





North Carolina Connectivity: The Good, The Bad, and The Ugly

By H. R. Trostle and Christopher Mitchell

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Contents

Executive Summary	4
Introduction	6
Background: Internet Access Infrastructure	8
Types of Technology	8
Defining Broadband: Past, Present, and Future	9
Subsidizing the “Private Sector” in North Carolina	10
The Problem: Connectivity in Rural North Carolina	11
North Carolina’s Rural/Urban Digital Divide	12
The Private Sector Is Not Expanding FTTH to Rural North Carolina	14
A Solution: Local Control and Cooperatives	17
Telephone and Electric Cooperatives	17
Local Government Investment	20
Conclusion: Recommendations for Rural Internet Access	24
1. Remove barriers to cooperative investment.	24
2. Allow communities to decide for themselves if a municipal investment is appropriate, and if so, what business model most fits local needs, challenges, and culture.	24
3. Expand Internet access from existing locally-accountable networks.	25
4. Create a state program to offer matching grants or a revolving loan fund.	25
Endnotes	26



Executive Summary

As high-quality Internet access continues to be more and more essential for everything from education to basic commerce in the 21st century, North Carolina has a dramatic inequality of access across the state.

Though 4 out of 5 rural residents have at least basic broadband access (defined as a minimum of 25 Mbps download and 3 Mbps upload by the Federal Communications Commission), access to higher capacity connections tends to be limited to some urban areas. As more devices develop greater appetites for bandwidth, rural areas are being left behind.

Local government efforts in some urban areas have recruited Google, Ting, and other companies to deploy fiber-optic infrastructure. In some of these newly competitive areas, AT&T and CenturyLink have upgraded their last-generation networks with fiber-optics.

However, rural communities pose a greater challenge for the private sector model and have seen far less investment. The maps in this report confirm that almost all private sector investment in fiber-optic networks in North Carolina is within urban areas. Simultaneously, the vast majority of rural areas have either zero or one option for basic broadband access.

Examining the rural areas with high-quality access shows a common denominator: cooperatives. North Carolina has 8 telephone cooperatives and each of them has already invested in fiber-optics; 6 of them have already replaced or aim to replace all their old copper with fiber-optics. Some of them are bringing fiber-optics to nearby areas outside

of their historic territory long neglected by the big incumbent telephone companies.

North Carolina's rural residents largely receive electrical service from an Electric Membership Corporation (EMC co-op) and several of the state's 26 EMCs have begun investing in fiber-optics to help their communities. Telephone and electric co-ops should be a major focus for improving Internet access across the state, but a state law passed in 1999 limits EMC access to capital for telecommunications.

Another state law—known as H. 129 when it passed in 2011—limits local government authority to build networks. The city of Wilson's Greenlight citywide fiber-optic network connects the community's largest employers and has attracted high tech firms to town. Its rural neighbors are desperate for it to expand but the state prohibits Wilson from sharing its network with the region.

During a period when H. 129 was struck down by the FCC because it limited investment in advanced Internet networks, Wilson had expanded Greenlight to nearby Pinetops. Pinetops is a small town where local businesses were stuck with a monopoly DSL provider that was so slow the connection did not quality as even basic broadband. Wilson offered a connection 100 times faster in download capacity and 1,000 times faster in upload capacity. But a recent court decision has reinstated H.129 and Wilson will now have to cut Pinetops off, leaving it without basic broadband access. This is the same story with a packing plant Wilson was serving in Nash County. Arbitrary limits on expanding successful networks

serve only to protect the politically powerful cable and telephone companies, not local businesses and residents.

Recognizing the state's need for better Internet connectivity, the Broadband Infrastructure Office issued a report in mid-2016 entitled, "Connecting North Carolina State Broadband Plan."

That plan is essentially a "one-hand-on-deck" policy that naively pins the future of the state on the big telephone and cable companies. North Carolina should adopt an "all-hands-on-deck" approach that recognizes the need for a mix of business models in providing essential infrastructure across the state.

Local leaders are better equipped to solve their problems than micro-managers from Raleigh. Some communities will embrace cooperatives, some may find ways of attracting private companies, and some may choose to work with Wilson or duplicate it. This report recommends that North Carolina remove its barriers to local choice and focus on encouraging more sources of investment rather than focusing largely on firms based outside of the state. ■



Introduction

For the past 100 years, the United States has acted upon the principle that the nation is stronger when everyone has access to essential infrastructure. In the early 1930s, we electrified rural communities, creating the productivity and lifestyle benefits that supercharged the economy. Then, we expanded the telephone to everyone—again growing markets and increasing productivity for the entire country. That investment later enabled the information revolution, as Internet access began to overtake voice technologies. Each technology brought greater productivity and access to larger markets.

The Good: North Carolina has widespread basic broadband access, using the 25 Megabits per second (Mbps) downstream and 3 Mbps upstream definition of the Federal Communications Commission (FCC).¹ According to the North Carolina Broadband Infrastructure Office’s “Connecting North Carolina State Broadband Plan,” the state has “the highest deployment rate among southeastern states” with a 93 percent deployment rate.² Some urban areas already have, or will soon have, multiple options for high-speed Internet access, including gigabit (1,000 Megabits per second) connectivity.

The Bad: Widespread basic broadband access is an important first step, but North Carolina has no actual plan to ensure most communities will soon have better connectivity. In particular, rural areas that are dependent on DSL service for Internet access have few prospects for better access. As small businesses and residents increasingly need higher capacity upload connections for common applications, most will have no options or be stuck with a monopoly provider. North

Carolina’s widespread basic broadband access will not automatically translate into widespread next-generation service. The state needs to encourage investment by removing policies that actively prevent investment in fiber-optics and high capacity fixed wireless solutions.

The Ugly: Most of North Carolina has no competition for high-speed Internet access. While those served by well-liked local entities like cooperatives may not need a choice to ensure good connectivity, other providers like AT&T and CenturyLink are regularly ranked at the bottom of customer satisfaction surveys and require greater competitive pressure to act more responsibly.

Many urban neighborhoods in North Carolina are already on the path for this next-generation Internet connectivity. Google is bringing fiber-optic networks to Charlotte and some Research Triangle Park communities. AT&T has announced more fiber network investment in those areas as well. Some smaller companies like Ting are entering some markets with the help of municipal fiber leases, as in Holly Springs. But the overwhelming majority of private-sector investment in fiber-optic networks in North Carolina is focused on urban areas. Most rural areas not only have no path to next-generation connectivity, the state has both enacted policies to prevent them from building their own municipal networks and hobbled the capacity of co-ops to invest in needed connectivity.

The Solution: North Carolina should embrace all manner of investment. Some rural communities can press forward on their own. Cooperatives, first formed in the early 20th century by active citizens to provide essential services to their communities,

are taking on the new challenge of expanding Internet access. North Carolina's eight telephone cooperatives are already serving rural areas with high-speed Internet access using fiber-optic networks. Some electric cooperatives have started to offer Fiber-to-the-Home (FTTH) as well. These telephone and electric cooperatives are reaching the unserved and underserved rural areas.

Local governments have created innovative projects as well. Municipalities, such as Wilson and Salisbury,³ built groundbreaking citywide projects to serve the unmet need of businesses and residents, but have been prevented from serving their rural neighbors by state law.⁴ Other local governments have worked with partners like the cooperative Wilkes Communications to expand networks in small towns and rural communities.⁵

But local governments and cooperatives face state limits on how they can support expanding Internet access. Many rural communities face a double challenge in that big corporations do not want

to invest in them and state laws discourage or prohibit them from investing in themselves.

North Carolina should embrace an all-hands-on-deck philosophy. Given the tremendous need for improved Internet access, the state should welcome all manner of investment rather than restricting those most impacted: communities themselves. We offer the following recommendations:

1. **Remove barriers to cooperative investment.**
2. **Allow communities to decide for themselves if a municipal investment is appropriate, and if so, what business model most fits local needs, challenges, and culture.**
3. **Expand Internet access from existing locally-accountable networks.**
4. **Create a state program to offer matching grants or a revolving loan fund.■**



Background: Internet Access Infrastructure

Types of Technology

Residents and businesses in rural areas often have few choices for Internet access. These options are often satellite or DSL. Despite being faster than dial-up, these technologies are not generally able to offer a good enough connection to take full advantage of modern Internet applications. For example, they may not be sufficiently reliable to support home business ventures. Cable may be available in some population centers within rural counties, but is often comparatively expensive and may not be as reliable as the cable networks in larger cities like the Charlotte region. Understanding the relevant technologies delivering access today is crucial to ensuring local businesses and residents have the connectivity they need.

Satellite

This technology relies on signals beamed down from geostationary satellites in space. This often results in high latency (the delay in moving data across distances) that can be a problem for many modern applications. Satellite is also not very effective in mountainous regions; it works best with clear skies and flat terrains.⁶

Downloads and Uploads

Download speed is how quickly information moves from the Internet to the user, as in watching a YouTube video or downloading a podcast. Upload speed is how quickly a user can send information (sharing a video or off-site backup). These are often abbreviated as *download/upload* in Megabits per second (Mbps).

Satellite can have functional download speeds but very slow uploads. Low capacity, high latency options met user needs when the web was mostly text, images, and simple videos—aspects that only require download speeds. In the modern economy, faster upload speeds are becoming increasingly necessary for homes, businesses, schools, public safety, and hospitals. Satellite providers also often have monthly bandwidth caps, which can restrict usage.

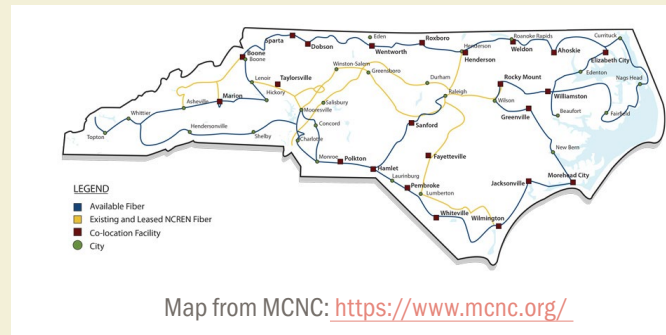
Wireless

Wireless networks are more and more common, but different wireless approaches have different tradeoffs. For instance, Wi-Fi is a short-range technology that is quickly offloaded to a wired network and therefore works primarily in close proximity to a fixed wired network. Fixed wireless, where a stationary antenna at the subscriber premise receives and sends signals to a distant tower, can be very challenging in mountain terrain but can be a good interim solution.⁷ However, the end user experience of fixed wireless is quite mixed and may depend on the technical capacity of the deployer. Cellular or mobile wireless has bandwidth caps and high costs that make it uneconomic for small- and home-based businesses.

Wireless remains a complement to wired networks—despite unending claims to the contrary. In the mid 2000's, many claimed Wi-Fi would make fiber-optics unnecessary. When that did not happen, WiMax was hyped to replace fiber. When WiMax stumbled, LTE became the next technology that would obviate the need for fiber. Now, 5G and millimeter wave technologies are supposed to supplant fiber. However, these are comparatively

MCNC's Research and Education Middle-Mile Network: The Opportunity to Connect

MCNC is a non-profit organization based in Durham, North Carolina that has created a high-speed fiber network called NCREN. It connects all of the public school districts in North Carolina, 17 institutions of the UNC System and General Administration; 95 North Carolina Charter Schools; 27 North Carolina Independent Colleges and Universities, and 58 North Carolina Community Colleges. MCNC provides rural students access to digital learning initiatives.



Now MCNC hopes to expand Internet access to even the most rural homes. The MCNC goal is to make North Carolina one of the most connected states in the nation by 2020. NCREN could serve as a middle-mile network to which last-mile providers could then connect rural families.

short-distance solutions, so implementing them will require fiber-optics deep into neighborhoods to backhaul the wireless traffic.

Wired

DSL allows Internet access to be delivered over a telephone line. The frequencies used to communicate information on DSL deteriorate quickly over long distances (more than a few thousand feet). To get the best DSL service, customers have to live within half of a mile of the central office. Though DSL can deliver services in excess of 25/3 Mbps under the right circumstances, most connections are much slower. Even back in 2011, AT&T CEO Randall Stephenson called DSL “obsolete.”⁸ DSL often has the same drawback as satellite: functional download speeds but very slow uploads.

A slightly faster option more common in population centers is **cable**. This technology can handle high-speed downloads, but tends not to have a high upload speed. Cable networks can also be congested during times of peak activity as multiple users vie for bandwidth. New cable standards have allowed for higher download capacity but have not significantly boosted its constrained upstream capacity in practice, which

is particularly problematic for teleworking and small business access. Though the DOCSIS 3.1 standard can allow for faster uploads, enabling it would require significant costly upgrades that cable companies are unlikely to make.

The gold standard for sustainable, reliable, Internet access is **fiber-optics**. Fiber can support incredibly high upload and download speeds. It is fast and reliable—key components of telecommuting for work, of doing homework for students, and of providing telemedicine to patients. The tradeoff is that building FTTH is extremely costly, largely in labor as every house and business must be wired with a new connection. However, FTTH has been shown to increase home values by up to 3.1 percent—for a typical home.⁹ Currently, fiber is known for delivering a “Gig,” short for a gigabit, in cities such as Wilson, North Carolina; Chattanooga, Tennessee; and Kansas City. Both Salisbury’s Fibrant and Chattanooga’s EPB Fiber have already announced a 10 Gig tier.¹⁰

Defining Broadband: Past, Present, and Future

With the new emphasis on digital learning, the rise of cloud computing, and the advancement of telemedicine, the previous FCC broadband standard

of 4/1 Mbps proved inadequate. In 2015, the FCC updated the minimum definition of broadband to 25 Mbps/3 Mbps.¹¹ But, only approximately 12 percent of North Carolina’s rural population has a choice in providers at that speed—there is no real competition for high capacity services in most areas.¹² Furthermore, according to the FCC’s 2016 report, about 20 percent of North Carolina’s rural residents do not have access to 25 Mbps/3 Mbps versus only 1 percent of urban residents.¹³

These statistics may actually understate the problem because they are based on data aggregated at the census block level (then further analyzed at the census tract level), and rural areas often have large census blocks.¹⁴ This combination can lead to the overstatement of broadband coverage for rural residents because a provider may only cover a few addresses per block, leaving many others unable to connect.¹⁵

Although 25 Mbps/3 Mbps supports most current needs, it will soon be insufficient. With more video content, more bandwidth-heavy applications,¹⁶ and more Wi-Fi enabled devices, these speeds will prove inadequate in the next few years. The question is not whether a single application needs higher capacity but whether common applications running simultaneously would in aggregate require greater connectivity. Homes and especially businesses have many different devices simultaneously attempting to use the network. Fiber-optic networks and some forms of fixed-wireless networks are the only technologies that can clearly meet future needs.¹⁷

Without both high-speed uploads and downloads, at least one out of five rural North Carolina residents have trouble accessing cutting-edge technology, new educational

opportunities, and ways to increase productivity both on the farm and in small businesses.¹⁸

Subsidizing the “Private Sector” in North Carolina

Large incumbent providers have a long history of using federal subsidies to bring voice and Internet access to North Carolina. In 1998, the federal government introduced annual high cost universal service support to subsidize the highest cost telephone networks. Existing High Cost Program support was frozen in December 2011, and the FCC is reorganizing and modernizing the program under the Connect America Fund.¹⁹ Between January 2012 and July 2015, AT&T received almost \$15 million (\$14,913,045) through Frozen High Cost Funding for North Carolina.²⁰ And CenturyLink, during that same period, received a total of almost \$40 million (\$39,248,121) for its operations in North Carolina.²¹

The Connect America Fund still provides annual support to incumbent providers to increase speeds in some areas of rural North Carolina to at least 10 Mbps/1 Mbps by 2020.

AT&T has accepted ~\$3.5M each year to reach 13,000+ homes and businesses, and CenturyLink accepted ~\$10M per year to connect 36,000+ homes and businesses.

Even today, the large incumbent providers continue to accept millions of dollars in federal subsidies. The Connect America Fund still provides annual support to incumbent providers to increase speeds in some areas of rural North Carolina to at least 10 Mbps/1 Mbps

by 2020.²² AT&T has accepted \$3,498,889 each year to reach 13,139 homes and businesses,²³ and CenturyLink accepted \$10,008,390 to connect 36,159 homes and businesses.²⁴ These upgrades will take years to build, only to deliver a connection that is already outdated.

10 Mbps/1 Mbps does not meet the FCC definition of broadband, but the Connect America Fund has not updated the service requirements. Residents with 10 Mbps/1 Mbps, which is often even slower in reality than advertised, are already on an outdated connection. Spending so much for obsolete connections is poor policy.■



The Problem: Connectivity in Rural North Carolina

All of North Carolina needs high-speed Internet access—especially rural communities that account for nearly 34 percent of North Carolina’s population.²⁵ The unadjusted unemployment rate stands at 5.2 percent, ranging from lowest to highest: 3.5% in Buncombe County (home to Asheville) to 8.6% in very rural Scotland County (compared to the overall U.S. unemployment rate of 4.7%).²⁶ Rural Residents would benefit tremendously with reliable high-speed Internet access from increased access to labor markets, improved standards of living, and better educational opportunities. Without high quality access rural communities will continue to fall behind, if not disappear entirely.

Reliable, high-speed Internet access can improve the rural economy, provide better healthcare, and increase digital learning. Businesses are attracted

to fast, reliable connectivity—bringing new vitality to local communities. Farmers need high-speed Internet access to track field conditions and soil nutrition accurately and get expert advice on improving crop or livestock yields. With affordable, high-speed Internet in people’s homes, the elderly and military veterans can take advantage of telemedicine. Students need connectivity at home—especially after the legislature passed 2013 H. 44. The bill largely removed textbook funding from schools, and instead funded digital learning initiatives. Many rural students now face a homework gap: insufficient home Internet access to complete these digital school assignments. Most modern households simply cannot go without reliable Internet access. For instance, CCR’s family in Columbus County shared their story.²⁷ In addition to running a home business that needed reliable connectivity, CCR had grade-

Broadband Adoption and Digital Literacy

In this paper, we focus on infrastructure deployment and access to next-generation technology. We do not offer recommendations for increasing basic broadband adoption or for improving digital literacy.

We do, however, recognize the growing problem of the digital divide between household income levels. Without home Internet access, low-income families have limited resources to access educational resources and social programs. Relying only on public Internet access at libraries creates burdensome limitations on when and how low-income students can do their homework.

We commend organizations like Eliminate the Digital Divide (E2D) for their work to close the digital divide in North Carolina. To date, E2D has assisted more than 1,200 families with their low-cost laptop and digital literacy programs. In our Community Broadband Bits Podcast Episode 218, E2D co-founder Pat Millen described how the organization is currently working with five of the lowest-income high schools in the Charlotte area and the role of the local municipal Internet service provider MI-Connection in Mooresville.

school children who needed high-quality Internet access for homework assignments. The existing provider’s low speed options did not support the entire family’s needs for Internet access. In 2015, CCR saw AT&T and Time Warner Cable laying fiber around their neighborhood. For several months, CCR was told that high-speed Internet access would be available at their home. In the meantime, CCR had to drive **45 minutes to a coffee shop or a fast food restaurant in order to establish a reliable Internet connection.** CCR’s cell phone bills were hitting more than \$600 a month, from repeatedly exceeding cell phone data limits. CCR expressed fear that their children would grow up less educated. And moving to an area with better Internet access would be difficult. Internet access directly affects home prices, and many buyers avoid houses without high-quality Internet access.²⁸ Fast, affordable, and reliable connectivity is not a luxury item, but a necessity.

North Carolina’s Rural/Urban Digital Divide

Broadband Internet access (25 Mbps/3 Mbps) appears largely available in North Carolina (see Map 1) but that capacity is the bare minimum baseline. The North Carolina Broadband Infrastructure Office noted that “within the next three to five years, many regions will not be able

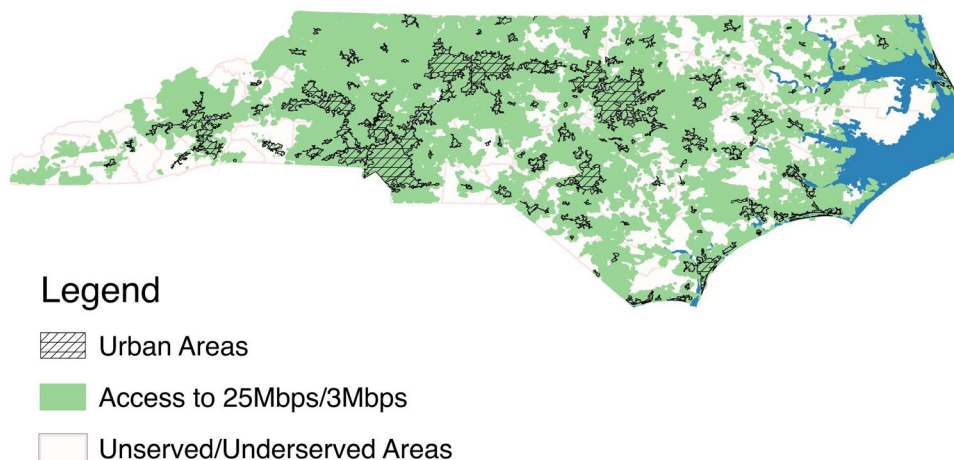
to support the needs of businesses and individuals” with the current broadband technology.²⁹

The problem is even worse among some populations—with 99 percent of North Carolina’s tribal lands lacking broadband availability according to the FCC.³⁰ This statistic accounts only for the federally recognized tribe—the Eastern Band of Cherokee—but the State of North Carolina recognizes eight tribes. Data on the other seven tribes’ Internet access is unavailable because of the federal data collection methodology and analysis.³¹ However, access on North Carolina’s tribal lands is typically even worse than the average on tribal lands across the United States.

Rural North Carolina will again fall behind without a commitment to deploying modern technology. But, most private sector investment in new technology, such as FTTH, is focused on the urban centers. We detail this situation below and offer potential pathways forward.

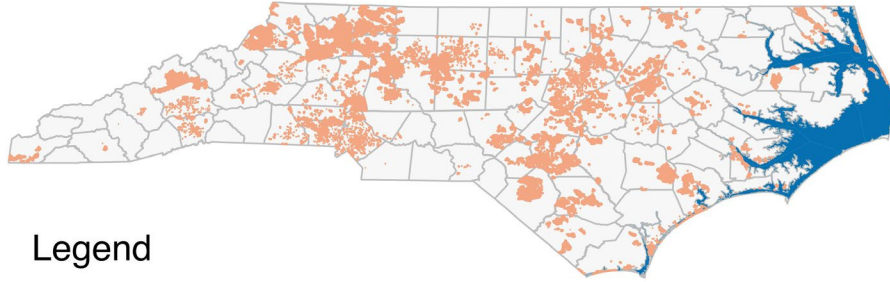
Finally, it bears repeating that the maps and figures throughout this report likely overstate existing broadband availability: the data is self-reported by the operators and aggregated at the census block level, thereby ignoring those who are in census blocks where service is only available to a portion of area households.

Rural Regions Often Have Basic Broadband Internet Access



Map 1: Urban and Rural High-Speed Internet Access
Based on FCC Form 477 Data from June 2015, Released March 2016.

Little Competition in Rural North Carolina



Legend

More than one provider that offers 25Mbps / 3Mbps

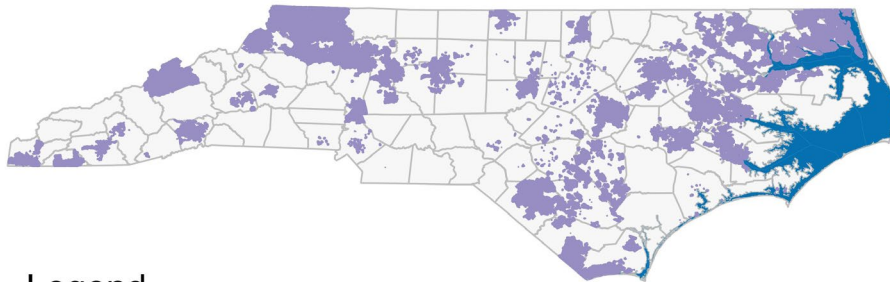
Map 2: High-Speed Internet Access Competition
Based on FCC Form 477 Data from June 2015, Released March 2016

Although the majority of rural North Carolina residents have access to one provider that meets the FCC's minimum definition for broadband today, most people do not have a choice. Few of these providers have overlapping service areas. Without competition, which creates a fear of losing unhappy subscribers, the large incumbent providers have little incentive to improve their services by investing in next-generation technology.

Most rural networks would require costly upgrades to offer higher capacity services. See Map 3 shows how much of North Carolina (including

business connections) can access a 10 Mbps upload connection, which would be a minimum for most businesses seeking to remain productive and competitive. The technologies that can deliver a 10 Mbps upload stream today are more likely to have an upgrade path to higher capacities in the future. When the FCC next updates the broadband definition, these communities will be left behind without significant investment. Rural North Carolina is clearly falling behind urban communities, who are seeing that next generation, fiber-optic investment.

Rural Areas Lack Higher Capacity Connections



Legend

10 Mbps Upload Speed Available

A minimum for most businesses seeking to remain productive and competitive in the digital economy.

Map 3: North Carolina homes and businesses with access to a 10Mbps upload connection
Based on FCC Form 477 Data from June 2015, Released March 2016.

The Private Sector Is Not Expanding FTTH to Rural North Carolina

Fiber-optic technology is being deployed in major cities, but it is not widely available elsewhere from private sector providers. Large telephone and cable companies do not want to pay the high capital cost of building a FTTH network in low-density areas. Companies like CenturyLink and AT&T have to answer to shareholders that prefer larger short-term dividends rather than long-term, low return-on-investment upgrades in rural regions. Yet co-ops, municipalities, and even some local private companies have developed successful

business models because they recognize the many direct *and indirect* benefits resulting from high quality Internet access.

Large companies have announced upgraded networks in some North Carolina cities, but have largely ignored rural regions, particularly for fiber-optic investments. We compiled a list of where the large private companies have claimed they already have or soon will upgrade their networks (see Figure 1). It is rarely clear if these announced upgrades, sometimes called fiber-to-the-press-release, will impact significant areas of a community or only a few apartment buildings, for instance.

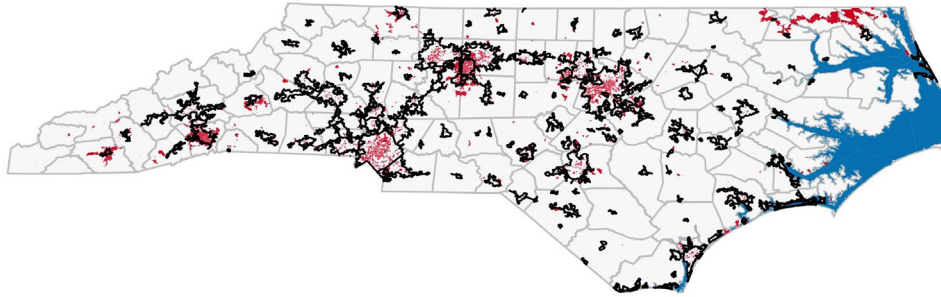
Figure 1. Large Private Providers' Residential Expansion List

Urban Areas	Rural Areas
<ul style="list-style-type: none"> Charlotte (AT&T, Time Warner Cable*, Google Fiber) Raleigh (AT&T, Time Warner Cable*, Google Fiber) Durham (AT&T, Google Fiber) Carrboro (AT&T, Google Fiber) Cary (AT&T, Google Fiber) Chapel Hill (AT&T, Google Fiber) Garner (AT&T, Google Fiber) Morrisville (AT&T, Google Fiber) Greensboro (AT&T, Time Warner Cable*) Holly Springs (AT&T, CenturyLink) Apex (AT&T) Gastonia (AT&T) Huntersville (AT&T) Winston-Salem (AT&T) Wilmington (Time Warner Cable*) Angier (CenturyLink) Clayton (CenturyLink) Fuquay-Varina (CenturyLink) Hillsborough (CenturyLink) Mebane (CenturyLink) Pittsboro (CenturyLink) Roxboro (CenturyLink) Smithfield (CenturyLink) Wake Forest (CenturyLink) Fayetteville (CenturyLink) Raeford (CenturyLink) Southern Pines (CenturyLink) Whispering Pines (CenturyLink) 	<p>~_(_)_/~</p> <p><i>We could not locate any announcement of a large private company expanding FTTH in rural areas.</i></p>
<p>*Time Warner Cable's "TWC Maxx" uses cable, not FTTH.</p>	

For greater clarity, we have also highlighted the areas below where private providers offer fiber-optic connections to some residents and

businesses (see Map 4) and where they have announced new technology to residents (see Map 5).

Private Providers Invest in Metro Areas, Not Rural Regions

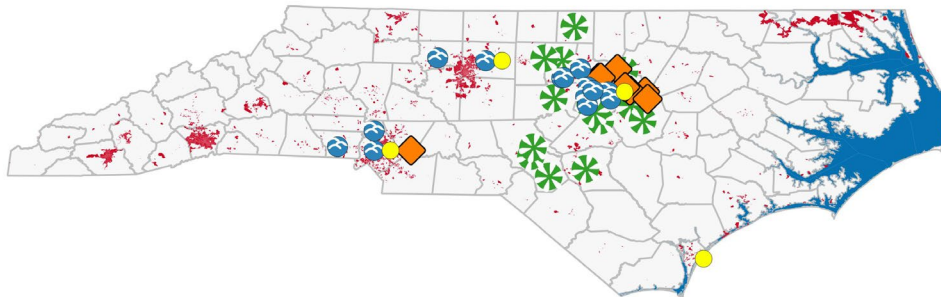


Legend

- Urban Areas
- Private Providers' Residential and Business Fiber

Map 4: Private Providers' Residential and Business Fiber in North Carolina
Based on FCC Form 477 data from June 2015, released March 2016

Private Providers' Future FTTH Plans Show Continued Metro Bias



Legend

- Private Providers' Residential and Business Fiber
- Time Warner Cable
- AT&T
- Google
- CenturyLink

Map 5: Private Providers' FTTH Expansion Plans
Based on 2010 Census Data and 2015 press releases/news reports (subject to change).
Time Warner Cable's are announced speed upgrades.

With Google announcing FTTH projects in Charlotte and the Raleigh-Durham area, other large incumbent providers have decided to invest there as well. AT&T announced plans to improve its network in parts of the urban cores. CenturyLink announced gigabit FTTH in several North Carolina cities, but focused on new subdivisions.³² CenturyLink only made plans for FTTH in Holly Springs after another small company (Ting) moved into the market.³³ It is worth noting that none of the large firms have committed to serving entire cities—they each pick and choose neighborhoods to serve using various criteria. Lower income urban neighborhoods, which often have low levels of broadband adoption, may not see the investment that higher income areas do. Meanwhile, Time Warner Cable (recently sold to Charter) is likely to increase download speeds (not upload, or at least not significantly) through its cable network rather than upgrading users to fiber connections.

Some of those urban areas already had some fiber, and these companies are expanding only around those large urban centers. They tend to pass over smaller urban areas that serve as hubs of regional rural economies. Even as the big companies expand, some residents and businesses are left behind because the companies decide which neighborhoods get service—ensuring that they can get an immediate return on investment for their shareholders. This model works well to maximize short term profits, but is poorly suited to an essential utility in the modern era.

Additionally, these upgrade announcements demonstrate that DSL is obsolete. When faced with fiber-optic competition, AT&T and CenturyLink are more likely to invest in their own fiber, even as they tell the rest of their customers that DSL is sufficient. Where they are unlikely to face competition, they have little reason to upgrade.

Fortunately, North Carolina's rural communities have options beyond relying solely on the big companies that have shown so little interest in connecting them.■

A Solution: Local Control and Cooperatives

Telephone and Electric Cooperatives

Cooperatives are already serving and expanding in underserved rural communities. Locally owned and accountable to their member-owners, co-ops have invested for economic development, educational opportunities, and better connectivity. Cooperatives have quietly stepped up to the challenge of building in low-density, low-income areas, often providing connectivity superior to that available in metro regions and with a strong record of customer service.

In the first half of the 20th century, large electric and telephone providers passed over communities that were deemed unprofitable. With the Rural Electrification Administration, the federal government provided loans for electric co-ops and much later subsidized the operating costs for rural telephone providers,

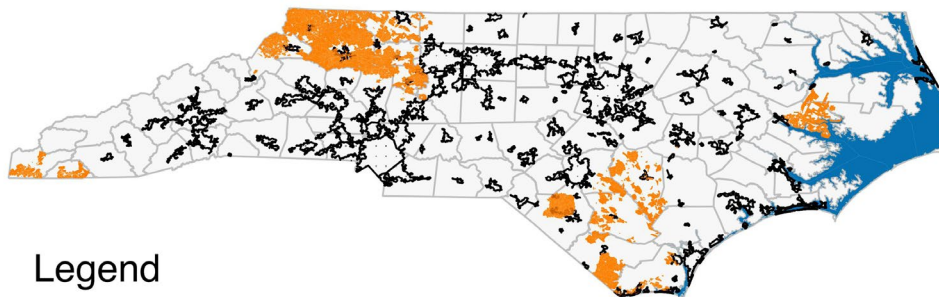
Cooperatives have quietly stepped up to the challenge of building in low-density, low-income areas, often providing connectivity superior to that available in metro regions and with a strong record of customer service.

building universal access to the essential infrastructure communities needed.

North Carolina has eight telephone cooperatives, called Telephone Membership Corporations, or TMCs, that serve over 130,000 mostly rural members in 26 counties. Each route-mile averages only about eight customers.³⁴ Despite that challenge, all of these cooperatives provide high-speed Internet access and are building FTTH networks.

Two co-ops, Randolph TMC and ATMC, are only installing fiber in new housing developments. The other six (Tri-County TMC, Star TMC, Skyline TMC, Surry TMC, Wilkes Communications, and Yadtel) are replacing their copper networks entirely with fiber. Wilkes Communications will also upgrade its recent purchases of the Barnardsville Telephone Co., Saluda Mountain Telephone Co., and Service Telephone Co.

Cooperatives Bring High-Speed Internet Service to Rural Areas



Legend

- Cooperatives' FTTH
- Urban Areas

Map 6: Cooperatives' Fiber
Based on FCC Form 477 data from June 2015, released March 2016.

Three of these cooperatives have already announced gigabit speeds: ATMC, Skyline TMC, and Wilkes Communications. The lower tier co-op services, usually between 20 and 30 Mbps, range from \$35 to \$65 a month; they have affordable options for high-quality Internet access that can be scaled up in the future.

Telephone cooperatives are not alone, as some rural electric cooperatives are also investing in high quality rural connectivity. North Carolina has 26 electric cooperatives (Electric Membership Corporations or EMCs) that serve

more than 2.5 million people. Historically, electric co-ops tended to avoid expanding into telecommunications but many have since decided the risks of doing nothing outweigh the challenges and have begun investing. Electric cooperatives, however, also have their own set of hurdles due to a state law passed in 1999.³⁵

Although the North Carolina law states that electric membership corporations may form a subsidiary to provide telecommunication services, those subsidiaries cannot be financed with loans or grants from the Federal government's Rural

Wilkes Communications RiverStreet Networks: An In-Depth Look at A Telephone Cooperative

In the northwest quadrant of North Carolina, residents banded together over 60 years ago to learn about their options for telephone service. Thanks to their tenacity and the federal Rural Electrification Act, Wilkes Telephone Membership Co-op was established as a telephone co-op. Over the years, it remained a center for connectivity—evolving to offer Internet service—and changed the name to Wilkes Communications.



The co-op serves the Wilkes County School System, Wilkes Community College, and all their co-op members, even those in the mountains on the edge of Wilkes County. The minimum speed offered is 25 Mbps/5 Mbps, and they offer up to a gigabit. Other services include television, telephone, security systems, and businesses services.

By 2010, Wilkes Communication had already replaced some of its copper network with fiber. In August 2010, they received \$21.6 million of federal stimulus money, which enabled upgrades to the most remote, highest cost areas. Thirty percent of the money was a loan, but the rest was a grant of about \$15 million. By 2014, the co-op had upgraded its entire service area with FTTH. They then set out to provide connectivity to more rural communities.

To expand beyond its service area, Wilkes Communications bought three local exchanges (new service areas) and created a subsidiary, RiverStreet Networks, (named after the street they are located on in Wilkesboro) to continue to expand FTTH. Several counties wanted to know about starting a co-op, but were deterred by the difficulty of doing so. (Since then, the RS Fiber Co-op in Minnesota cracked the code to starting a new fiber co-op.) Instead of a new cooperative, the Wilkes Communications subsidiary RiverStreet Networks, LLC, plans to partner with local governments to support each community's fiber needs.

Eventually all of Wilkes' subsidiaries may be merged into Wilkes Communications—ensuring that everyone can become a member of the cooperative. Those not in the original service area (Wilkes County, excluding the city of Wilkesboro) would become non-voting members in the cooperative. Non-voting members would still receive dividends, which is a portion of any profit the co-op made, and other benefits, such as scholarship opportunities for local students, from the cooperative.

Starting A New Cooperative: RS Fiber in Minnesota

Those not living near a co-op have now a feasible model for creating their own fiber-optic and wireless cooperative.

In Minnesota, small farming communities in Sibley and Renville counties developed an innovative solution, creating a new cooperative to start building a high quality wireless and Fiber-to-the-Farm network to connect every premise in the 600+ square mile project area.

The new co-op developed an innovative funding mechanism that began with local governments bonding and making an economic development loan to the co-op. Additional private loans and grants got the project started. ILSR's case study of the project describes the organizing and financing in great depth: <https://ilsr.org/report-mn-rural-fiber/>

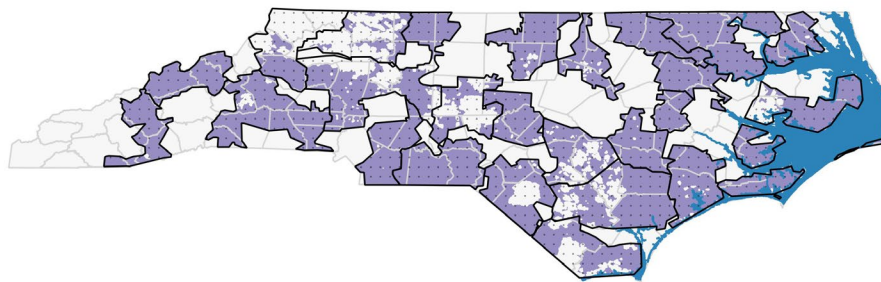
Once complete, the RS Fiber network will serve more than 6,000 homes, farms, and businesses throughout the region.

Utilities Service program or the U.S. Department of Agriculture. These are the main sources of funding for co-ops and rural infrastructure more generally. The electric membership cooperative is also not able to pledge more than 10 percent of its assets to back its telecommunications projects.



Despite these obstacles, Blue Ridge Mountain EMC found a way. The co-op began building the FTTH network in 2006 in North Carolina and Georgia. The cooperative collaborated with other electric providers in building the North Georgia Network Cooperative's middle-mile network with the financial support of a federal broadband stimulus grant. Now, Blue Ridge Mountain EMC has connected to that middle-mile and expanded FTTH service throughout its territory of 48,000 members.³⁶

Lumbee River EMC teamed up with Horry Telephone Cooperative of South Carolina to create BlueWave Communications. Lumbee River received \$20 million in American Recovery and Reinvestment Act funds (75% loans and 25% grants) in 2010 to build a FTTH network.³⁷ Lumbee River does not provide services on the network, but instead leases it to Horry Telephone Cooperative.³⁹ The partnership will

Electric Cooperatives: Potential for FTTH in North Carolina



Legend

-  Electric cooperatives' service areas
-  Areas without FTTH within electric cooperatives' service areas

Map 7: North Carolina's Electric Cooperatives and FTTH
Based on FCC Form 477 Data from June 2015, released March 2016.
Service Areas available from the South Carolina GIS Data Web Portal.³⁸

offer FTTH to about 12,000 homes and businesses in Robeson County.⁴⁰

This emerging model enables the rural electric co-op to focus on just the fiber on the poles. A trusted local partner, such as a nearby telephone cooperative, delivers services and manages customer service. This lowers the risk of engaging in a new venture. Both partners can focus on their area of expertise—physical infrastructure or Internet service—without engaging new risks.

In many cases, electric cooperatives have already installed fiber for internal uses, such as communicating with electrical substations. Now they have the opportunity to expand their use of it throughout the community. Many people without basic broadband access live within the boundaries of an electric cooperative and most of the electric co-op service areas do not have robust fiber-optic access (see Map 7). Rural electric coops could provide future-proof fiber infrastructure throughout much of rural North Carolina.

Local Government Investment

Local governments investing in networks are not a new phenomenon. Some cities and counties have extensive fiber networks for traffic systems or institutional networks. (Institutional networks provide connectivity to government buildings, and often libraries and schools.)⁴¹ For example, Morganton expanded its electric utility in the 1980's to also offer cable TV because the commercial provider provided such unreliable service. Internet service is even more important to rural communities now.

Local governments can find themselves in a bind because they have no authority to compel existing providers to offer faster service or meet affordable price points. In short, they cannot require any other entity to provide service their businesses and residents need. And for more than five years, state law has effectively prohibited them from providing that service directly themselves. 2011 H.

129 (Session Law 2011 84) has halted municipal investment in retail fiber networks.⁴²

Under this law, communities are effectively prohibited from providing Internet services to the public themselves. Though those who argued for 2011 H. 129 have claimed cities could still build networks, no community has been able to run the gauntlet of barriers. After compiling an extensive record of evidence, the FCC found that the state had simply blocked municipalities' entry into the market.⁴³

In February 2015, the FCC issued an order to preempt the state laws that restricted municipal broadband in Tennessee and North Carolina. In response, the states went to the 6th Circuit Court of Appeals, which reversed the FCC's order in August 2016. While these legal fights play out, communities cannot easily take action to improve their own connectivity.

Few North Carolina communities took action after the FCC order, and those that did are now in legal limbo. In January 2016, the small community of Highlands in the Appalachian Mountains of Western North Carolina created a community network, Altitude Community Broadband.⁴⁴ Using a combination of fiber and fixed wireless, the local government delivers affordable, reliable Internet service to several residents and businesses. The town board borrowed \$40,000 from the general fund and the \$210,000 from their electric enterprise fund, all to be repaid with revenue

From the "Connecting North Carolina State Broadband Plan"

"In [North Carolina's Broadband Infrastructure Office]'s 2015 survey, a majority of stakeholder's identified 2011 H. 129 as the most pressing challenge inhibiting their communities from addressing their broadband needs. The survey did not ask respondents for feedback on the law and the comments were written in."⁴⁵

from the network. The town's economy of 1,000 people depends in large part on tourism and high-speed Internet access is increasingly necessary. Mayor Patrick Taylor of Highlands stated in March 2016, "Either a community will have unlimited broadband capacity or it will wither and dry upon the economic vine."⁴⁶ It remains to be seen how the Court's decision to reverse the FCC order will affect this underserved community.

Before 2011 H. 129 became law, some cities built networks to ensure high quality access for local businesses and households. Three cities (Mooresville, Davidson, and Cornelius) joined together under the name "MI-Connection," and bought the bankrupt Adelphia cable system to ensure their communities would continue to have cable and Internet service. MI-Connection now provides fiber connections to local businesses, encouraging economic development. However, the private company Adelphia had left the network in

far worse shape and with fewer active subscribers than anticipated, resulting in greater costs than forecast. The network has required subsidies to operate but is providing important communities benefits.⁴⁷ As we noted above, subsidies are not unique to public sector providers—AT&T and CenturyLink have received billions in subsidies from the federal government.

Wilson and Salisbury built new networks to connect both businesses and residents providing economic development gains.⁴⁸ Nearby communities would like to see those networks expand their services to a wider footprint.

From the beginning, Wilson intended to bring FTTH into the surrounding rural communities where its municipal electric utility already provides service. When the state passed 2011 H. 129, Wilson was forced to halt the expansion plans. But, after the FCC issued a decision to remove that barrier,

The City of Wilson: Economic Development and Greenlight



The city of Wilson did not originally plan to build a municipal FTTH network, but only built the network after trying unsuccessfully to develop a public-private partnership. Both Time Warner Cable and Embarq (since merged with CenturyLink) turned down the city's proposal. Wilson decided to move forward alone.

The city's electric utility constructed the Greenlight network with \$28 million from Certificates of Participation. These are financial instruments that allow private investors to finance the network, being later repaid with revenues from the sale of telecommunications services. For years, critics said it would fail, but Wilson never missed a debt payment, runs the network strongly in the black, and has been an unambiguous success.

The network supports economic development, having attracted some new businesses to town and enabled established local companies to expand to new markets. For instance, local business Computer Central reaches more customers and provides more services.⁴⁹ And the film production company, Exodus FX, opened a new special effects studio in Wilson, specifically choosing the location for its excellent connectivity. Brad Kalinoski, co-owner of Exodus FX told the New York Times: "We were doing so much business that we had to have increased bandwidth, so we started looking around and found Wilson."⁵⁰

Director of Planning and Community Revitalization in Wilson, Kimberly Van Dyk, explained Wilson's new appeal to businesses, "Having the infrastructure in place around technology, as well as the asset of this really historic and charming downtown, is a really interesting intersection and I think a lot of people are drawn to that."⁵¹

Wilson's Greenlight expanded gigabit service to rural Pinetops, a farming town of 1,300 people about 20 miles away. Prior to April 2016, Pinetops businesses and residents only had access to unreliable and poorly maintained DSL and Satellite Internet service. Now, the small rural community has access to some of the best connectivity in the country. But in August 2016, the 6th Circuit Court of Appeals reversed the FCC decision, restoring authority to the state law. Wilson's Greenlight is once again prevented from expanding beyond the county line and state law requires it to stop offering service in Pinetops. Though the fiber-optic cables will remain, Pinetops' only option will be slow DSL from CenturyLink that is far below the definition of basic broadband.

Similarly, after Time Warner Cable and AT&T refused to improve service, Salisbury decided to build its own network in 2008. The city initially funded the network with about \$35 million in Certificates of Participation—investing in the future vitality of the community.⁵² Salisbury's network offers service of up to 10 gigabits per second but has not yet broken even financially.⁵³ Although Salisbury has faced financial challenges, nearby communities want the network to expand to their large institutions and manufacturers; doing so would help the network's finances.⁵⁴

Local governments should not believe the only options are between making a high-cost investment or doing nothing. Some communities

Next Century Cities

Communities must take action to ensure they will see the benefits of next-generation networks, whether they decide to partner or invest directly in public infrastructure. Some 150 local governments have joined Next Century Cities to promote local solutions that will ensure everyone has a choice in high quality Internet access providers. In North Carolina, Chapel Hill, Charlotte, Davidson, Raleigh, Salisbury, and Wilson are members. Learn more at the website: www.NextCenturyCities.org

have embraced active policies to improve Internet access without operating their own network. To date, these approaches have generally achieved fewer public policy goals (universal access, economic development, etc.) but they come with less risk as well.

Holly Springs built a fiber backbone and designed it in the hope of finding a private company to do FTTH because they were restricted from doing it themselves under state law. A small company named Ting embraced that opportunity and leases fiber from the municipality's network. This is dark fiber that Ting must "light" by attaching the necessary electronics, and then Ting will extend the last-mile to the home. Ting may be at the forefront of a growing number of companies using

Reports of Their Demise Are Exaggerated

Several studies, often funded by the big cable and telephone companies, have argued that publicly owned networks are not worthwhile investments.⁵⁵ Many of these studies have had major factual errors that reveal their bias.⁵⁶ Others have used an improper framework from the private sector to attack municipal investments: short-term profitability without accounting for indirect benefits such as lower consumer bills, higher real estate values, and other community benefits. Public sector investments are focused on bringing long-term vitality to businesses and residents, especially by providing needed services and encouraging economic development. ILSR specifically responded to one of these reports with a line-by-line rebuttal to explain why its claims were without merit.⁵⁷

this model but it is too early to tell and at present, there are not many companies like it.

In the Research Triangle, six municipalities and four research universities created a regional initiative called North Carolina Next Generation Networks (NCNGN). By collaborating, they encouraged private providers to deploy fiber networks in the region. NCNGN developed an RFP in 2013, bringing more investment from AT&T.⁵⁸ West—Next Generation Network (West-NGN) is taking a similar approach near Asheville.⁵⁹ These strategies are more likely to work in population centers than rural regions.

Greensboro and surrounding communities are opening up their underground fiber traffic management network to private providers through the Tri-Gig Project.⁶⁰ It is unlikely that Greensboro will receive the same investment as Holly Springs because Greensboro does not yet have a committed provider. Greensboro instead must convince providers to join with them and extend the fiber network. These approaches are more likely to result in smaller investments—perhaps wiring a business district or parts of a neighborhood than the entire community.

We hasten to note that these “market-driven” approaches tend to create winners and losers—they often leave the lowest-income areas without improved access. It is unclear what future business model would later extend coverage to them because future investment becomes more difficult as increased competition for high-margin customers removes the possibility of using them as anchor tenants to offset the costs of extending service to low-margin low-income residential areas. The most effective way to ensure low-income neighborhoods are not left out is to require universal service, but this policy option has been all but abandoned to entice investment in high-margin areas.■



Conclusion: Recommendations for Rural Internet Access

Rural regions cannot wait until the big companies get around to investing in modern connectivity. The future of their rural economies depends on access to modern connections to retain businesses, attract new employers, and ensure their children not only get a good education but can find good jobs as they start their own families.

Although large incumbent companies have started to offer fiber to some businesses and some neighborhoods in large urban centers, cooperatives and local governments are essential to achieve universal access. Some cooperatives have already converted to FTTH and begun to expand into the neglected territory of the big incumbents like CenturyLink. Cities like Wilson and Salisbury installed fiber to improve the community and attract modern businesses. They each recognized that their communities could not thrive with slow DSL or last-generation cable.

We cannot help but note that the North Carolina Broadband Infrastructure Office's report "Connecting North Carolina State Broadband Plan" seems to focus intently on private investments rather than empowering communities to solve their own problems where possible with local investment. These approaches were essential in the rapid expansion of roads, electricity, and telephone service.

All options should be on the table for local communities to obtain access to this critical infrastructure. Though grant/loan programs to encourage rural investment would be good policy, the first step is to restore local authority because

no one better understands the challenges and assets in each community than the community itself. And no one is more motivated to improve access than local businesses and residents.

1. Remove barriers to cooperative investment.

The telephone cooperatives are already providing high-speed Internet access to rural communities. They can expand outside their traditional service areas in order to broaden connectivity—partnering with local governments to lease publicly owned conduit and/or fiber would facilitate rapidly improved access. Some electric cooperatives may be hesitant to become a telecommunications service provider. Instead, they can install the fiber while partnering with nearby telecommunications firms to deliver the service. The state should not prevent electric co-ops from seeking federal loans or other support; this would require removing the restrictions on cooperatives providing Internet service found in N.C. Gen. Stat. § 117-18.1.

2. Allow communities to decide for themselves if a municipal investment is appropriate, and if so, what business model most fits local needs, challenges, and culture.

Municipalities such as Wilson and Salisbury have expressed a desire to expand and serve their rural neighbors, but 2011 H. 129 prevents these municipal fiber networks from expanding and prevents new networks from being created.

Small towns such as Pinetops and Highlands now face the undoing of all their work to connect their communities. Local governments can be an important piece of the puzzle in expanding high quality access in some regions. This alone will not solve all of North Carolina's rural investment needs, but it will lessen the need for state intervention or subsidy in some areas.

3. Expand Internet access from existing locally-accountable networks.⁶¹

North Carolina has fiber infrastructure that can serve as the backbone for statewide connectivity. MCNC has an existing middle-mile network that traverses the state. Non-profits PANGEA and ERC have grown fiber networks in Western North Carolina. Internet service providers regularly save on operational expenditures by connecting to these middle-mile networks. However, the capital cost of connecting those networks to individual homes and businesses is a major hurdle.

Focusing policy support—loans and subsidies if necessary—on locally rooted co-ops and nonprofit entities will ensure the network continues to meet community needs well into the future and that money recirculates in the local economy. Locally rooted companies are also far preferable to national absentee firms that typically have much lower customer satisfaction levels. But local companies can sell out to the national firms, later creating problems. Communities should consider right-of-first refusal language to buy network assets if they choose to subsidize private providers.

4. Create a state program to offer matching grants or a revolving loan fund.⁶²

Those willing to invest in fiber and/or fixed wireless networks should have access to the necessary funding. For instance, Colorado communities that have some of the necessary financing can apply for a matching grant through the Colorado

Department of Local Affairs. This program enabled rural Rio Blanco County to deploy fiber in its population centers and build a wireless network for its most remote areas. Matching grant or loan programs ensure that communities are invested in the outcome of the project and that dollars are stretched farther to make a larger impact for connectivity throughout the state.

North Carolina has all the pieces it needs to ensure rural regions have high quality Internet access. MCNC has a strong fiber-optic backbone throughout the state. Several cooperatives are already providing the challenging last mile access in very rural regions. Hesitant cooperatives need only look to one of the models pioneered by other communities in their state and around the country. Many North Carolina communities have the tools they need to solve this problem if the state would remove barriers to local self-reliance. Everyone in North Carolina should have an opportunity to succeed in the digital age.

Infrastructure that guarantees high-quality Internet access both now and into the future requires not only investment, but also empowerment. Communities should have the freedom to decide for themselves whether a municipal investment or a cooperative model would ensure the access they need. All options should be kept open for North Carolina's communities as they move forward.■

Endnotes

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- 3 The City of Wilson built the fiber network Greenlight to provide high-speed, high-quality Internet service to all homes and businesses in the community. Funding for the network came from Certificates of Participation that have been paid back by those who subscribed to the network. See Todd O’Boyle and Christopher Mitchell’s 2012 report “Carolina’s Connected Community: Wilson Gives Greenlight to Fast Internet” <https://ilsr.org/wilson-fiber-greenlight/>. The City of Salisbury began to consider a municipal network after Time Warner Cable and AT&T refused to improve service. Salisbury took out \$29 million in Certificates of Participation in 2008 to deploy the fiber network Fibrant. Nearby communities have requested Salisbury expand Fibrant to their communities. See Lisa Gonzalez’s October 2015 post “Fibrant Rolls Out 10Gbps, A Look at Salisbury’s Challenges in FTTH” <https://muninetworks.org/content/fibrant-rolls-out-10-gbps-look-salisburys-challenges-ftth>
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- 12 These statistics are approximate. They are based on 2010 US Census population data of rural census blocks that have more than one choice of broadband provider according to our analysis of deployment data from FCC Form 477 June 2015. (The FCC 2016 Broadband Progress Report uses population data from 2014, analyzing adoption and deployment rates on the census tract level using population density (see Appendix C).) Although two broadband providers may operate within the same census block, they may not actually both offer broadband services to a specific address within that census block. This is on par with national statistics where only 13% of rural residents have more than one choice.
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- 15 See also Government Accountability Office. GAO-16-222 p. 24–25, January 2016. <http://www.gao.gov/assets/680/674906.pdf> See also FCC 2016 Broadband Progress Report, January 2016. Footnotes 258–261. Page 40. https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf
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- 31 FCC 2016 Broadband Progress Report, January 2016. Appendix C. Sections 12–13. Pages 64–65. https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf
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