Bridging the Digital Divide with Municipal Fiber Networks: Discussion and Recommendations

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EXECUTIVE SUMMARY

Municipalities across the U.S. have begun to play a bigger role in providing internet access by implementing their own fiber internet networks. Fiber internet networks offer customers and operators faster speeds, lower costs, and increased reliability compared with other forms of internet service. Municipal fiber networks increase access to the internet for those who currently do not have broadband and can be an effective tool in bridging the digital divide. In what follows, we investigate the benefits of fiber networks and show that fiber access can improve equity, economic, educational, and healthcare outcomes for a community. We conclude with recommendations for communities looking to adopt their own municipal fiber network.

BACKGROUND

Understanding Fiber Technology

Fiber internet is the use of optical fibers to transmit internet data. Optical fiber, or simply fiber, are glass wires that carry digital data using pulses of light.[1] Compared to traditional copper wires, fiber has a higher capacity to transmit data (*bandwidth*), which allows for incredibly fast data rates. A single fiber strand can carry over 32 terabytes of data per second (TB/s) and the speed is limited by the end-to-end electronics rather than the fiber. [2] In addition, fiber transmits longer distances, has less interference, has more security, and is more durable than copper wires.[3]

Fiber is a future-proof technology that is unlikely to be replaced for decades and will not require future upgrades. Internet companies already use fiber for long-distance communication and for connecting large data centers. However, fiber-to-the-home is an upgrade to existing internet infrastructure in most cities and allows individuals and business to access the benefits of fiber.

Key Findings

Access to low-cost internet enabled by municipal fiber-to-the-home is an effective tool at reducing the digital divide within a community.

Access to fiber internet can improve equity, economic, education, and healthcare outcomes for a community.

Municipal fiber infrastructure directly supports both the creation and retention of jobs, and the expansion of business investments in a community.

A fiber-connected community increases the educational resources for children, schools, and skilled workers by providing cheaper and faster internet access.

Fiber can improve healthcare outcomes and equity by enabling access to telehealth. Lack of transportation is one of the main barriers to healthcare access, especially in lower-income communities and for the elderly and people with disabilities.

Understanding the Digital Divide

Cities across the U.S. are currently assessing ways to provide their own fiber-to-the-home infrastructure to compete with networks to improve their communities and address the digital divide. The digital divide is the unequal access to internet technology between groups of people and reinforces societal inequality across demographic and geographic lines. Internet in the 21st century is inseparable from modern life and is necessary for everything from education and healthcare to applying for jobs and accessing government programs. Internet that is faster than dial-up, called broadband internet, is essential to meet modern internet demands. Estimates from the FCC and independent researchers report that between 20 to 40 million Americans in 2020 were without broadband internet.[4,5] Black and Hispanic adults, rural adults, and adults earning less than $30,000 a year are among those

significantly less likely to have broadband internet access. The problem of the digital divide has been a topic of political discussion at the federal as well as state and local government levels.[6,7,8]

Two of the biggest reasons many Americans are without internet are the lack of network infrastructure and high subscription costs.[9] A major cause is that a small number of private telecom companies have an effective monopoly on internet access and pricing in the United States.[10,11] These companies control who gets the internet, who does not, and what prices they will pay. Local governments are increasingly looking at what role they can play in closing the digital divide to improve their communities, but are often unable to overcome the power these companies hold over internet access.

How Does Fiber Address the Digital Divide?

Municipal fiber-to-the-home networks addresses the two main drivers of the digital divide, high internet costs and lack of network infrastructure. Fiber can provide less expensive internet for residents which can reduce the digital divide by lowering subscription costs. A study from Harvard University found that in 23 out of 27 communities analyzed, community-owned fiber-to-the-home networks provided a lower cost to the consumer than private internet options over a four year study period.[44] Municipal fiber internet prices were 2.9 to 50 percent less than private internet options in these communities. This is both the result of the cheap operational cost of fiber once installed and the increased pricing transparency offered by non-profit municipal agencies.[13] The same fiber infrastructure can be shared between several companies due to its high capacity, proving an open access network which further reduces costs through competition.[14] Several cities across the U.S. have already funded and built their own fiber infrastructure to improve internet access within their communities.[12]

Fiber Adoption Models

There are several different models for communities to provide fiber-to-the-home. Some cities have launched a municipal-owned fiber service which is provided as a public utility, similar to electricity or water.[15] Other cities have adopted co-op models or private-public partnerships.[16,17] Regardless of the access method, cities that own their fiber infrastructure have much more control to increase broadband internet adoption rates and provide affordable internet to those who need it.[18]

FIBER NETWORK BENEFITS

A major benefit of robust fiber-to-the-home infrastructure is the reduced cost of high-speed Internet which improves Internet adoption and reduces the digital divide. However, there are other benefits of fiber that indirectly improve societal equity within a community. These benefits include driving economic growth, improving access to education, and improving healthcare access.

Fiber Drives Economic Growth

Fiber spurs economic growth by both attracting new businesses and residents to expand the workforce. The municipal savings from the increased reliability of fiber infrastructure can also be reinvested into local business initiatives. Large and small companies rank high-speed internet access as one of the top factors when making relocation decisions.[19] A 2020 study found fiber infrastructure directly supported the creation and retention of over 9,000 jobs and $963 million in business investments in Chattanooga, TN over a 10-year period.[20]

Fiber internet also attracts and retains residents to maintain a healthy workforce. According to residential consumers, "very high speed/reliable internet access" was a top community attribute when deciding where to live, behind only low crime and affordable housing.[21]

Counties that have high-speed internet access also add population at a faster rate on average than counties with lower levels of internet speeds. This effect is especially pronounced in population-declining regions, such as in rural communities where the addition of fiber
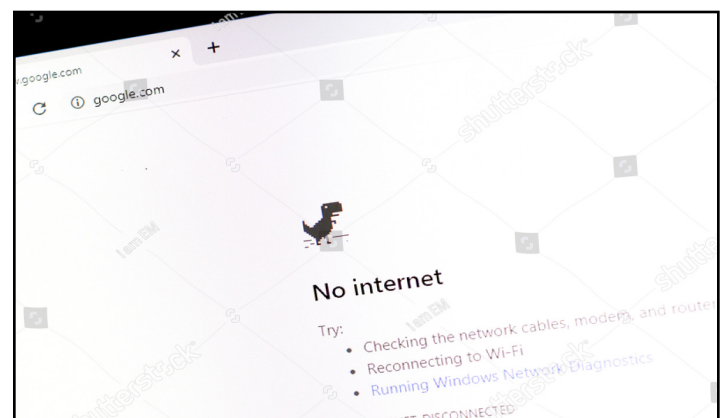
infrastructure has contributed to a reversal of population decline.[22] Mid-sized cities such as Lafayette, LA; Wilson, NC; and Chattanooga, TN have also experienced population

growth since the addition of fiber infrastructure.[23] While not all of this growth can be attributed solely to fiber, these trends show that communities with fiber internet access tend to have better job growth and less population decline than those without.

Finally, the decreased cost and increased reliability of fiber networks can save local governments money that can be reinvested in the local economy. Municipalities including Chattanooga TN; Howard County, MD; and Spanish Fork, UT documented millions of dollars in savings for both their residents and local governments.[24,25,26] These cities serve as case studies on how these savings can potentially be used to further spur economic growth, such as offering government small business grants in Chattanooga, or as business regions such as the Pine-Nash Street District in Wilson, NC.

Up to 15% of U.S. households with school-age children do not have a high-speed internet connection at home.

Fiber Enables Education

A fiber-connected community increases the educational resources for children, schools, and skilled workers by providing cheaper and faster internet access. The COVID-19 pandemic underscored the essential role internet access plays in both K-12 and postsecondary education. Nearly 93% of households with school-age children reported some form of distance learning since 2020.[27]

Despite this, up to 15% of U.S. households with school-age children do not have a high-speed internet connection at home.[28] This number rises to 35% for households with an annual income below $30,000 a year. Municipal fiber-to-the-home will increase broadband access for education by lowering subscription costs, which is the number one barrier to access.[29]

Fiber connections at schools improve K-12 education quality by increasing speeds and bandwidth. Only 28% of school districts in the U.S. currently have one megabyte of internet bandwidth available per student, a minimum requirement for effective virtual learning.[30] Community colleges, one of the largest drivers of social mobility, are also more likely to utilize online classes compared to traditional 4-year colleges, requiring high-speed internet to be effective.[31]

In addition, skills-based training through online courses is an increasingly important educational resource for skilled labor. Up to 86% of US employers agreed that online "micro-accreditation" through online services such as Coursera or similar massive online open courses (MOOCs) strengthens a candidate's job application, leaving those without internet access behind.[32] High-speed internet access is a necessary condition for education at all levels, and fiber can help increase access to low-cost high-speed internet for students and schools.

Fiber Improves Healthcare Access

Fiber can improve healthcare equity by enabling access to telehealth. Lack of transportation is one of the main barriers to healthcare access, especially in lower-income communities and for people with disabilities. Up to 3.6 million people a year in the U.S. do not receive medical care due to a lack of transportation.[33]

Telehealth is an effective method to improve healthcare access by eliminating transportation barriers and reducing costs. Importantly, telehealth is as effective by most outcome metrics as in-person visits for primary care patients.[34] Lower-income residents are more likely than other groups to use telehealth services and benefit from having high-quality telehealth options from home enabled by affordable internet.[35]

Telemedicine can also address healthcare needs that are undertreated due to the lack of nearby health professionals. For example, over 20% of US adults have untreated mental health disorders, while at the same time 150 million people live in federally designated mental health professional shortage areas.[36]
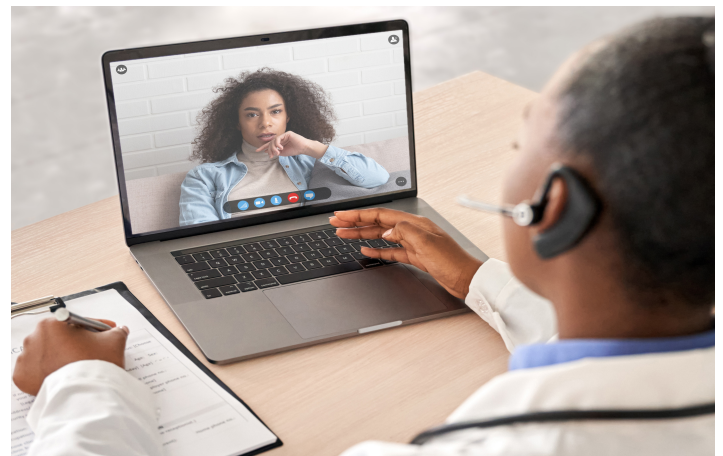
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Telemedicine therapy using video conferencing has been shown to be an effective and more accessible therapy method by the American Psychological Association, which is enabled by the higher bandwidths of fiber.[37]

Finally, eldercare is another area where access to fiber internet can improve health outcomes. Eldercare in the US suffers from severe understaffing, with staffing expected to reach crisis levels in the next few years.[38] Telehealth for elder care is one effective way to better utilize available healthcare workers but is limited in its reach as 42% of older Americans do not have broadband access at home.[39] Fiber access can help reduce costs to increase broadband adoption among older Americans and improve the quality of eldercare.

RECOMMENDATIONS FOR COMMUNITIES CONSIDERING MUNICIPAL FIBER

Reach Out to Cities Already Using Fiber Networks

There are over 750 communities in the U.S. that have built their own internet networks.[40] This primarily consists of

rural communities that historically have had unreliable or no internet access. These communities represent many different models of fiber access, including municipal-owned, open access (publicly owned, privately leased), and community-owned (co-ops). The largest and most studied fiber network is in Chattanooga, TN, which is municipally

owned and serves over 100,000 people. However, almost every state has a local fiber success story. Reaching out to local partners is especially important to learn about what specific barriers your state has to public fiber networks. This map continuously updates community networks across the country.

Be Prepared for Pushback from Private Telecom Companies

Almost every community that has adopted, or tried to adopt, their own fiber network has a story involving pushback from a local private telecom company. Pushback can come in the form of these companies suddenly lowering prices in an area to earn public support, giving money to local opposition groups, or influencing local leaders to abandon plans. Look to our companion document, *Responses to Fiber Concerns* for detailed answers from our community partner to commonly asked questions.

Learn From Experts

There is a wealth of information available from existing and future fiber networks, both domestically and abroad. Four resources are highlighted here:

1. Our community partner, The Detroit Office of Digital Inclusion and Equity, has released a comprehensive infrastructure plan for their own open-access fiber network. Their work aims to reduce the digital divide in Detroit and includes a cost analysis for their proposed fiber network.

2. Bento J. Lobo, Professor of Finance at The University of Tennessee at Chattanooga, has published a comprehensive assessment of the municipal-owned fiber network in Chattanooga which shows, 10 years on, the benefits the city reaped from fiber. His conclusions highlight the money saved by the city and the jobs created due to its fiber network.[41]

3. Susan P. Crawford, Professor of Law at Harvard Law School, has published several papers and books showing the benefits of fiber, including comparative analyses from other countries. She has written a non-fiction book on the benefits of fiber networks, *Fiber: The Coming Tech Revolution—and Why America Might Miss It*.[42]

4. The Congressional Research Service has released a memo detailing the role of municipal networks to address the digital divide. This document contains the U.S. Federal Government's assessment of municipal networks as well as details on regulations.[43]

The University of Michigan's Science, Technology, and Public Policy (STPP) program is a research, education, and policy engagement center concerned with cutting-edge questions at the intersection of science, technology, policy, and society. This document was written as part of STPP's community partnerships initiative, where we work with organizations that have concerns related to a current or anticipated science or technology issue. If you want us to take a deep dive into the implications of an emerging technology in your community, and you want more information, contact stpp@umich.edu.

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