of policy and the style of effective writing; and to the Benton trustees, board, and staff generally for their continuing support. Special thanks to Research Associate Ryland Sherman (PhD, JD) for his year-long efforts in assiduously marshalling the facts of which this report is made. Thanks also to Eva Shapiro (PhD) for her helpful counsel.

In the course of preparing this report, we talked to over 200 people. I am particularly grateful to those who reviewed different parts of this report; lending their special expertise, raising important questions, and offering sage recommendations. The report is better for their contributions.

Christopher Ali, PhD, Associate Professor, Department of Media Studies, University of Virginia; Benton Faculty Research Fellow

Jonathan B. Baker, Research Professor of Law, American University Washington College of Law

Larra Clark, Deputy Director, American Library Association Public Policy & Advocacy and Public Library Association

Mignon L. Clyburn, Commissioner Emeritus, FCC, Principal, MLC Strategies; Benton Board member

Paul de Sa, Quadra Partners, LLC

Kathryn de Wit, Broadband Research Initiative, The Pew Charitable Trusts

John B. Horrigan, PhD, Senior Fellow, Technology Policy Institute

Joanne Hovis, President of CTC Technology & Energy; Benton Board member

Bernadine Joselyn, Director, Public Policy & Engagement, Blandin Foundation

Jim Kohlenberger, former White House policy advisor; President of JK Strategies; Benton Board member

Blair Levin, Non-Resident Fellow, Brookings Institution Metropolitan Policy Project

Christopher Mitchell, The Institute for Local Self-Reliance

Jon Peha, Professor, Carnegie Mellon University

Colin Rhinesmith, Assistant Professor, Simmons University

Denise Linn Riedl, Chief Innovation Officer for the City of South Bend (IN); Benton Fellow

Andrew Jay Schwartzman, Benton Senior Counselor, Benton Institute for Broadband & Society

Debra Socia, President, The Enterprise Center Chattanooga

Gigi Sohn, Distinguished Fellow at the Georgetown Law Institute for Technology Law & Policy; Benton Senior Fellow & Public Advocate

Sharon Strover, Ph.D., Philip G. Warner Regents Professor of Communication. Director, Technology & Information Policy Institute, Moody College of Communication | The University of Texas at Austin

Tom Wheeler, Former FCC Chairman; Visiting Fellow, Brookings Institution; Senior Fellow, Harvard Kennedy School

Jon Wilkins, Quadra Partners, LLC

John Windhausen, Executive Director, SHLB Coalition

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191. Broadband providers can report connectivity to a census tract if they *can* provide services to at least one household within that census tract "without an extraordinary commitment of resources" "within a service interval that is typical for that type of connection", (FCC, "FCC Form 477 Local Telephone Competition and Broadband Reporting," December 6, 2016, p. 17, https://transition.fcc.gov/form477/477inst.pdf), so if at least one house in a census block is close enough to be connected to an existing network without requiring more complex and time-consuming deployment methods like trenching, then entire census block can be deemed served, even if the ISP might charge thousands of dollars to connect a household to the nearby network. See, e.g., Jon Brodkin, "When Home Internet Service Costs $5,000—or Even $15,000," *Ars Technica*, January, 16, 2019, https://arstechnica.com/information-technology/2017/01/when-home-internet-service-costs-5000-or-even-15000/. See also, Statement of Commissioner Geoffrey Starks, Dissenting, "2019 Broadband Deployment Report," Starks Dissenting Statement, p. 3; FCC, "FCC Form 477 Local Telephone Competition and Broadband Reporting," 17.

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194. Georgia Bullen (Experiment Review Committee, M-Lab; Executive Director, Simply Secure), in email correspondence with Jonathan Sallet, August 15, 2019.

195. Sascha D. Meinrath, Hannah Bonestroo, Georgia Bullen, Abigail Jansen, Steven Mansour, Christopher Mitchell, Chris Ritzo, and Nick Thieme, "Broadband Availability and Access in Rural Pennsylvania," The Center for Rural Pennsylvania, June 2019, https://www.rural.palegislature.us/broadband/Broadband_Availability_and_Access_in_Rural_Pennsylvania_2019_Report.pdf.

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200. Merit Network, "School Districts Chosen to Pilot Michigan Moonshot Data Collection Project," *Merit News*, April 24, 2019, https://www.merit.edu/school-districts-chosen-to-pilot-michigan-moonshot-data-collection-project/. For research context, see The Quello Center and Merit Network, "Citizen Enabled Advances in Broadband Availability Data," Docket No. 180427421–8421–01, July 16, 2018, https://www.ntia.doc.gov/files/ntia/publications/quello_merit_commentsdocket_no.180427421-8421-01.pdf.

201. FCC Digital Opportunity Data Collection Order.

202. FCC Digital Opportunity Data Collection Order, at para. 1.

203. FCC Digital Opportunity Data Collection Order, at paras. 2-3.

204. FCC Digital Opportunity Data Collection Order, at para. 4.

205. The emphasis on speed to the detriment of usage limits would be odd given that the practical impact of de-prioritization is precisely to reduce the speeds available to a customer. Comments of Next Century Cities; The Institute for Local Self-Reliance; Benton Institute for Broadband & Society; National Digital Inclusion Alliance; and Access Humboldt, Establishing the Digital Opportunity Data Collection Modernizing the FCC Form 477 Data Program, WC Docket No. 19-195, WC Docket No. 11-10, September 23, 2019.

206. Oscar A. Lopez, III and Phillip Berenbroick, Public Knowledge, Letter submitted to FCC, Establishing the Digital Opportunity Data Collection, WC Docket No. 19-195; Modernizing the FCC Form 477 Data Program, WC Docket No. 11-10; Universal Service Contribution Methodology, WC Docket No. 06-122, August 7, 2019, p. 6, https://prodnet.www.neca.org/publicationsdocs/wwpdf/8819pk.pdf.

207. The FCC's Form 477 groups services into five speed tiers of minimum advertised speeds: 10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. FCC, "Fixed Broadband Deployment Data from FCC Form 477."

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211. Comment Submitted by Measurement Lab (M-Lab) to the Federal Trade Commission, RE: FTC Hearing #10: Competition and Consumer Protection Issues in U.S. Broadband Markets, Docket ID: FTC-2018-0113, May 31, 2019, 3.

212. "United States of Broadband" (web-based application), Open Technology Institute, https://opentechinstitute.github.io/USBB-mbtiles/#county/dec_2017/mlab_fcc_dl_comp/-76.00/39.06/8.00, accessed September 15, 2019, focusing on Maryland, Delaware, and Washington, DC.

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214. US Telecom, "Broadband Mapping Initiative," US Telecom Issue Brief, June 2019, 2, https://www.ustelecom.org/wp-content/uploads/2019/06/2019-6-17-Broadband-Mapping-Initiative.pdf.

215. US Telecom, Letter to FCC, Modernizing the FCC Form 477 Data Program, WC Docket No. 11-10, Connect America Fund et al., CC Docket No. 10-90, March 21, 2019, https://ecfsapi.fcc.gov/file/10321026256876/032019%20Mapping%20Exparte%20FINAL.pdf.

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221. Mignon L. Clyburn, Former FCC Commissioner, Written Testimony before the U.S. House of Representatives Committee on Energy and Commerce, Re: "LIFT America: Modernizing Our Infrastructure for the Future," May 22, 2019, 6, (copy available from Benton Foundation).

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228. FCC, "New Docket for the Rural Digital Opportunities Fund," WC Docket No. 19-126, Public Notice, April 30, 2019, https://docs.fcc.gov/public/attachments/DA-19-361A1.pdf; Bill Lucia, "FCC Rural Broadband Fund Would Move Funds From Existing Program," April 17, 2019, *NextGov*, https://www.nextgov.com/emerging-tech/2019/04/fcc-rural-broadband-fund-would-move-funds-existing-program/156360/.

229. Congressional Research Service, "Broadband Loan and Grant Programs in the USDA's Rural Utilities Service," March 22, 2019, 4-5, (hereafter "CRS Review of RUS Grants and Loans"). Under this program, "rural" is defined as any area not located within a "city, town, or incorporated area that has a population of greater than 20,000 inhabitants" or an "urbanized area [with a certain level of population density] contiguous and adjacent to a city or town that has a population of greater than 50,000 inhabitants." Ibid.

230. Rural Utilities Service - Department of Agriculture, Rural Broadband Access Loans and Loan Guarantees Program, Federal Register, Vol. 83, No. 221, 57407, November 15, 2018, https://www.govinfo.gov/content/pkg/FR-2018-11-15/pdf/2018-24860.pdf.

231. USDA, "Reconnect Program Overview," https://www.usda.gov/reconnect/program-overview, accessed September 16, 2019.

232. Department of Commerce - State of Washington, "Rural Broadband Program - Washington State Department of Commerce," https://www.commerce.wa.gov/building-infrastructure/community-economic-revitalization-board/rural-broadband/.

233. Minnesota Department of Employment and Economic Development - Office of Broadband Development, "Minnesota Broadband Infrastructure Plan," https://mn.gov/deed/assets/state-broadband-plan_tcm1045-380006.pdf, 1. The state's enunciated goals also include that the state rank among the top five states in the nation for broadband speed universally accessible to residents and businesses and the top 15 when compared to countries globally for broadband penetration. Minnesota Department of Employment and Economic Development - Office of Broadband Development, "Minnesota Broadband Goals," https://mn.gov/deed/programs-services/broadband/goals/, accessed September 16, 2019.

234. Michigan Consortium of Advanced Networks (MCAN), "Michigan Broadband Roadmap," August 2018, xi, https://www.michigan.gov/documents/snyder/MCAN_final_report_629873_7.pdf.

235. ConnectME Authority, 99-639 Chapter 101 § 5(A), p. 8, https://www.maine.gov/connectme/sites/maine.gov.connectme/files/inline-files/Final%20Rule%20April%202018_3.pdf.

236. ConnectME Authority, 99-639 Chapter 101 § 5(A), pp. 8-9.

237. ConnectME Authority, 99-639 Chapter 101 §§ 5-6, pp. 9-16. The program offers infrastructure grants up to $100,000 for broadband projects to unserved communities, covering up to half of deployment costs.

238. Leading Infrastructure for Tomorrow's America Act, H.R.2741 — 116th Congress (2019-2020), introduced May 16, 2019, amending Title I of the Communications Act of 1934 (47 U.S.C. 151 et seq.) by adding Sec. 14, https://www.congress.gov/bill/116th-congress/house-bill/2741/text, (Sec. 14 (d) elaborates on project requirements, including the need to provide 100/20 Mbps service.).

239. The discussion in this report does not focus on the special needs of Alaska and/or U.S. territories, which can pose very particular challenges that the nation needs to meet.

240. In 2019, for example, the Universal Service Administrative Company explained that it dispenses funds to support the building of broadband networks to schools by looking at whether the expenditure of E-rate funds will be cost-effective, not simply whether public monies had been previously used to support incumbent networks. Letter from Radha Sekar, CEO, USAC, Responding to Commissioner O'Rielly's 3/7/19 Letter, April 1, 2019, 1-2, 4, https://docs.fcc.gov/public/attachments/DOC-357046A1.pdf; John Eggerton, "USAC to O'Rielly: E-Rate Overbuilds Are OK," Multichannel News, April 17, 2019, https://www.multichannel.com/news/usac-to-orielly-e-rate-overbuilds-are-ok. Thus, the use of public funds to support new networks where networks already exist is not by definition wasteful.

241. Arno Penzias and Robert Wilson, Bell Laboratory scientists, won the Nobel Prize in Physics in 1978 for their discovery of microwave radiation that helped prove the existence of the universe's origin in the Big Bang. "The Nobel Prize in Physics 1978," NobelPrize.org, https://www.nobelprize.org/prizes/physics/1978/summary/, accessed September 16, 2019. Bell Laboratory was a font of numerous innovations, including the transistor.

242. FCC, "CAF II Auction website." A separate problem arises from the limitations of FCC Form 477 data, described above in Chapter 2, Section I.A. A census block is ineligible if the Form 477 data shows that such an internet-access provider is present in the census block but, of course, such a provider could be serving only a single house in that census block.

243. USDA – RUS, "Rural Broadband Access Loan and Loan Guarantee," https://www.rd.usda.gov/programs-services/rural-broadband-access-loan-and-loan-guarantee, accessed September 16, 2019. ReConnect applicants requesting grants must deploy their service only to areas where there is no household broadband access (defined as 10 Mbps/ 1 Mbps or below), while loan and mixed-loan-and-grant funding can be applied only to areas where at least 90 percent of households do not have access to 10/1 Mbps service. USDA – RUS, "Reconnect Program Eligible Service Area," https://www.usda.gov/reconnect/eligible-service-area, accessed September 16, 2019.

244. "CRS Review of RUS Grants and Loans," 6; Rural Broadband Access Loans and Loan Guarantees, Title 7, Subtitle B, Chapter XVII, §1738.2 Definitions; Agriculture Improvement Act of 2018, P.L. 115-334, December 20, 2018.

245. Minn. Stat. § 116J.394(h).

246. New York State Broadband Program Office, "Frequently Asked Questions," https://nysbroadband.ny.gov/frequently-asked-questions, accessed September 27, 2019.

247. See Fiber Broadband Association, "Fiber Broadband Association Releases Study on Rapid Fiber Growth in North America," December 11, 2018, https://www.fiberbroadband.org/blog/fiber-broadband-association-releases-study-on-rapid-fiber-growth-in-north-america. DSL has become only the third most common way of receiving internet service, behind coaxial cable and fiber. Ibid.

248. Joanne Hovis, in private conversation with Jonathan Sallet, September 22, 2019.

249. U.S. Government Accountability Office, "Tribal Broadband: Few Partnerships Exist and the Rural Utilities Service Needs to Identify and Address Any Funding Barriers Tribes Face," September 2018, 23, https://www.gao.gov/assets/700/694810.pdf.

250. A Navajo Hogan is "a sacred home for the Diné (Navajo) people who practice traditional religion." "Navajo Homes – Hogans," NavajoPeople.org, http://navajopeople.org/navajo-hogans.htm, accessed September 17, 2019, (emphasis omitted).

251. John Badal, "Basic Broadband for 'Homes' on Tribal Lands," Benton Foundation, Digital Beat, August 28, 2019, https://www.benton.org/blog/basic-broadband-homes-tribal-lands?utm_source=sendgrid&utm_medium=email&utm_campaign=Newsletters.

252. John Badal, "Basic Broadband for 'Homes' on Tribal Lands."

253. Brian Howard and Traci Morris, Tribal Technology Assessment: The State of Internet Service on Tribal Lands," Arizona State University, American Indian Policy Institute, Fall 2019, 36.

254. Howard and Morris, "Tribal Technology Assessment," 41.

255. See, e.g., FCC, Connect America Fund, WC Docket No. 10-90, and Universal Service Reform –Mobility Fund, WT Docket No. 10-208, Report and Order and Further Notice of Proposed Rulemaking, adopted February 23, 2017, paras. 3-25, (discussing the reallocation of universal support funding), https://docs.fcc.gov/public/attachments/FCC-17-11A1.pdf.

256. David C. Wyld, "Reverse Auctioning: Saving Money and Increasing Transparency," IBM Center for the Business of Government, 2011, 6, http://www.businessofgovernment.org/sites/default/files/Reverse%20Auctioning.pdf; Sandy D. Jap, "Online Reverse Auctions: Issues, Themes, and Prospects for the Future," *Journal of the Academy of Marketing Science* 30, no. 4 (September 2002): 506–525, https://link.springer.com/article/10.1177%2F009207002236925.

257. FCC, "Rural Digital Opportunity Fund, WC Docket No. 19-126, Connect America Fund, WC Docket No. 10-90, Notice of Proposed Rulemaking, adopted August 1, 2019, para. 16, https://docs.fcc.gov/public/attachments/FCC-19-77A1.pdf. See also Robbie McBeath, "Can "Slapping 'New and Improved' on CAF" Close the Digital Divide?," April 22, 2019, https://www.benton.org/blog/can-"slapping-'new-and-improved'-caf"-close-digital-divide.

258. See, e.g., Leading Infrastructure For Tomorrow's (LIFT) America Act, H.R. 2741, introduced May 15, 2019, https://www.congress.gov/bill/116th-congress/house-bill/2741text?q=%7B%22search%22%3A%5B%22Leading+Infrastructure+For+Tomorrows%22%5D%7D&r=1&s=2.

259. FCC, "CAF II Auction website."

260. Jeffrey Nordhaus, "New NY Broadband Program," (presentation), New York Broadband Program Office, 24, https://nysbroadband.ny.gov/sites/default/files/phase_2_bidders_ppt_0.pdf; New York Broadband Program Office, "New NY Broadband Grant Program – Phase 1 Application Questions," 2-3, https://nysbroadband.ny.gov/sites/default/files/documents/new-ny-broadband/Phase%201%20Auction%20Questions%20-%20FINAL.PDF.

261. For example, an area that has received support from another RUS program or a state funding program is ineligible for the ReConnect program, even if the area would otherwise satisfy the program's level of underservice requirement, and an area that received CAF II auction funding is ineligible for ReConnect grants. USDA – RUS, "Reconnect Program Eligible Service Area."

262. Cathy Cash, "Electric Co-ops Get a Big Boost for Rural Broadband Efforts in FCC Auction," NRECA, August 31, 2018, https://www.electric.coop/electric-co-ops-get-big-boost-rural-broadband-efforts-fcc-auction/; T. Warren, "FCC Approves $225 million for 35 Electric Cooperatives to Provide Rural Broadband," NRECA, August 28, 2018, https://www.electric.coop/fcc-approves-220-million-33-electric-cooperatives-provide-rural-broadband/; Conexon, "Rural Electric Cooperative Consortium Awarded $186M in FCC's Connect America Fund Phase II Auction, Becoming Single Largest Gigabit Winning Bidder," *Cision – PR Newswire*, August 28, 2018, https://tinyurl.com/y2yr2j4e.

263. USDA, "Reconnect Program Overview."

264. Congressional Research Service, "Broadband Internet Access and the Digital Divide: Federal Assistance Programs," January 9, 2019, summary page; USDA – RUS, "Community Connect Grants," https://www.rd.usda.gov/programs-services/community-connect-grants, accessed September 16, 2019.

265. USDA – RUS, "Rural Broadband Access Loan and Loan Guarantee," https://www.rd.usda.gov/programs-services/rural-broadband-access-loan-and-loan-guarantee, accessed September 16, 2019; USDA – RUS; "Telecommunications Infrastructure Loans & Loan Guarantees," https://www.rd.usda.gov/programs-services/telecommunications-infrastructure-loans-loan-guarantees, accessed September 16, 2019; USDA, "Reconnect Program Overview"; USDA – RUS, "Community Connect Grant Program Funding Opportunity Announcement," 3, https://www.rd.usda.gov/files/2019_CC_FOAfinal.pdf.

266. Mignon L. Clyburn, Former FCC Commissioner, Written Testimony before the U.S. House of Representatives Committee on Energy and Commerce, Re: "LIFT America: Modernizing Our Infrastructure for the Future," May 22, 2019, 4-5, (copy available from Benton Foundation).

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268. Ryan Knutson, "How Fast Internet Affects Home Prices," *The Wall Street Journal*, June 30, 2015, https://www.wsj.com/articles/SB11064341213388534269604581077972897822358.

269. Alabama, California, Colorado, Delaware, Maine, Massachusetts, Minnesota, Nebraska, New York, Tennessee, Vermont, Virginia and Wisconsin all have had strategies in place. Danielle Dean, "Filling Gaps in Broadband Deployment," National Conference of State Legislatures (NCSL), *Legis Brief* 26, no. 09 (March 2018), http://www.ncsl.org/research/telecommunications-and-information-technology/filling-gaps-in-broadband-deployment.aspx), while Arizona, Indiana, Maryland, New Mexico, and Wyoming recently appropriated funding for their broadband strategies, and Georgia and Illinois are in the process of finalizing their strategies through funding. Joanne Hovis, document comment, June 12, 2019.

270. Pew, "State Broadband Policy Explorer," accessed October 28, 2019, https://www.pewtrusts.org/en/research-and-analysis/data-visualizations/2019/state-broadband-policy-explorer.

271. Minnesota Department of Employment and Economic Development, "Broadband Development Grant Application," September 8, 2016, iv, 8-10, 17-18.

272. Minnesota Department of Employment and Economic Development, "Broadband Development Grant Application," iv, 8-10, 17-18.

273. "Middle Mile: The connection between a local network, also called a "last mile" connection, and the backbone Internet network." BroadbandUSA, "Broadband Glossary," https://broadbandusa.ntia.doc.gov/sites/default/files/resource-files/bbusa_broadband_glossary_161024.pdf.

274. Minnesota Governor's Task Force on Broadband, "2018 Annual Report," October 2018, 3, https://mn.gov/deed/assets/2018-bbtf-report_tcm1045-354312.pdf.

275. Ibid., 3.

276. The importance of broadband to support tourism was emphasized by officials from Maryland's Garrett County, which includes the vacation destination Deep Creek Lake, and Kent County, where a local marina told the county that lack of broadband would decrease boat traffic. Scott Boone (Information Technology Director, Government of Kent County, Maryland), in teleconference interview with Joanne Hovis and Benton Foundation, September 11, 2018.

277. Walker Orenstein, "Why Even the Most Ambitious Broadband Bill at the Legislature Still Won't Bring Speedy Internet to All Minnesotans," *MinnPost*, January 16, 2019, https://www.minnpost.com/good-jobs/2019/01/why-even-the-most-ambitious-broadband-bill-at-the-legislature-still-wont-bring-speedy-internet-to-all-minnesotans/, explaining the challenges facing Rainy Lake and Voyageurs National Park, Minnesota.

278. Ibid.; Cook County Minnesota (webpage), https://co.cook.mn.us/index.php/about-cook-county, accessed September 16, 2019. Recall that fiber-based networks refer to networks that utilize fiber to carry signals near consumer sites but may utilize coaxial cable or other technologies to carry high-performance broadband the remainder of the distance to the consumer. See endnote 33.

279. "Municipal FTTH Networks," ILSR, https://muninetworks.org/content/municipal-ftth-networks#IA, accessed September 27, 2019.

280. BroadbandNow, "US States With the Worst and Best Internet Coverage 2018," August 14, 2018, https://broadbandnow.com/report/us-states-internet-coverage-speed-2018/.

281. Sam Bloch, "The FCC Says All of Iowa Has Access to Broadband Internet. Speed Tests Tell a Different Story," The New Food Economy, June 20, 2018, https://newfoodeconomy.org/rural-iowa-broadband-data-fcc/.

282. Laura Barczewski, "Gov. Reynolds Requests $20 Million for Rural Iowa Broadband Infrastructure," *WHO.tv*, January 15, 2019, https://whotv.com/2019/01/15/gov-reynolds-requests-20-million-for-rural-iowa-broadband-infrastructure/.

283. Barbara Rodriguez, "Kim Reynolds Flexes Legislative Deal-Making Muscle, with Mixed Results. She Sees Progress." *Des Moines Register*, May 3, 2019, https://tinyurl.com/y27jaenq.

284. Mandy Billings, "Governor Reynolds Announces Rural Broadband Grants," KSOM/96.5 FM, May 8, 2019, http://965ksom.com/governor-reynolds-announces-rural-broadband-grants/.

285. USDA – RUS, "ReConnect Mapping Tool," https://www.usda.gov/reconnect/mapping-tool, accessed September 16, 2019.

286. USDA – RUS, "ReConnect Mapping Tool."

287. Christopher Ali and Mark Duemmel, "The Reluctant Regulator: The Rural Utilities Service and American Broadband Policy," *Telecommunications Policy* 43, no. 4 (May 2018): 380-392, 382.

288. "CRS Review of RUS Grants and Loans," 18-19.

289. For example, the Rural Broadband Access Loan and Loan Guarantee Program requires that "[n]o part of the proposed funded service area overlaps with the service area of current RUS borrowers, nor the services areas of grantees that were funded by RUS." §1738.102(a)(4). See also "ReConnect Eligible Service Area," Chapter 2, Section I.E, discussing this ineligibility requirement.

290. FCC, "Federal Communications Commission Universal Service Fund Overview – Initiatives that Advance Broadband Infrastructure," https://www.ntia.doc.gov/files/ntia/publications/fcc_universal_service_fund_overview.pdf; USAC, "High Cost Program Overview," https://www.usac.org/hc/program-overview.aspx, accessed September 16, 2019; https://www.usac.org/hc/program-overview.aspx. This funding is administered by the Universal Service Administrative Company, with guidance provided by the FCC. USAC, "Who We Are," https://www.usac.org/about/about/who-we-are/default.aspx, accessed September 16, 2019.

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504. FCC, "2016 Lifeline Modernization Order," para. 226. The FCC subsequently has suggested that it lacks the power to designate Lifeline Broadband providers, raising the ire of public-internet groups. See, e.g., Reply Comments of Public Knowledge, Re: Bridging the Digital Divide for Low-Income Consumers, Lifeline and Link Up Reform and Modernization, Telecommunications Carriers Eligible for Universal Service Support, WC Docket No. 17-287, WC Docket No. 11-42, WC Docket No. 09-197, March 23, 2018, https://tinyurl.com/yxgfddn. Congress should end any uncertainly that exists.

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512. U.S. Senator Dick Durbin (IL) and U.S. Representative Sean Patrick Maloney (NY-18) have introduced a bill, *Promoting Access to Broadband Act*, in both houses of Congress that is intended to increase enrollment in the Federal Lifeline program, increase funding, and enable states to partner with non-profit and community-based organizations to provide individuals with service information and assistance applying for Lifeline. Office of Dick Durbin, U.S. Senator of Illinois, "Durbin, Maloney Introduce Bicameral Bill to Increase Access to Broadband Service for Low-Income Americans," Press Release, September 25, 2019.

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