CONNECTING NORTH CAROLINA

State Broadband Plan

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Broadband Infrastructure

INFORMATION TECHNOLOGY

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Information Technology

PAT McCRORY
Governor

KEITH WERNER
State Chief Information Officer

June 21, 2016

Fellow North Carolinians:

When Governor Pat McCrory took office, he committed to transforming the state's digital infrastructure to more effectively and efficiently serve North Carolinians, better positioning the state for the future. He understands that high-speed internet access is critical to enhancing education, economic development, health care, and public safety.

In accordance with Session Law 2015-241, I am proud to offer this plan as the state's guiding document on the policies and actions necessary to increase North Carolinians' access to affordable high-speed internet. A collaborative effort, the plan uses feedback gathered from more than a dozen stakeholder listening sessions, discussions with nearly 80 subject matter experts, and a survey of 3500 local leaders.

Through the course of writing the plan, two common themes emerged: active and engaged communities and their partnerships with private sector internet service providers are the biggest factors in bridging existing digital divides. Therefore, the plan's recommendations encourage communities to be active participants in the development process.

Recommendations focus on lowering deployment construction costs, expanding access for K-12 students at home, preparing a 21st century workforce, and increasing small business adoption and use. It also looks at ways to enable new health care technologies and provide the necessary tools to public safety responders to ensure North Carolinians' safety.

I am pleased to say that North Carolina leads the nation in many measurable categories such as the percentage of the population with access to high-speed internet and public school connectivity. But, according to the Federal Communications Commission, almost 750,000 North Carolinians still do not have high-speed internet access, and eighty-nine percent of those citizens live in sparsely populated communities and counties. So, there is still more to be done. This plan provides the guidance and roadmap to ensure all North Carolinians have access to affordable broadband service and to prepare the state for future growth and demand. Most importantly, it helps to achieve Governor McCrory's vision of effectively serving the citizens of North Carolina by reimagining the role information technology plays in the state.

Sincerely,

Keith Werner

EXECUTIVE SUMMARY

High-speed internet may be the most significant innovation of the late 20th century. It's benefits—from creating jobs to transforming education—are profound.

North Carolina's broadband internet infrastructure is robust. The state leads the nation in developing, leveraging, and utilizing broadband-enabled technologies to help children learn and stimulate economic development. The existing infrastructure positions the state to create a 21st century prepared workforce, increase small businesses' efficiency and effectiveness, and enable new healthcare technologies and service models. Faster, more reliable connectivity allows first responders and law enforcement to access data that could save lives and increase safety.

However, broadband's benefits are not evenly dispersed and a digital divide, or "a gulf between those who have ready access to the internet and computers,"[i] and those that don't, is growing. Many communities, typically in sparsely populated or economically-distressed areas lack access to infrastructure or affordable service. Additionally, broadband adoption—the proportion of citizens subscribing to internet service—is low in NC given the rate of broadband availability in the state and contributes to the widening digital divide.

This divide, new technologies, user demand,[ii] and greater reliance on internet access, necessitates ongoing infrastructure upgrades within our state.

Time for a Plan

This plan answers the charge by the North Carolina General Assembly (NCGA) [EN: Session Law 2015-241] to assess the current status of broadband availability and use across the state, analyze the best methods and means to "establish universal access," and offer strategies to achieve universal access.

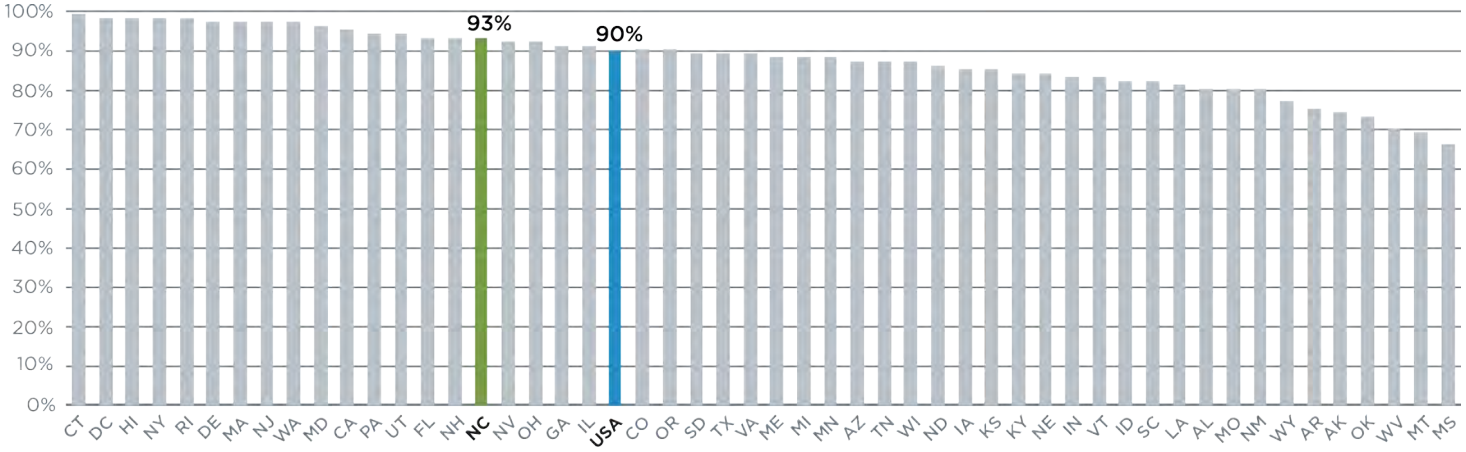
A thorough analysis of current deployment, access, and adoption was completed using available data from state and federal resources and feedback from community leaders and stakeholders. In keeping with the statutory requirement, the plan's recommendations are informed by subject matter experts, providers, state agencies, local leaders, and stakeholders representing various populations and industries (Appendices B and C).

The majority of the recommendations are state budget-neutral. The few that require funding identify a funding source, typically an established private, federal, or state loan or grant fund.

Current Status

These recommendations and the implementation strategies build upon the current state of broadband deployment and adoption. NC's broadband deployment rate (tied with FL) ranks slightly above the U.S average (93 percent) and is the highest deployment rate among southeastern states. [iii] Providers continue to invest in expanding infrastructure in NC as evidenced by NC's seven percent increase in deployment rates between 2013 and 2014.

FIGURE 1. BROADBAND DEPLOYMENT RATE COMPARED TO OTHER STATES

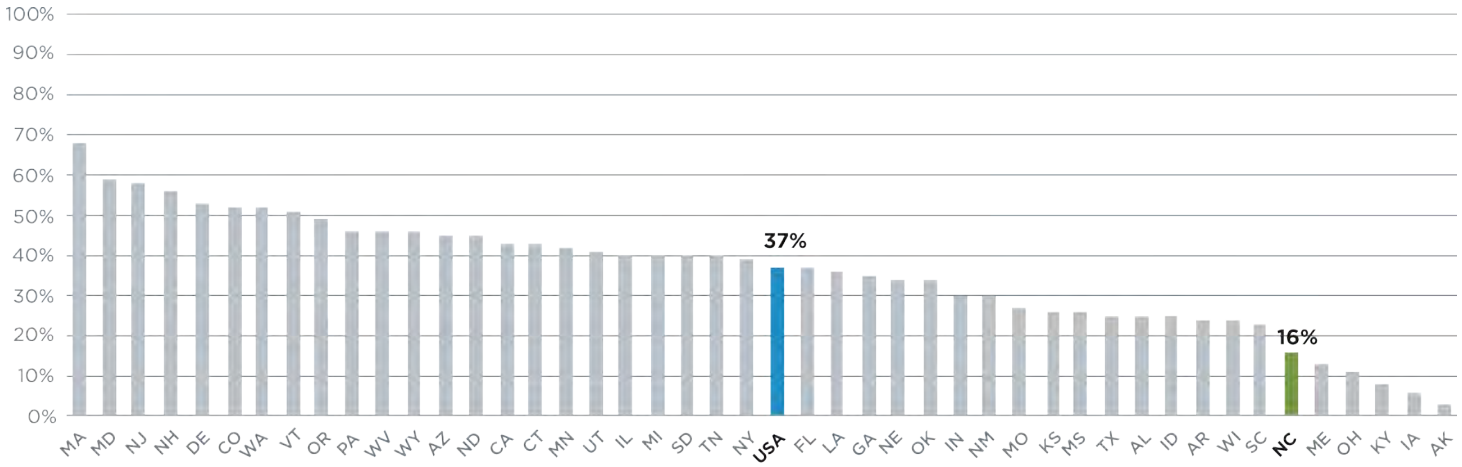


Source: FCC 2016 Broadband Progress Report, data current as of 12/3/14

The counties with low deployment rates are areas with low population density. Only one percent of the households without access are in urban areas.

However, North Carolina has one of the lowest adoption rates in the country. Even among households with access to broadband (defined at 25 Megabits per second and 3 Megabits per second upload) only 16 percent are subscribing. Adoption is particularly low among low-income households. In 2013, only 47 percent of NC households with annual incomes under $15,000 adopted broadband.[iv]

FIGURE 2: BROADBAND ADOPTION RATE COMPARED TO OTHER STATES*



**out of 45 reporting states. Source: FCC 2016 Broadband Progress Report, Data Current as of 12/14*

Because adoption is a key indicator of use, it is inextricably linked to universal access. Usage enhances consumer demand, which drives deployment and investment, and drives further innovation and economic development. Adoption rates directly affect broadband's social benefits, namely a better educated and informed citizenry.

In addition to the lack of broadband availability, there are four main barriers to broadband adoption, and they're particularly pronounced among low-income households. The primary barriers are: the cost or affordability of service; the real or perceived costs of a computer; laptop or other devices; digital literacy; and the internet's perceived relevancy in a person's daily life.

Within the broad topics of availability and adoption, the plan addresses specific issue areas and industries identified as facing significant and imminent challenges and opportunities.

The issue areas addressed in the plan include: K-12 education, economic development, telehealth, and public safety.

As the state moves to digital learning and enhances internet connectivity within schools, a large number of children cannot complete digital homework assignments. This phenomenon-called the 'homework gap'-is a significant concern among educators, community leaders, and parents and must be addressed if our children are to be prepared for the digital economy.

The state must better leverage broadband infrastructure to enhance economic development in rural areas, workforce development, and small business adoption. Using broadband technologies, the state can develop opportunities in the healthcare sector to reach a greater number of people and reduce costs. Finally, digital infrastructure must be large and secure enough to ensure the effective execution of public safety agencies' missions—to protect North Carolinians.

State Broadband Plan

State and local government leaders can impact the broadband ecosystem by encouraging competition and empowering communities to act. By updating laws and policies, and designing policies to incentivize adoption in sectors the government heavily influences, lawmakers can foster both the supply-side and the demand-side. The plan recognizes:

- Increased competition drives innovation, affordability, and the deployment of future-proof infrastructure.
- In areas where competition is lacking, empowered and engaged communities form more equitable partnerships with private sector internet service providers (ISPs). Communities can lower deployment costs by better leveraging existing infrastructure, easing access to right-of-ways and poles to facilitate path creation, and investments in next-generation infrastructure.
- Community-based adoption and utilization programs help drive demand.
- Federal, state and private loans and grants offer untapped funding for infrastructure, planning, and adoption initiatives, including subsidies for low-income households.

GOALS AND OBJECTIVES

The plan's overarching goal is for every North Carolinian to have affordable access to broadband service—wireline or wireless—if they so choose, by June 2021. The following objectives support these goals:

- Increase the percentage of households with access to fiber optic cable to 50 percent by June 2021
- Increase the percentage of households with access to broadband to 100 percent by June 2021
- Increase household adoption rates to over 60 percent by June 2021[v]

- Affordable access to the internet outside of school for 100 percent of K-12 students by June 2021
- Ensure high-speed internet access is available at all libraries by 2020 (currently just over 50 percent)
- A state-wide model for the development and deployment of local, community-based digital literacy programs

SUMMARY OF RECOMMENDATIONS

The plan's recommendations specifically support the achievement of these goals. While not interdependent, they are interrelated and build on one another.

The final recommendations were informed by subject matter experts, providers, and stakeholders. While compiling research and recommendations from stakeholders, two consistent themes emerged: 1) communities that plan and have 'skin in the game' impact deployment and affect adoption; and 2) where competition is lacking, communities will need to partner with private-sector entities and ISPs to expand affordable options.

With these themes in mind, the recommendations offer ways for state and local leaders to foster an ecosystem that supports the expansion of access and increased adoption at the community and state level. They include:

1. **Incentivize investment in next generation, future-proof infrastructure and reduce barriers to deployment.**
   - Ease access to state and municipality-owned right-of-ways, poles, and vertical assets
   - Create "Dig Once" and "One Touch" policies to reduce the number of times the rights of ways (ROWs) are disrupted, and allow the ROW owners to better manage encroachments and reduce permitting costs
   - Leverage existing federal and state loan programs for local governments
   - Create grant programs to support community-based incentives for providers and, where necessary, community-based infrastructure investment
   - Ensure building codes include broadband
   - Encourage and leverage ongoing research and development of next-generation technologies to reach non-adopters and unserved households
   - Broadband Infrastructure Office (BIO) provides ongoing technical assistance to local governments
2. **Create community-based adoption and utilization programs and initiatives:**
   - Educate low-income households and their community leaders on affordable broadband subsidies and programs
   - State Librarian/BIO should continue to lead effort to ensure high-speed, next-generation connectivity to all NC Libraries
   - Foster creation of digital literacy tools by and for local communities
   - Support and expand device delivery programs and the organizations who conduct them
3. **Close the 'homework gap' for K-12 students without access at home:**
   - Advocate for leveraging schools' digital infrastructure for use by the community as a whole
   - Leverage K-12 education system to reach children and their parents
   - Encourage creation and/or expansion of tech-based curriculum in K-12 schools
   - Expand device delivery to low-income households, especially those with K-12 students
   - Provide low-cost, mobile service solutions
4. **Facilitate integration of broadband into economic development strategies:**
   - Include broadband as an indicator in the "Certified Work Ready Community" program
   - Facilitate a state-supported campaign to brand the state (internally and externally) as a digital leader
   - Leverage existing state agency workforce development tools
   - Encourage communities to include broadband in their economic development plans
5. **Recognize and leverage the influence telehealth technologies' have on household broadband adoption and use:**
   - Improve education and marketing for federal "Health Care Connect Fund" (HCF)
   - Create best practices for healthcare providers
   - Require broadband be built into new healthcare facilities
   - Providers market low-cost options for broadband at their homes
   - Implement remote monitoring pilots
   - Provide medical reimbursements for broadband service
6. **Enhance public safety and first responder connectivity, by continuing the pursuit of a state-wide, interoperable data network and the Next-Generation 911 initiative.**

Implementation

The best laid plans remain mere ideas unless they're adopted and thoughtfully implemented. To achieve the goal of ensuring every North Carolinian has affordable access to broadband service, if they choose, by June 2021, collaborations and shared responsibility for implementation is required. Building this plan was a collective effort. The responsibility for implementing the plan will also require a team-based approach.

As the plan's author and resource-hub for broadband in the state, the Broadband Infrastructure Office (BIO) within the Department of Information Technology will monitor implementation and report on the plan's progress.

Successful implementation also relies upon strong leadership by those who directly impact the broadband ecosystem: the executive branch, the General Assembly, state agencies, non-profits, and broadband service providers.

BIO's Technical Assistance team will continue to work with NC's counties and communities using a proven process to expand and enhance access. Recognizing that a one-size-fits-all approach does not work, BIO will rely heavily upon county and municipal governments, the Councils of Governments, and community leaders to partner with BIO to tailor solutions for their communities.

Together, we can collectively ensure North Carolina benefits from all that broadband has to offer.

INTRODUCTION

The list of technologies that have universally impacted the world's people and economies is short. Few have superseded borders and overcome typical barriers to widespread change, like differing nationalities, languages, beliefs, and values: running water, electricity, the steam engine, motorized vehicles, mechanization, computers. And now the internet.

The internet intersects with and impacts nearly every facet of the modern American's life. Through it, citizens can buy and sell goods and services, engage with their governments, complete homework, earn degrees and certifications, receive healthcare services, work from home, run a business, connect with friends and family, watch movies, stream their favorite television show, catch up on current events from around the world, or visit art museums—all without leaving their home.

In more profound terms, the internet has closed an information gap for all people. Today, using a smartphone or tablet, any person can access the world's most significant research and data. It has leveled the economic, social, and cultural playing fields. Just within the last decade and a half, it has created a trillion-dollar industry and multi-billion dollar companies that have altered the trajectory of entire economies.

But the value citizens reap from broadband is directly tied to whether they have access to it, can afford to purchase a subscription, see a need for adopting the technology, or have the existing capabilities to use the technology. Without reliable and consistent access to next generation broadband speeds — the situation for over 738,306 NC households — the utility of the internet drops significantly for both the individual and their community.

And when people do not adopt high-speed broadband because they cannot afford a subscription, do not see its relevance to their daily lives, or are not digitally literate, they lose broadband's potential positive impacts.

North Carolina's leaders are committed to ensuring all North Carolinians can access this life-changing technology and that no North Carolinian is left on the wrong side of the "digital divide." To that end, Governor Pat McCrory and the State Chief Information Officer (SCIO) established the Broadband Infrastructure Office (BIO) in 2015 as a statewide resource for broadband access, first responder communications, economic development, and student connectivity initiatives.

BIO aligns NC Broadband, the statewide effort to expand high-speed internet access, with the FirstNet public safety initiative for improved resource sharing across state agencies. The centralized and streamlined office provides the opportunity to work across agencies and with willing communities to identify program and infrastructure development needs across NC.

This plan, directed by the North Carolina General Assembly (NCGA) in Session Law 2015-241, includes an assessment of the current status of broadband availability, adoption and use in NC. It considers the infrastructure needs to meet future economic, government, and individual demands. It then provides recommendations for how best to address the challenges the state faces enhancing broadband's access and impact.[vi]

STATE BROADBAND PLAN

Session Law 2015-241, Page 27, Section 7.23.(A).

The State CIO shall develop a State broadband plan that includes: (1) Information regarding the availability and functionality of broadband throughout the State and an evaluation of the current deployment of broadband service. (2) A strategy to support the affordability of broadband service as well as maximum utilization of broadband infrastructure, including potential partnerships and sources of funding to support the effort. (3) Analysis of means, methods, and best practices to establish universal broadband access across the State. In developing the State broadband plan, the State CIO shall coordinate with other State agencies in order to maximize the effectiveness and efficiency of available resources.

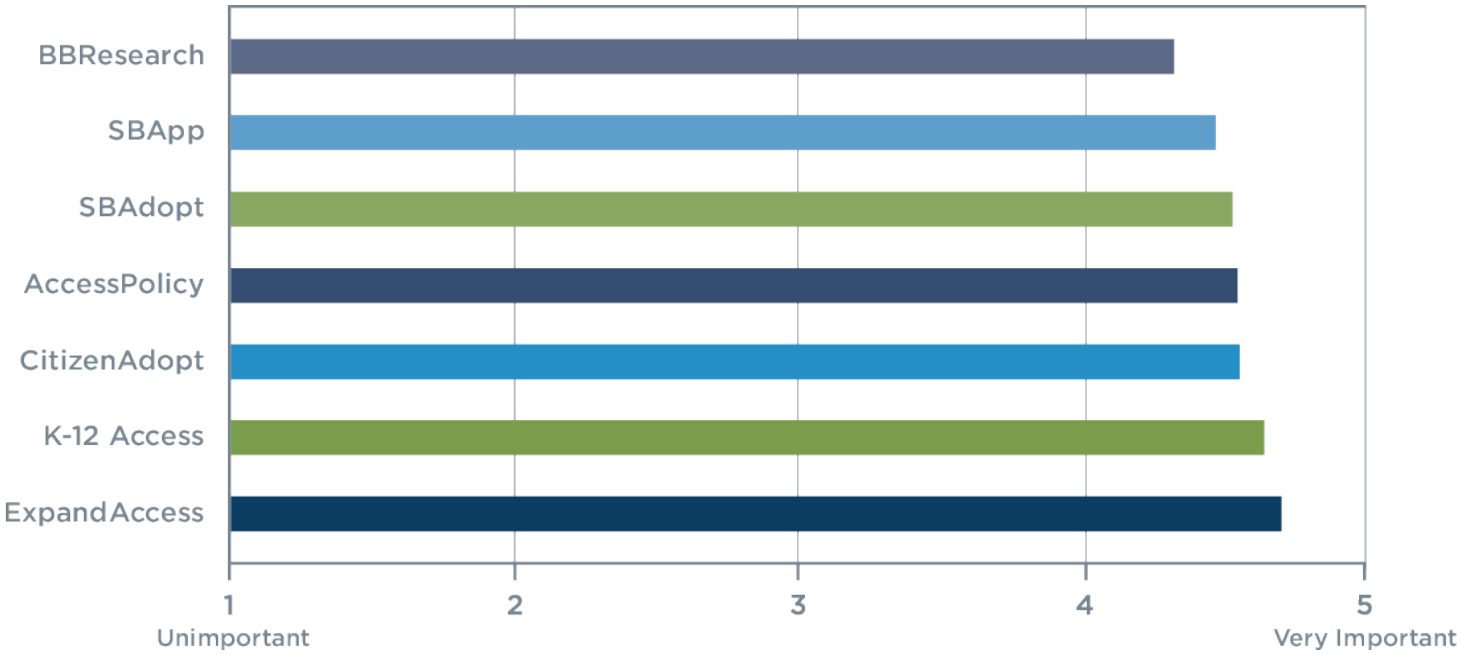
Background and Overview

All aspects of the plan were informed by subject-matter experts and stakeholders from across the state. From the identification of the challenges to the specific solutions found in this plan, BIO engaged stakeholders throughout the entire process. As such, BIO is confident the recommendations put forth in this plan are the best solutions for expanding broadband availability, adoption, and use.

To determine which challenges the plan should address, BIO first gathered data and reviewed research and academic literature on what challenges are the most prevalent barriers to improving broadband availability and adoption.

Next, BIO surveyed over 3,500 community leaders from across the state. More than 500 community leaders—including city and county managers, IT specialists, economic developers, and local elected officials—responded to the survey. The quantitative and qualitative results assisted in identifying which challenges stakeholders viewed as the most urgent and which factors should be addressed to resolve those challenges (See Appendix A for the full survey results).

FIGURE 3. BROADBAND DEPLOYMENT AND ADOPTION INITIATIVE SURVEY RESULTS



BBResearch = Conducting research on broadband in NC
SBApp = Small businesses' ability to use we-based applications
SBAdopt = Small businesses' adoption/use of broadband internet
AccessPolicy = Statewide policies that enhance broadband access
CitizenAdopt = Increasing citizens' broadband adoption and use
K-12Access = Home broadband access for K-12 Students
ExpandAccess = Expand broadband access

Respondents rated the following issues as the most important:

- Expanding broadband access, particularly for K-12 students;
- Increasing adoption and digital literacy for all citizens and businesses; and
- Developing statewide policies that enhance access.

With these priorities in mind, BIO determined the plan should address broadband's role in supporting K-12 education, increase small business's efficiency and effectiveness, ensure NC's workforce is equipped with the skills needed to excel in the 21st century, provide the opportunity for telehealth to increase its reach to unserved citizens, and support public safety activities.

To identify potential solutions, BIO hosted 10 brainstorming sessions with subject-matter experts in each subject area the plan addresses (see Appendix B for a full list of the sessions and participants). At the sessions, the participants provided recommendations, some of which were then developed more fully by the stakeholders at the meeting. In addition, BIO solicited recommendations from individual stakeholders and broadband experts through individual discussions (See Appendix C for a full list of the individual stakeholder meetings). After the meetings, BIO compiled and aggregated the recommendations. The recommendations found in this report are a result of this engagement.

During this data-gathering process, two consistent themes emerged:

1. Communities that plan and have 'skin in the game' impact deployment and affect adoption, and
2. Where competition is lacking, communities will need to partner with private-sector entities and ISPs to expand affordable options.

The plan explores these themes and others that emerged from the data-gathering process. The plan begins with an overview of broadband availability and adoption, which includes definitions, data, and a brief history of broadband expansion and adoption in NC. Next, it addresses the challenges and identifies opportunities for increasing broadband availability and adoption. The plan then focuses on broadband's intersection with the K-12 schools and their populations' households, economic development—specifically small business adoption and use and workforce development, telehealth, and public safety. The plan concludes with suggestions for implementation.

Designed by and for the many stakeholders in the state and all North Carolinians, this plan ensures NC's children, workforce, businesses, healthcare providers, and public safety organizations are equipped with the broadband infrastructure needed to succeed in the 21st century.

BROADBAND AVAILABILITY AND ADOPTION

Broadband Availability

BROADBAND AVAILABILITY STATISTICS TO KNOW

- NC ranks 9th in the nation in broadband deployment
- An estimated 93 percent of NC households have access to broadband
- 52 of NC's 100 counties have a deployment rate equal to or greater than the US average (90 percent)
- 89 percent of NC households without access live in sparsely populated areas

Broadband's benefits to communities and individuals are well-documented and researched, but before those benefits can be realized, the infrastructure to deliver high-speed Internet access must exist.

Broadband availability, sometimes referred to as deployment, has historically been measured in a variety of ways.

Most commonly, availability represents the ratio of the population with access to broadband at the speed data is transmitted or bandwidth capacity, measured in bits per second.[vii] Also referred to as deployment, it measures the basic "supply" level of broadband.

Access can also be measured by technology types. Common technologies and infrastructure used include fiber optic cable, digital subscriber line (DSL)(copper), cable modem (coaxial), satellite, fixed wireless, and mobile wireless. NC has all technology types.

At a bird's eye view, the most recent deployment data show that much of the state has access to basic broadband. However, when looking at more granular data, pockets of unserved areas in both rural and urban locations exist. Sparsely populated areas generally lack a traditional business case for private sector providers to serve them, and as the last unserved areas in the state, they are likely the hardest and most expensive areas to serve. In urban areas, a lack of demand and affordability limit deployment.

This section presents the current status of availability throughout the state, identifies factors limiting deployment in certain areas and technology types, and proposes recommendations for overcoming those challenges.

Broadband Defined

Since its inception, how broadband is defined and how the federal, state, and local governments have regulated its expansion has changed over time. It also varies from state to state. The United States Code defines broadband without reference to a speed threshold or specific technology.[viii] NC's General Statutes define broadband service, in part, as "a high-speed access capability to transmit at a rate of not less than 200 kilobits per second in either the upstream or downstream direction."[ix] In January 2015, the Federal Communication Commission (FCC) updated its recommended "availability" target speed threshold to 25 Mbps (download)/3Mbps (upload) from the previous recommended benchmark 4 Mbps (download)/1 Mbps (upload).[x]

In 2010, the FCC noted in the National Broadband Plan that a universal target threshold of 4Mbps/1Mbps is "comparable to what the typical broadband subscriber receives today."[xi] Yet merely five years later it "conclude[d] that 25 Mbps/3 Mbps continues to provide consumers with the capacity necessary to use 'advanced' services that 'enable users to originate and receive high-quality voice, data, graphics, and video telecommunications.'"[xii]

While there has been plenty of debate surrounding the speed thresholds used to define broadband and the universal availability targets, this plan will use the FCC's target speed threshold as a reference point.[xiii] It is the benchmark used by the FCC and other federal government agencies when comparing NC to the nation and to individual states.

The target also sets a goal or objective toward which the state should strive. Data trends suggest that the need and demand for faster broadband speeds are growing, and will continue to rapidly grow.

For example, in August 2000, 41.6 percent of households had adopted dial-up connections (at either 28.8 kbps or 56 kbps), but only 4.4 percent of households had a home broadband connection (then considered 200 kbps). By 2010, dial-up subscribers declined to 2.8 percent of households, whereas 68.2 percent of households were subscribed to broadband service.[xiv] From 2001 to 2014, US households with internet access increased from 50.6 percent to 75.8 percent.[xv]

According to the Cisco Visual Networking Index: Forecast and Methodology, 2014–2019 "[g]lobal Internet Protocol (IP) traffic has increased more than fivefold in the past 5 years, and will increase nearly threefold over the next five years. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 23 percent from 2014 to 2019. Broadband speeds will double by 2019. By 2019, global fixed broadband speeds will reach 43 Mbps, up from 20 Mbps in 2014."[xvi]

Technology Types

Various technology types can transmit data at the FCC target speed threshold.

Much of the state's broadband infrastructure was deployed to expand telephone and TV cable services alone. At the time, using this infrastructure to deliver high-speed internet access was not contemplated. Much of this infrastructure was retro-fitted for internet connectivity. Technological advances continue to allow DSL and coaxial cable to increase bandwidth capacity.

Over the past decade, several telecommunications and cable companies began deploying fiber-optic cable to the home or premises (FTTP). Most have already built-out their middle-mile networks using fiber. Considered "future-proof," fiber transmits data using light along fibers

no bigger in diameter than a human hair at hundreds or thousands of Mbps (1,000 kbps). It has few limitations in transmitting large amounts of data at the speed of light.

NC's larger providers continue to make upgrades to their networks. AT&T, Time Warner Cable, Charter Cable, Frontier, and CenturyLink together provide access to 25 Mbps download to a majority of households in the state over copper or coaxial cables. Technologies such as DOCSIS 3 have enabled cable companies to increase data speeds over DSL to 50-105 Mbps.[xvii] Fiber-to-the-node (FTTN) or neighborhood increases speeds to premises or homes connected by cable.

AT&T, the telephone cooperatives, regional providers such as RiverStreet, Country Cable, NorthState, Balsam West, Broadplex, GoogleFiber, and municipal providers like Greenlight (Wilson) and Fibrant (Salisbury) have built or have announced plans to build FTTP networks. These networks can offer various high-speed connections up to 1 Gbps (Giga-bit per second).

Both fixed and mobile wireless internet service providers (WISPs) continue to invest in upgrades to achieve greater transmission speeds. Typically, fixed wireless—directing a radio signal from a vertical location directly to the home or premises—can deliver speeds up to 1 Gbps depending on the configuration and equipment. Many areas in the western and central parts of the state use fixed wireless options for last mile service[xviii] through providers such as SkyRunner, SkyTec, and SkyFi. Less than 50 percent of the state has access to a fixed wireless service (see Appendix D).

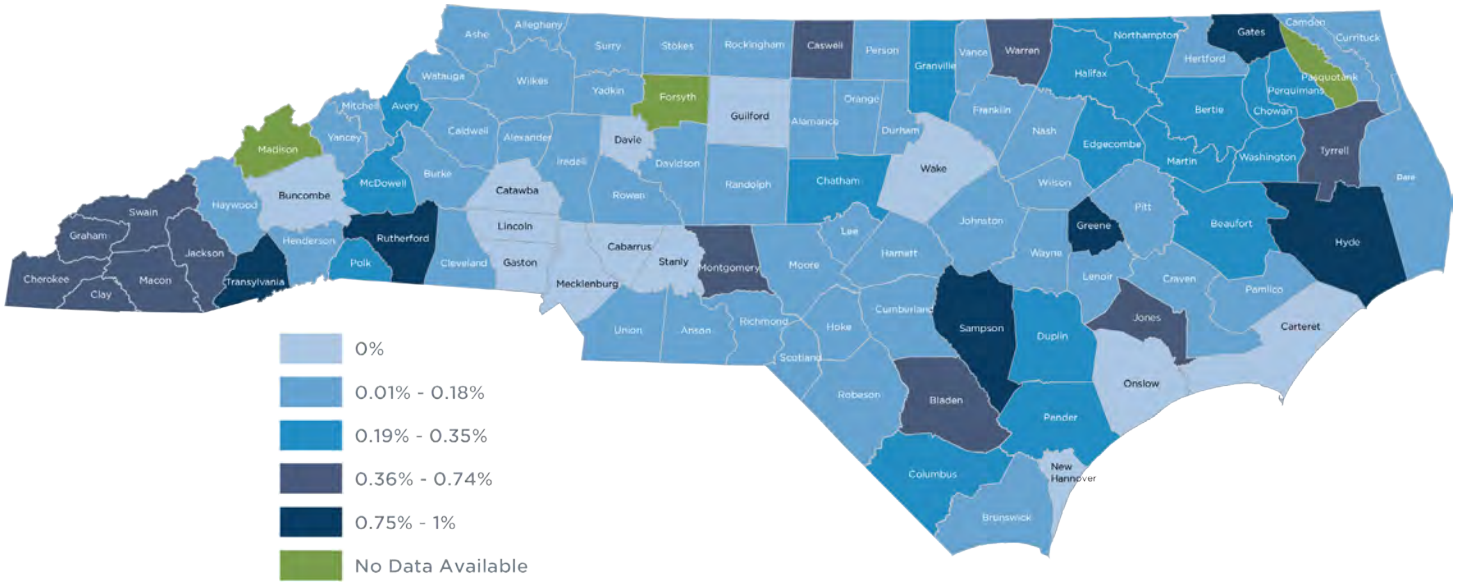
The major national wireless companies including Verizon, AT&T, Sprint, US Cellular, T-Mobile, and others provide wireless service in NC. Data speeds and caps vary, but mobile wireless is capable of delivering speeds comparable to DSL and cable modem. The FCC estimates that mobile wireless covers approximately 98 percent of the state's households.[xix]

Satellite is another form of wireless service used most often in remote areas where wireline options are unavailable or unaffordable. Download and upload speeds are typically slower than DSL or cable modem and can reach 500 kbps depending on the line of sight to the satellite and weather.

Current Status

The FCC reports that 93 percent of NC's population has access to the internet at the FCC threshold speeds of 25 Mbps download/3 Mbps upload.[xx] Only one percent of those without access live in urban locations while 89 percent of those without access—nearly 640,000 people—live in sparsely populated areas.[xxi]

FIGURE 4. PERCENTAGE OF POPULATION WITHOUT BROADBAND ACCESS BY COUNTY

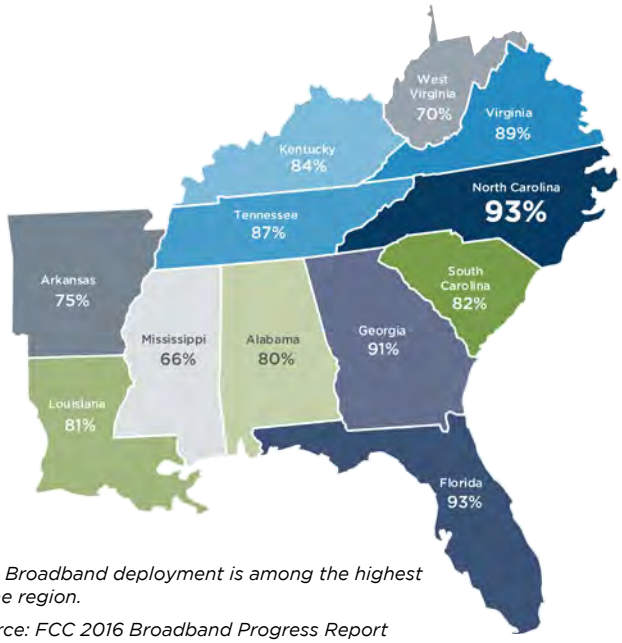


Source: FCC 2016 Broadband Progress Report, data current as of December 31, 2014

In addition, 99 percent—8,910 people—in NC's tribal lands lack broadband access at the FCC threshold.[xxii]

NC's broadband deployment rate ranks ninth in the nation, slightly above the US average. Among Southeastern states, it ranks first, tied with Florida (see Figure 5).

FIGURE 5. NORTH CAROLINA: A LEADER IN SOUTHEAST ON BROADBAND INFRASTRUCTURE AND CONNECTIVITY



93% Broadband deployment is among the highest in the region.

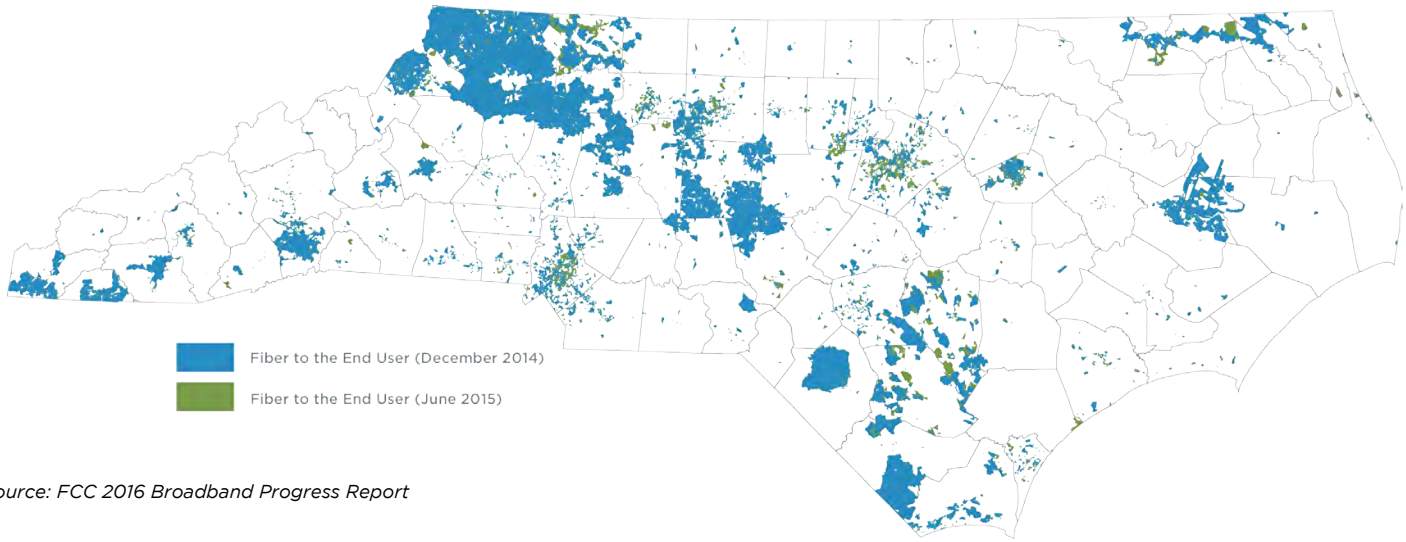
Source: FCC 2016 Broadband Progress Report

Within NC, 52 of the 100 counties have a household broadband deployment rate equal to or above the US average of 90 percent.[xxiii]

Most people access the internet over DSL or cable. The proliferation of DSL was aided by federal or state telecommunications laws and regulations, and cable by local cable television franchise agreements. While the coverage is pervasive, this infrastructure was not originally intended for current internet usage and applications. New and increased data demands have exposed problems with latency, reliability, and bandwidth. New technologies, such as DOCSIS 3.1, promise to increase DSL bandwidth. Without these technologies or network upgrades using fiber-optic cable within the next three to five years, many regions of the state will not be able to support the needs of businesses and individuals.

While FTTP deployment has nearly tripled since 2013, according to the North Carolina Department of Commerce's (NCDOC) 2013 Innovation Index, to 10 percent from 3.9 percent, NC's rank, 37th, remains lower than all peer states. Updated and current information suggests that deployment rates for FTTP are well above 10 percent, but significantly less than the US average—24.96 percent.[xxiv]

FIGURE 6. FIBER TO THE HOME PROGRESSION MAP, 2014-2015



Source: FCC 2016 Broadband Progress Report

When examining speeds and capacity available through these "last-mile" deployments (connections to the end user), as well as potential solutions to serve the unserved areas in the state, it is critical to note that NC has significant "middle-mile" assets. These provide the backbone for last-mile networks and create the ability for higher capacity and speeds around the state. While standard metrics for middle-mile are difficult to obtain, provider reports, infrastructure assessments, and other tools show the state has significant middle-mile assets.

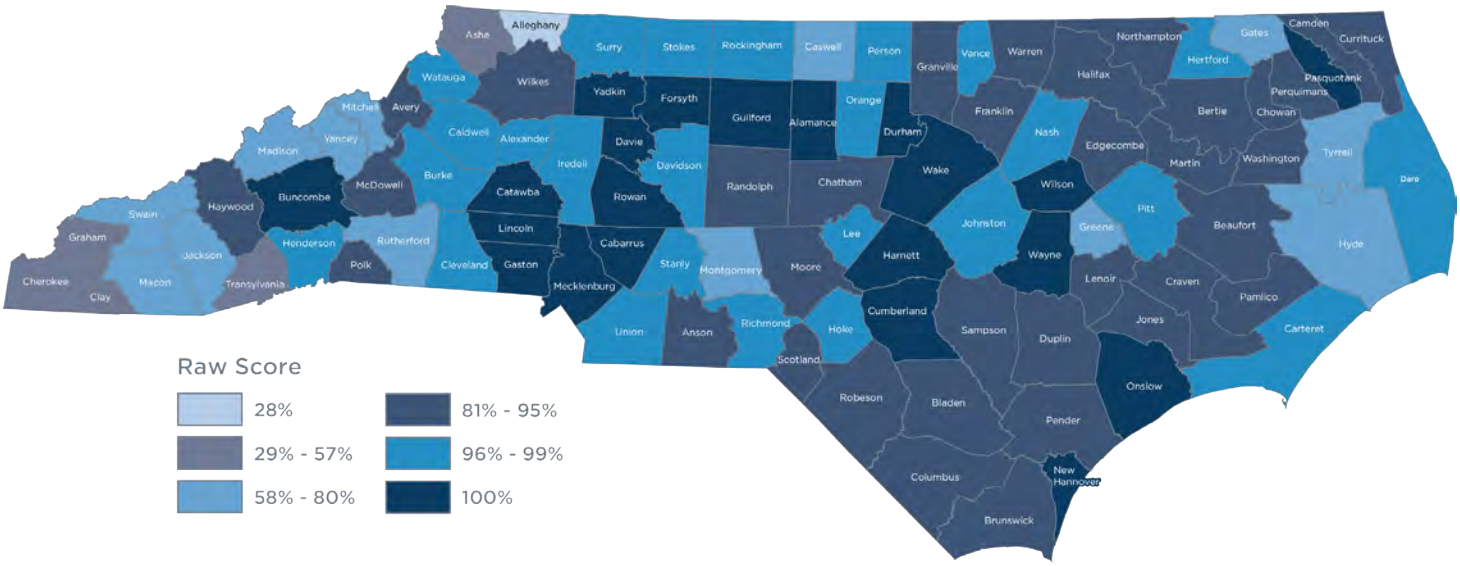
In addition, NC possesses the highest recorded inventory of open access middle-mile dark fiber assets of any state. Built and operated by the nonprofit, MCNC, the dark fiber strands are in a 2,600-mile contiguous build that touches 82 of the state's 100 counties (see Appendix E for visual). Forty-eight to 96 strands of fiber are available to broadband service providers to serve consumers and businesses in all areas of the state and for enterprises across all vertical markets (financial services, technology, healthcare, biotech, transportation, logistics, etc.) to build their own enterprise networks. Dark fiber shares the conduit with a lit fiber optic backbone that serves the broadband needs of all K–20 public education institutions, most K–20 private education institutions, and select research institutes, nonprofit healthcare providers, public safety, and other anchor institutions.

The significance of these assets must be considered when looking at opportunities for expanding deployment. Other similar entities like ERC in the western part of the state provide fiber optic middle-mile infrastructure for non-profit, educational, and commercial entities.

Gaps in Coverage

As previously mentioned, the most recent data provided by ISPs show approximately seven percent of North Carolinians do not have access at bandwidth speeds the FCC determines is adequate.[xxv] This number is likely much higher.

FIGURE 7. BIO'S BROADBAND AVAILABILITY INDEX AT 25 MBPS DOWNLOAD SPEEDS

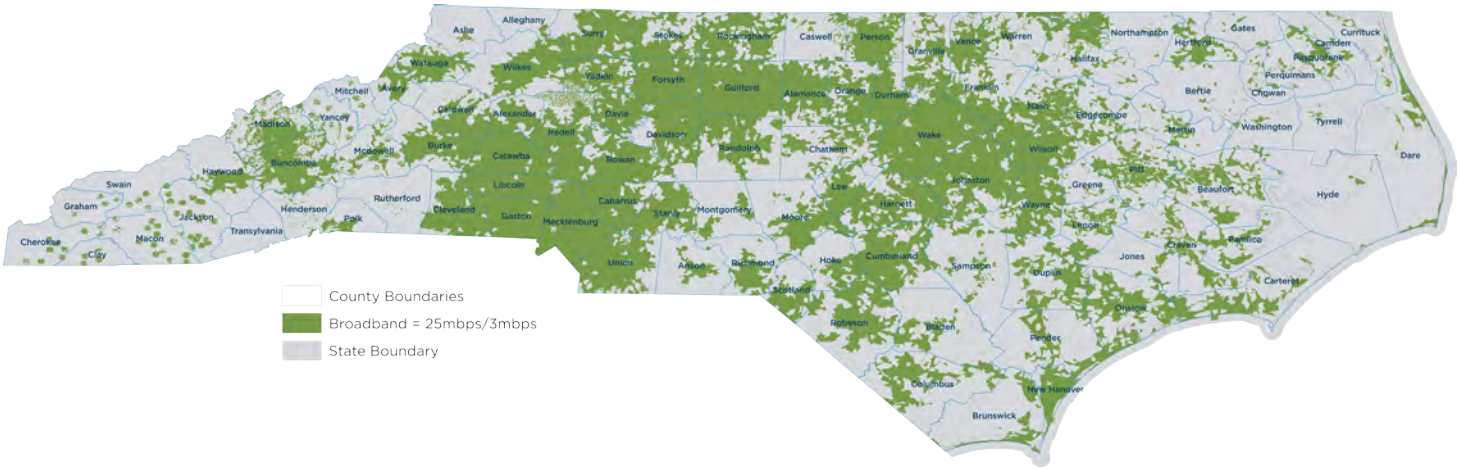


The lighter shades of blue seen in Figure 7 show where significant gaps exist in the state. Not surprisingly, these areas represent some of the state's most economically distressed regions. Counties struggling with economic development, high unemployment, and aging populations correlate strongly with those with insufficient broadband infrastructure.

The issue is not strictly a rural one. It also persists where the population density or income levels are low.[xxvi] Even in urban areas, or sparsely populated areas within proximity to population hubs, gaps in access exist.

In fact, there are many sparsely populated counties and areas in the state that boast next-generation, high-speed internet access. Figure 8[xxvii] shows where residents in small towns and cities have access to fast internet service at affordable or competitive prices.

FIGURE 8. BROADBAND AVAILABILITY AT 25 MBPS DOWNLOAD SPEEDS



Thus, any analysis of coverage gaps must be precise. Inventory assessments at the community or county level must involve on-the-ground inspection. Surveys and qualitative data should be coupled with inventory assessments and the FCC's availability data from for a comprehensive understanding of the status of availability at the local level.

Barriers to Deployment

The two major barriers to broadband deployment in NC are the costs of construction (CAPX) and population density.

Wireline broadband is delivered by placing cables and supporting infrastructure (conduit) underground or above ground by attaching to poles.

Underground deployment requires digging a trench or boring through the soil to create a pathway for the wires. The cost of these methods varies depending on what lies beneath the surface. Boring through granite, prevalent in the western part of the state, is costlier than boring through clay, prevalent in the Piedmont, and substantially costlier than digging or boring through sand prevalent in eastern NC.

Providers and contractors estimate trenching or boring costs can vary from $20,000 to $50,000 per mile or higher. These expenditures can account for 60 to 90 percent of a project's budget.[xxviii] The conduit, cable, and/or fiber generally comprise a small percentage of the deployment costs.[xxix]

Attaching to poles—typically owned by telephone and electric companies or municipalities—can cost anywhere from $1,500 to $10,000 depending on several factors. Pole owners typically charge an attachment fee anywhere between $0 and $160 per pole. Providers are also responsible for the "make-ready work"—the cost to properly prepare the pole. These costs include labor, equipment and moving existing infrastructure on the poles. Make-ready work fees vary widely depending on the pole owner and location.

Other costs associated with deployment include right-of-way (ROW) access fees, permitting fees, and other equipment used to operate the network. Because the North Carolina Department of Transportation (NCDOT) owns or manages approximately 80 percent of the roadways and corresponding ROWs in the state, they've permitted utility, cable and telecommunications companies to use these ROWs to deploy without fees for access or permits. This has reduced providers' CAPX and eased deployment throughout the state.

The CAPX costs greatly influence the business case for deployment in sparsely populated locations. In other words, the significant investment it takes to deploy is not offset by customer volume.

For larger providers, the return on investment (ROI) for infrastructure deployment or upgrades drives the business case for deployment to a location, area, or region. Shareholders of the publicly-traded providers expect to realize an ROI shortly after investments occur. Other providers, such as cooperatives or privately-owned companies, can endure a much longer investment to a ROI timeline—up to 20 years for some.

Even in areas where a business case exists, the market may be saturated by one or two providers. The population density in those areas may create a viable market for a limited number of providers, discouraging new entrants. Sparsely populated areas faced these same issues in the early part of the last century with electricity and telephone services. Cooperatives filled that gap and continue to do so. Telephone cooperatives have been successful in offering high-speed internet access to their owner-customers in many sparsely populated areas throughout the state.

S.L. 2011

The municipal broadband bill, or the "level playing field bill," was enacted in 2011.[xxx] In BIO's 2015 survey, a majority of stakeholders identified H129 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.

Although the law does not prohibit municipally-operated service, opponents stated its provisions are onerous and effectively prohibit municipalities from providing this service. Most significantly, opponents claim the current law removes the negotiating leverage with ISPs communities once had.

While certain cities around the country, including Wilson, are successful in providing affordable service to the public, studies suggest this model does not work for most municipalities.[xxxi] Based on research[xxxii] and interviews with subject matter experts, this plan focuses on fostering and developing low-risk, high-reward models of deployment and service. These models are based on public-private partnerships of one variety or another that incentivize providers to expand or enhance service.

Specifically, these models include municipally-owned infrastructure, such as conduit, paid for and leased to providers who cite high construction costs as a barrier to deployment. Municipalities already participate in civil engineering tasks and many own or control right-of-ways and poles. Leveraging these assets could allow them to provide the basic infrastructure while leaving the running of a business—broadband service—to the private sector.

Survey respondents did comment that since enactment, the number of locally-organized initiatives to expand and enhance service has decreased, in part, because communities are unclear what the law allows. As a result, many public entities have refrained from all initiatives involving broadband.

Towers

Unsurprisingly, cost and location are the two primary barriers to constructing infrastructure supporting wireless broadband. The cost of towers, which can require $100,000 or more to build, is a major impediment for new entrants. Additional costs include leasing or purchasing the land for the tower, electricity to the tower and associated fees, and the connection to a fiber backhaul.

Many communities discourage tower construction due to their appearance. Some even charge high permitting or leasing fees to ameliorate the nuisance.

In 2013, the NCGA passed the Cell Tower Deployment Act[xxxiii] to streamline the permitting process for the placement of wireless infrastructure. Some criticized the measure for usurping county and municipal authorities.[xxxiv] Providers, however, praised the measure for removing regulatory barriers by creating a more uniform, predictable process. Data on the bill's impact on deployment is not available. Therefore, further research is needed to fully understand this act's effect.

Broadband Availability Recommendations

RECOMMENDATION 1: Lower barriers to Broadband deployment.

AV1.1 Lower barriers to access local infrastructure.

- The League of Municipalities and the Association of County Commissioners, in cooperation with BIO, should create a set of best practices and checklists for their members to ensure consistency, certainty and adherence to a process for the review and approval of permits or other required documents. This should include timelines and deadlines for both municipalities and ISPs for application review, processing and access.
- The checklist should include which assets providers consider—vertical assets such as water towers, instructions on how to engage providers, and issues to consider for negotiating access agreements. These include exchanging access to assets and infrastructure in exchange for reduced service costs or increasing bandwidth.
- These should simplify permitting applications and consider on-line portals and applications to increase efficiency and reduce paperwork
- This initiative should create a time-limited task force or joint committee to explore whether permitting for rights-of-ways and easements should be further streamlined through legislation. This task force should explore how other states have streamlined permitting and access agreements, and it should look at amounts local governments are charging providers for permitting or access fees and taxes.

AV1.2 The state and local governments should better leverage existing federal, state and philanthropic foundation grants to help fund deployment.

- BIO should lead outreach to communities to educate and inform leaders about the federal and state funding sources available for broadband infrastructure and initiatives.
- The state houses numerous private foundations that generously support programs that improve local communities and the state as a whole. Many of these foundations have charters to support specific initiatives like healthcare, economic development, and education. Each of these initiatives is, or can be, positively impacted by broadband access. BIO should collaborate with these entities to identify funding opportunities.
- BIO should have a dedicated staff member to educate local communities through the League, NCACC, the COGs, the county commissioner and the NC Grantmakers Association about available and relevant grants. These groups should provide assistance to local communities or counties with identifying grant programs and with grant writing.

AV1.3 Incent providers to lay dark fiber strands.

- During deployments, providers and other entities relying on fiber-optic networks—NCDOT and municipalities—should maximize the number of stands deployed. The relative cost of the fiber is minimal compared to the cost of trenching, boring or attaching to poles. Thus, laying additional dark fiber strands while the ground is open would prevent decrease future expenses. Capacity will be a concern in the foreseeable future, and there will always be a need for backhaul for high-speed wireless networks.

AV1.4 Revise county infrastructure ownership regulations.

- Counties currently build and deploy various infrastructure, such as water and sewer, on which their citizens rely. These enterprise activities are specifically authorized by the General Statutes. Infrastructure supporting broadband deployment, like conduit, is not. The NCGA should amend the General Statutes to allow counties to invest in or directly fund deployment of infrastructure with the goal of partnering with private providers for Internet service. Specifically, the GA should:
  - Amend G.S. 153A-274 to define 'broadband and digital infrastructure' as an authorized "public enterprise." It should authorize the county to lease or allow commercial use of that infrastructure. Additional language in the provision should specify which infrastructure qualifies and excludes the county from engaging in providing Internet services. This will also allow the counties

to use the authority granted in § 160A-17.1—grants from other governments, to use grants for broadband infrastructure, as explained below.

- Amend § 153A-349.60, authorization to provide grants, to provide consistency with the changes proposed above. Currently, this provision only allows counties to provide grants to providers using "unrestricted general fund revenue." Most counties, particularly disadvantage counties, do not have the budget to use these funds for broadband incentive grants.

AV1.5 Design and implement a Dig Once Policy.

- Dig Once Policies at the federal and state level vary in process and form, but all aim to leverage the opportunity to lay conduit and/or cables during road building or expansion projects. In addition to lowering capital expenditures, it allows NCDOT better management of the ROWs by reducing the number of intrusions and by determining appropriate pathways. One policy will create uniformity across all regional divisions. The Federal Highway Administration encourages these policies and other states have adopted them with successful results. The Executive Branch should create a policy that provides ISPs with one of several options:
  - NCDOT installs multiple or segmented conduit during projects and enters into a "cost-basis lease" agreement for use by ISPs. NCDOT should consider bartering or exchange the use of the conduit for the installation or use of fiber-optic cables for their traffic signaling and Smart Transportation initiatives.
  - Notify providers of new road projects eligible for ISP facility installation when the project is announced and include standards, locations, and estimated costs. BIO could provide notifications to all ISPs quarterly. NCDOT should hold bi-annual meetings with ISPs to review new projects and work through anticipated issues.
- BIO should work with the League of Municipalities (NCLM) and the North Carolina Association of County Commissioners (NCACC) to create unified standards and best practices for local governments to incent providers to lay dark fiber or conduit when expanding roads—a dig once policy should apply at the local level when relevant.
- BIO, in cooperation with NCDOT, should create a database for use by ISPs and communities that include information on broadband-related projects occurring throughout the state, road projects, and major state infrastructure projects in locations where gaps in availability or access exist. This will help focus planning and capital where it is needed most.

AV1.6 Railroad Crossing Policy.

- Providers uniformly stated that deploying cables or fiber across railroad tracks is one of the biggest expenses they encounter and one of the most administratively exhausting. One anecdote ended with the provider deciding not to serve a particular neighborhood. BIO, NCDOT and the NCGA should engage railroads to develop standards and guidelines for access ROWs and for crossing railroads. These should contemplate reasonable costs for traversing areas owned by railroads. A uniform set of protocols should be agreed upon and followed when a provider makes a request. If a voluntary agreement cannot be reached, the NCGA should enact legislation similar to the statutory rights of providers to access privately owned utility poles.

AV1.7 Design and implement a One Touch/Climb Once Policy for pole attachments.

- Federal and state laws grant rights of access to poles. However, the negotiation process and expense continue to hinder deployment. The NCGA should lead a task force to explore the adoption, or codification if necessary, of a 'one touch' or a 'climb once' policy.
- Like 'dig once' there are variations of the form and content currently used, but the objective is to reduce the make-ready work for each pole to one action. Typically, when a new provider accesses a pole it must wait until the other inhabitants of the pole move their lines first. This results in multiple companies accessing the pole.
- A 'one touch' policy would allow prospective attachers to use independent, utility or owner approved certified contractors to perform all make-ready work under the joint direction and supervision of the pole owner. This promotes safety and limits disruptions to the ROW, typically a road. This policy should also address the need to develop an affordable, state-wide range for attachment fees and make-ready work costs.

Case Study 1

Gigabit Service in Yancey County

Yancey County, located in Northeastern NC, has a population of almost 18,000 residents, hosts three large industrial manufacturers, and supports tourism around Mount Mitchell. However, most tourists and residents could not consistently access broadband in the county due to poor availability. The county found that 64% of people surveyed were unable to receive service and only 10.5% were able to stream videos.

The county formed a public-private partnership with Country Cablevision, a local provider, applied for, and secured a federal grant from USDA's Rural Utilities Service. The grant funded a $25.3 million fiber-to-the-home broadband project in Yancey and neighboring Mitchell County.

Now completed, the network can deliver service at speeds from 25 mbps to 1 gigabit upload and download to every household in the county. The economic and social benefits the county is now experiencing is staggering. As a result of deployment, the county is attracting telecommuters and "lifestyle entrepreneurs" who relocate to the area because they prefer to live in the natural beauty of the western NC mountains. In addition, the county's three large industrial manufacturers have improved productivity, efficiency and, increased employment. Finally, the local community college, Mayland Community College, opened the "Anspach Advanced Manufacturing School" which utilizes the new connectivity to operate an advanced prototype operation, in addition to teaching advanced mechatronics and robotics techniques.

RECOMMENDATION 2: Assistance to Communities, Counties and Regions to Support Public-Private Partnerships

AV2.1 Expand the definition of those who get reimbursed for road move costs.

- Utilities and ISPs bear the cost of moving their facilities during road construction. NCDOT does not charge these entities for access to the ROW. However, NCDOT and ISPs should explore with USDOT the use of federal funds to offset these costs, which will provide the ISPs with capital to expand or improve their facilities.

AV2.2 Implement pilots like partnering with Army Reserve to lay fiber.

- Local communities working with ISPs should leverage low-cost or voluntary resources to perform trenching or boring. The Army Reserve has partnered with communities in the Appalachian Region to dig trenches and perform other manual tasks associated with deployment.

AV2.3 Design and implement a grant program for local governments.

- The state provide and administer a grant program to help communities with path creation and infrastructure investments to offset or reduce CAPX costs. Past grant programs, such as the "Broadband Supply-side Grant," offered by the state to incent deployment were part of the mix of programs that have positioned the state as one of the most connected in the nation.
- A low-dollar grant could provide communities with resources they currently lack: grant writing, planning, or inventory assessments. These activities empower communities to develop equal partnerships with, and incent, ISPs that cannot justify a business case to deploy or upgrade network facilities. Any state grant or incentive program should be technology neutral, but should require the ISPs to have the capability to scale to a specific speed threshold.
- Existing grant programs like the Community Development Block Grant program provided by the US Department of Housing and Urban Development and administered by the NC DOC and DEQ can serve as examples for designing this grant.

AV2.4 Design and implement a loan program for local governments.

- An alternative, or in addition to grant programs, the state should explore creating a dedicated fund to offer low-interest loan guarantees to communities looking for capital assistance using existing available state funds. The federal government and other state models, such as the NC DOC's and DEQ's "CDBG Revolving Loan Fund", could serve as an example when designing the fund and identifying its funding source.

AV2.5 Update state building codes so buildings are broadband-capable.

- The NCGA, through an existing committee or a joint committee, should study the building codes and determine best options for ensuring all new or renovated state-owned or state-funded properties allow for access points to facilitate fiber-optic and wireless equipment. The code should encourage building design and materials facilitate wireless penetration.

Case Study 2

NCNGN

Home to several major research universities and tech companies, the Triangle region has fostered a culture of innovation. Regional leaders have long understood that broadband access is essential for fostering this culture and maintaining a competitive edge.

This understanding prompted the local governments, universities, and chambers of commerce's in Cary, Chapel Hill, Carrboro, Durham, Raleigh, and Winston-Salem to form a regional partnership, North Carolina Next Generation Network (NCNGN), to address this need. The group focused on aggregating demand among its citizens and leveraging existing infrastructure and resources. The goal was to incentivize private ISPs to offer affordable high-speed internet service throughout these communities.

NCNGN worked through the Triangle J Council of Governments to issue a Request for Proposals (RFP) to create a competitive bidding process. AT&T was awarded the contract to substantially expand fiber to the home (FTTH) services in the NCNGN communities. As a result of this regional public-private effort, the FTTH expansion throughout each of these communities is ongoing and will be finalized by the end of 2016.

RECOMMENDATION 3: Leverage ongoing research and development of next-generation technologies to reach non-adopters and last-mile deployment.

AV3.1 Create a small grant program

- The grant program would have few restrictions and would allow the state to partner with next-generation technology companies to create pilots and test solutions. This could include partnerships with other state agencies and their offices, non-profits, grant-makers and for-profit companies such as (but not limited to) NC DOC, DPS, DPI and the NC DOC's Office of Science, Technology and Innovation, GoldenLEAF, and NC-based companies.
- The grant program would fund research to leverage technologies to expand access such as non-terrestrial technologies, small-cell technologies, and white space. It could also fund pilots for testing residential pointed (pointed directly at households) mobile access.

Broadband Adoption

Broadband internet improves social and economic well-being through ***adoption***–the percentage of the population that subscribes to broadband service.[xxxv] Research demonstrates that individuals who adopt broadband are more likely to find jobs, learn new skills, and successfully navigate social services than those who do not.[xxxvi] In recent decades, a wide range of organizations have shifted their services online including educational institutions, businesses, and government agencies. The reason for this shift is clear. Online services reduce organizations' costs and increase their efficiency.[xxxvii] Importantly, the benefits of broadband adoption are not limited to organizations, but also extend to individuals. Improving adoption rates is, therefore, a key strategy for social and economic growth.

The state's role in improving adoption should be fostering an ecosystem where adopting broadband is as easy as possible for all North Carolinians. Without adoption, broadband access cannot be used to improve local economies, enhance education, or streamline access to government services. For example, if a citizen does not have internet access they cannot renew their drivers license or apply for a job online from their home. And since adoption is a determinant of availability, broadband availability will not increase without increased levels of adoption.

BROADBAND ADOPTION STATISTICS TO KNOW

- NC ranks 40th among other states in broadband adoption rates
- 16 percent of NC households subscribed to broadband in their homes in 2014
- 33 percent of non-adopters (nationwide) cite subscription costs as the primary reason for not adopting broadband in their homes

Broadband Adoption Rates

Broadband adoption is typically measured by the percentage of households that subscribe to home broadband service.[xxxviii] Nationally, broadband adoption rates decreased by three percentage points between 2013 and 2015 according to a 2015 report from the Pew Research Center.[xxxix]

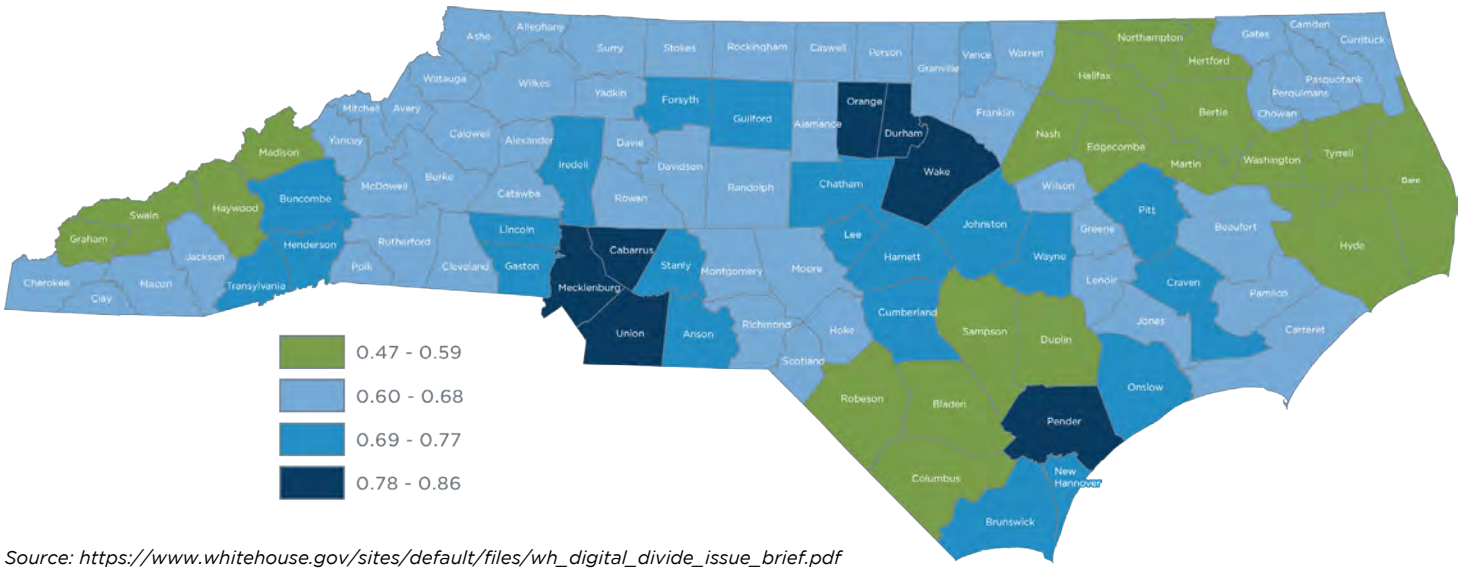
In NC, adoption rates at the FCC recommended speed threshold increased six percent between 2013 and 2014 (from 10 to 16 percent). But when compared to the rest of the nation, NC's adoption rate remains embarrassingly low.

As of December 2014, only 16 percent of North Carolinians adopted broadband in their homes compared to the national average of 37 percent at the recommended speed threshold (25 Mbps download/3 Mbps upload).[xl] At this adoption rate, NC ranked 40th out of the 45 reporting states.[xli]

As such, identifying the barriers to adoption and how to best overcome them is an issue nationwide.

Figure 9 displays NC's county-level adoption rates based on self-reported data from the *2013 American Community Survey*.[xlii] Adoption rates are highest in densely populated areas, such as Wake and Mecklenburg counties, and lowest in sparsely populated areas, such as Graham and Hyde counties. In fact, adoption rates in the most densely populated counties are more than 32 percent higher than in the most sparsely populated counties. This disparity is partly due to differences in broadband availability. As discussed in the next section, however, there are a variety of factors that impact adoption.

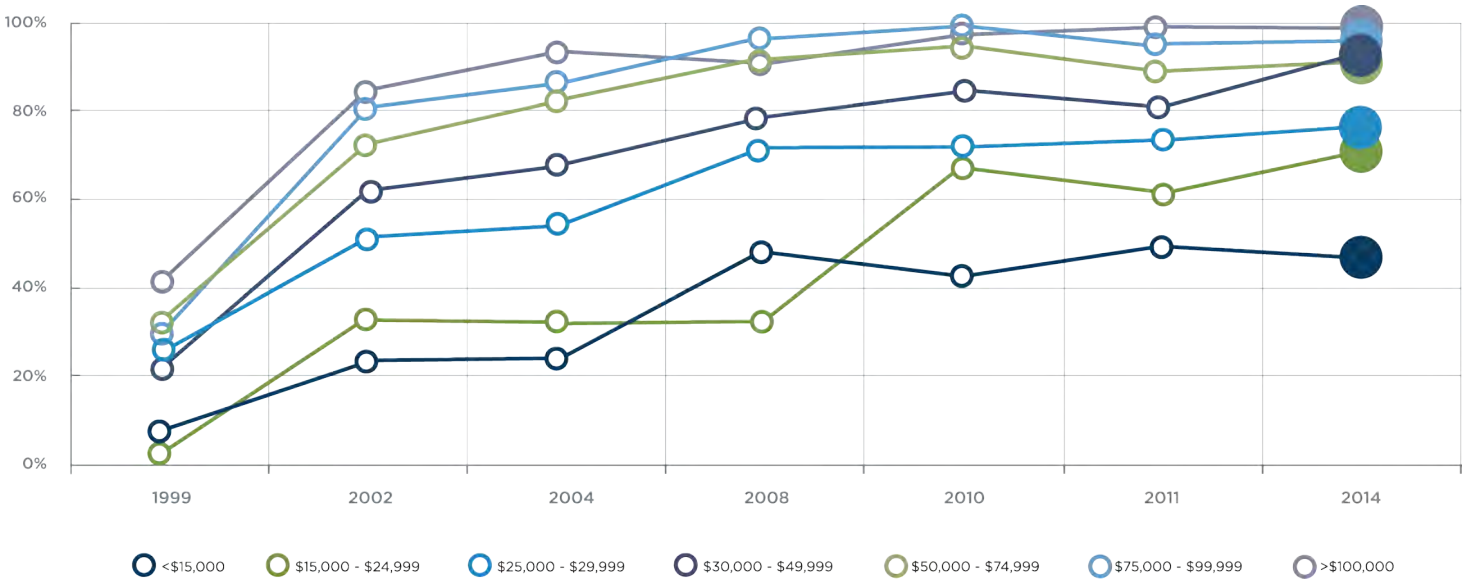
FIGURE 9. COUNTY-LEVEL ADOPTION RATES



Source: https://www.whitehouse.gov/sites/default/files/wh_digital_divide_issue_brief.pdf

Individuals with lower levels of education, income, and who are elderly or disabled are less likely to adopt broadband.[xliii] Research demonstrates that disparities by education and income are consistently larger than those observed by any other factor, including population density. The *2013 Citizens Survey* found that individuals with a graduate degree (97 percent) and who made ≥ $100,000 per year (99 percent) were more than twice as likely to adopt broadband than those with less than a high school degree (40 percent) and who made ≤ $15,000 per year (47 percent).[xliv] This suggests that even in areas where broadband is readily available, individuals with lower levels of education and income are choosing not to adopt.

FIGURE 10. NORTH CAROLINA BROADBAND ADOPTION RATES* BY INCOME, 1999-2014



** Rates represent adoption rates at all broadband speeds, not FCC threshold. Source: 2013 Citizen's Survey*

Research demonstrates some populations, particularly low-income and minority populations, may be replacing fixed broadband subscriptions with mobile broadband subscriptions. Further research is needed, but this initial data is troubling because of mobile devices and subscriptions' inherent limitations. While citizens can use smartphones to navigate the web, certain tasks, like completing homework, applying for a job, or renewing one's driver license are not easily achieved via smartphones (see Appendix F for more information).

Barriers to Broadband Adoption

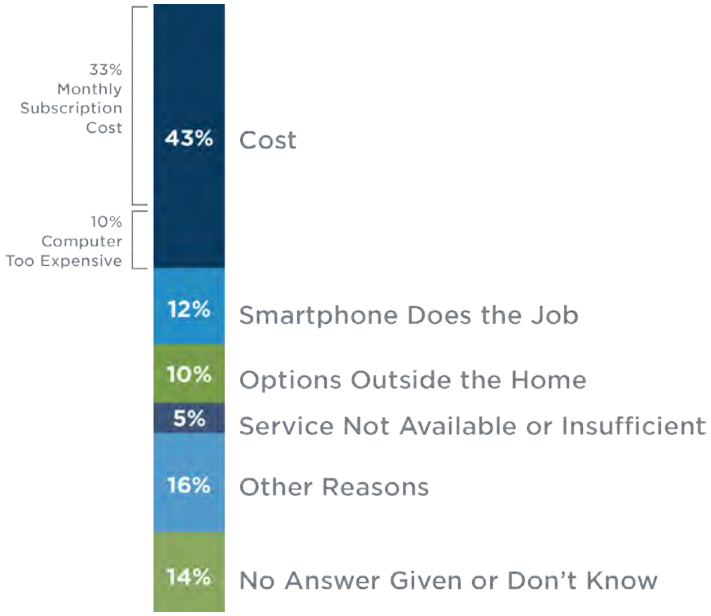
Broadband coverage is a key determinant of adoption. Individuals can only adopt broadband in areas where it is available, which tend to be areas that are densely populated because of the higher ROI for providers found in more populated areas. It is not surprising, therefore, that adoption rates are higher in densely-populated areas than sparsely-populated areas of the state (Figure 10). However, broadband coverage is not the only factor that limits adoption. Subscription costs, relevancy, and digital literacy restrict adoption rates even in areas with sufficient broadband coverage.

Subscription costs are one of the main barriers to adoption. In 2015, The Pew Research Center found that subscription costs are the primary barrier to adoption for 33 percent of non-adopting households nationwide.[xlv] This is especially true among low-income households. As mentioned earlier, NC's high-income households are more than twice as likely to adopt broadband than low-income households.

Recently, NC Broadband conducted a rigorous experimental study to examine how altering subscription costs affects adoption among low-income households. The study, referred to as NC LITE-UP (NC Linking Internet to Economically Underprivileged People), was conducted in Wilkes and Durham counties from January 2013 through August 2014; 179 households were randomly assigned to receive broadband subsidies of 0, 50, or 100 percent.

Results revealed: 1) households that received a subsidy had higher adoption rates than households that did not, 2) adoption rates among households that received 50 percent and 100 percent subsidies were similar, and 3) nearly 80 percent of households that received subsidies retained broadband service after the study ended.[xlvi] This suggests that reducing subscription costs for low-income households, even temporarily, will increase adoption rates in this group.

FIGURE 11. PRIMARY BARRIERS TO BROADBAND ADOPTION ACROSS THE NATION



Source: Pew Research Center, survey conducted June 10 - July 12, 2015. Sample size: 2,001

Efforts and programs spearheaded by the FCC and some ISP's to reduce subscription costs are underway. The FCC announced in March 2016[xlvii] its plans to modernize the Lifeline program that has offered subsidies for phone services to low-income American households for 30 years. The modernization will restructure the program so qualifying low-income households can use the $9.25 monthly subsidies for fixed or mobile broadband or bundled packages that include broadband. The modernized program will be available to subscribers in December 2016.

Providers such as CenturyLink, AT&T, and Comcast also offer low-cost options for qualifying low-income households. AT&T's recently announced "Access from AT&T" program provides service for qualifying households wireline services for $5-$10 a month depending on the speed the subscriber chooses. CenturyLink offers a similar program called, "Internet Basics"[xlviii] as does Comcast with their "Internet Essentials" program. Once Google Fiber's NC networks are built, they will offer free subscriptions to residents of low-income housing communities.[xlix]

New data also supports that the cost per gigabit of service is decreasing in NC. According to the 2015 report titled, "Golden LEAF Rural Broadband Initiative Evaluation,"[l] the price per gigabit of broadband service NC households receive has consistently decreased since the Center for Public Technology at the University of North Carolina at Chapel Hill began collecting data on household subscription prices in 2010. In short, subscribers pay approximately the same amount per month but receive faster speeds than they received last year or five years ago.

RELEVANCY AND DIGITAL LITERACY

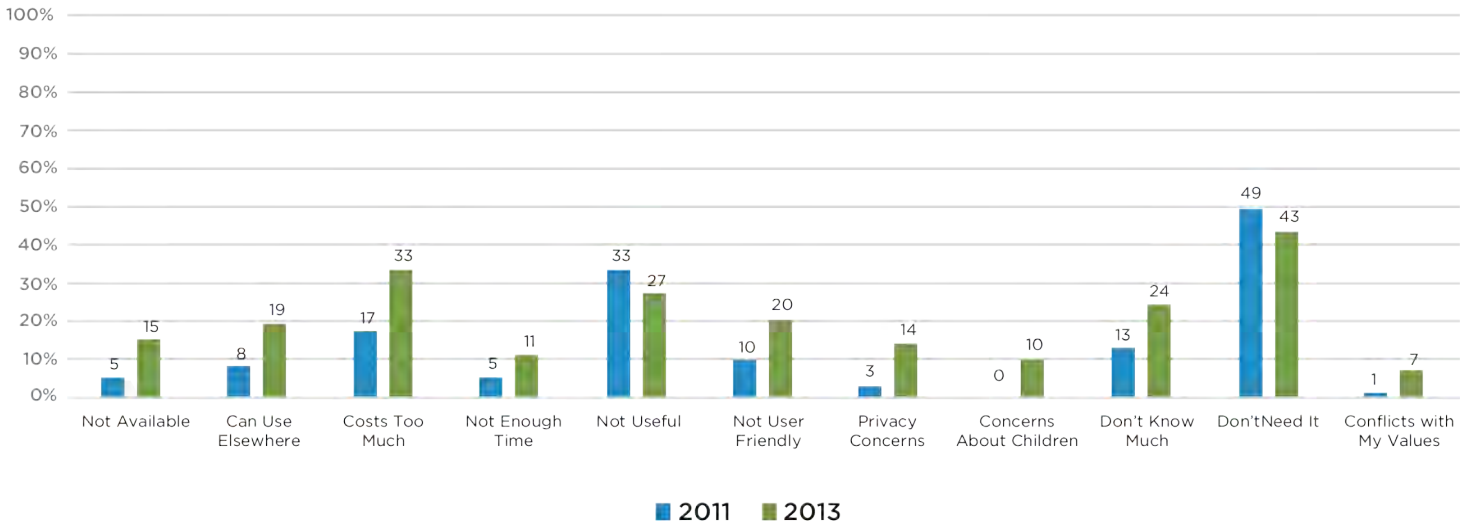
Relevancy: the belief that broadband is useful or necessary for daily life.

Digital Literacy: the ability to use broadband technology to find, evaluate, create and communicate information.

Relevancy and digital literacy also restrict adoption rates. ***Relevancy*** is the belief that broadband is useful or necessary for daily life. Research suggests that among North Carolinians who choose not to adopt broadband, 27 percent believe broadband is not useful and 43 percent believe that they simply do not need it.[li] These findings are an improvement from 2011 when 33 percent reported that broadband is not useful and 49 percent reported that they did not need it.

Digital literacy is the ability to use broadband technology to find, evaluate, create, and communicate information.[lii] Individuals who feel they lack the knowledge to use broadband internet and related technologies or that they are unable to learn how to use them have lower adoption rates. Research suggests that 20 percent of North Carolinians who do not adopt broadband believe that computers are difficult to use, and 24 percent report they do not know much about them. These numbers have increased since 2011, with 10 percent reporting that computers are difficult to use and 13 percent reporting that they do not know much about computers.[liii]

FIGURE 12. PRIMARY REASONS FOR NON-ADOPTION IN NORTH CAROLINA, 2011-2013



Source: 2013 Citizen's Survey

For all North Carolinians to realize broadband's full benefits, both state and local leaders must design and implement concerted efforts to address these four primary barriers to adoption: lack of availability, cost, relevance, and digital literacy. The following recommendations are a result of BIO's research and stakeholder meetings. They are offered as the first steps the state and local communities should take to increase adoption. Alone, these recommendations will not solve broadband adoption, but can begin the process of addressing the barriers comprehensively and effectively.

Broadband Adoption Recommendations

RECOMMENDATION 1: Educate low-income households and their community leaders on affordable broadband options

AD1.1 Advertise and promote lifeline and low-cost provider offerings.

- The state government, local governments, K-12 institutions, libraries, and healthcare providers who wish to improve broadband adoption should consider offering information on low-cost options such as Lifeline and the various provider offerings to low-income households.
- BIO should assist organizations who wish to promote the low-cost programs in developing necessary educational strategies, efforts, and materials.

AD1.1 The Public Utility Commission (PUC) Lifeline task force should meet regularly to assess and measure Lifeline subscription rates and provide recommendations at the state level for ensuring widespread adoption of the program.

- The task force should continue to publish quarterly reports.

- PUC should collaborate with BIO and other stakeholders to determine the educational efforts needed to ensure adoption of the program.

AD1.3 Publish best practices for local governments who want to offer subsidies or other adoption programs for low-income households for broadband.

- Programs to increase broadband adoption are most effective when spearheaded by the communities themselves. But, few resources exist for local governments seeking to increase broadband adoption in their communities through subsidies. Thus, BIO and its partners should develop and publish best practices for local governments who wish to construct a local-level subsidy program for vulnerable populations in their communities.

AD1.4 BIO and its partners should conduct a needs assessment and feasibility study of a state-level subsidy program for low-income households.

- As cost is a major barrier to broadband adoption, BIO recommends conducting new research studies, assessments, and feasibility studies to better understand the level of need for intervention and subsidy programs.
- BIO will utilize lessons-learned from the "NC LITE-UP program" and other national programs to compile and publish best practices.

RECOMMENDATION 2: In collaboration with the State Librarian, BIO should continue to lead the effort to ensure high-speed, next-generation connectivity to all North Carolina Libraries.

AD2.1 Leverage MCNC's infrastructure to better facilitate high-speed connections at 100 percent of the state's libraries.

AD2.2 State Librarian and BIO should pursue an endowment of a two-year position funded by foundation grants with the purpose of bridging the state's digital divide through the creation of community-based digital literacy programs, adoption initiatives, and technical assistance. These programs would be based on demonstrably successful models, such as Charlotte's "Digital Charlotte" program (see Case Study 3).

AD2.3 Use grant funds like E-Rate funds to obtain funding for the last mile to libraries.

AD2.4 Provide grant-writing assistance or connections to entities capable of assisting with grant writing and management to communities and organizations in need of assistance.

AD2.5 Create partnerships, search for cost-savings, and apply the savings to building out broadband to the communities and community anchor institutions. In addition, ensure government-owned community anchor institutions are adequately equipped with broadband infrastructure and digital devices to meet the local demand for services.

RECOMMENDATION 3: The state should continue to monitor and assess policies impacting mobile broadband adoption and use.

AD3.1 As mobile broadband use continues to increase, policies and regulations that impact mobile broadband adoption and use should be continuously monitored to better understand their benefits and challenges.

Case Study 3

Digital Charlotte

With more than 990,000 residents, Mecklenburg County is North Carolina's most populous county. According to a 2012 community survey conducted by the Knight School of Communication (Knight) at Queens University, 15 percent of Mecklenburg County adults do not use the internet. Data from the FCC and the US Census Bureau indicate 80,000 Mecklenburg County households do not have internet access and/or a computer in their home.

To address the issues identified through the survey, Knight formed and endowed "Digital Charlotte," a community-based digital inclusion program. The effort focuses on recruiting and training people within the low-adoption neighborhoods to serve as ambassadors and educators, showing neighbors the benefits of adopting broadband and how to effectively use it. The program includes basic computer and device training and workshops; a team that serves as a convening force to unite and organize dozens of city and county stakeholder organizations; and a website that serves as a central portal for connecting and promoting the city to the team's efforts.

Since 2012, Digital Charlotte has conducted roughly two dozen digital literacy workshops, educating 350 to 400 members of the community in these classroom-based experiences. It distributes educational resources to hundreds of other community members online; and it hosts the "Best Minds Conference," an annual citywide educational conference designed to focus attention on bridging the digital divide.

RECOMMENDATION 4: Foster aggregation and creation of digital literacy tools by and for local communities and house them in one central location.

AD4.1 Build upon existing tools like the federal government's digital literacy portal: digitalliteracy.gov to provide tested, digital literacy tools and curricula for organizations who seek to increase digital literacy in their communities.

AD4.2 Highlight existing intergenerational digital literacy training programs so they can be replicated

- Programs like the Raleigh Digital Connectors program—a program created and provided by the City of Raleigh that provides technology education to youth who then teach the skills they have gained to other members of their communities—create opportunities for cross-generational training, learning, and skill development. This and other similar programs are good examples of programs that could be replicated throughout the state.

AD4.3 Identify best practices and publish those/highlight case study models

- Programs like the Raleigh Digital Connectors program exist throughout the state, but information on them cannot be found in one central location. In collaboration with stakeholders and partners, BIO should compile a living list of these programs and models, publishing and distributing for NC communities and organizations to consult when developing their programs.

SPECIFIC ISSUE AREAS

Homework Gap

The internet's empowerment of the individual to access information may have no greater impact than on the education of our children. With proximity to information, curiosity becomes a superpower, confidence grows, and learning becomes self-initiated, personalized, and instantly measurable.

NC's lawmakers, educational leaders, and teachers recognized the impact internet access can have on classroom instruction almost a decade ago. Since then, dedicated fiber optic connections were built to every school, guaranteeing bandwidth demand.

Today, almost half of NC's schools have digital, learning-ready wireless networks in place, double the number from just two years ago. During 2015, the number of schools with digital learning-ready wireless moved to above 60 percent. The effort continues with a commitment to equip every classroom with a wireless access point by 2018.

Case Study 4

Montgomery County Schools

Montgomery County, home to over 27,000 residents, is a sparsely populated community in south-central NC. Over 21 percent of its families live below the federal poverty line, and 74 percent of students are considered economically disadvantaged, as determined by free or reduced price lunch eligibility. Through surveys and audits, the district found that many students lack internet connectivity at home, resulting in barriers to academic achievement.

Recognizing the direct relationship between broadband adoption and income levels, the district designed a unique plan to reach K-12 students who do not have access to broadband in their homes. The school district attached Wi-Fi hotspots to 12 school busses. As a result, this enabled learning to occur during the long commutes to and from school, decreased behavior incidents on the buses, and for around 150 students, provided otherwise unattainable broadband access.

Next, the district plans to park the connected buses in unconnected communities to serve as a Wi-Fi hotspot and provide connectivity during evening hours. And with the strategic build out of wireless hot spots at various places across the county, students now have better access outside of school to complete homework assignments.

In 2013, Governor McCrory signed into law legislation facilitating the transfer from textbooks to digital learning devices and instructional resources by 2017.[liv] The "NC Digital Learning Plan" details the process of that transformation.[lv]

One issue has emerged that inhibits completion of that transformation: the "homework gap."

The ***homework gap*** is defined as the proportion of students without access to broadband internet and broadband-related devices outside the school building. Nationally, 70 percent of teachers assign homework that requires broadband access, but only 33 percent of students have access in their home.[lvi]

FIGURE 13. BROADBAND ADOPTION DECREASES, 2013-2015

	2013	2015	% Change
Total	70%	67%	-3
Male	70%	66%	-4
Female	70%	67%	-3
Parents	77%	73%	-4
Non-Parents	67%	64%	-3
White	74%	72%	-2
African-American	62%	54%	-8
Hispanic	56%	50%	-6
18-29	81%	75%	-6
30-49	77%	74%	-3
50-64	68%	65%	-3

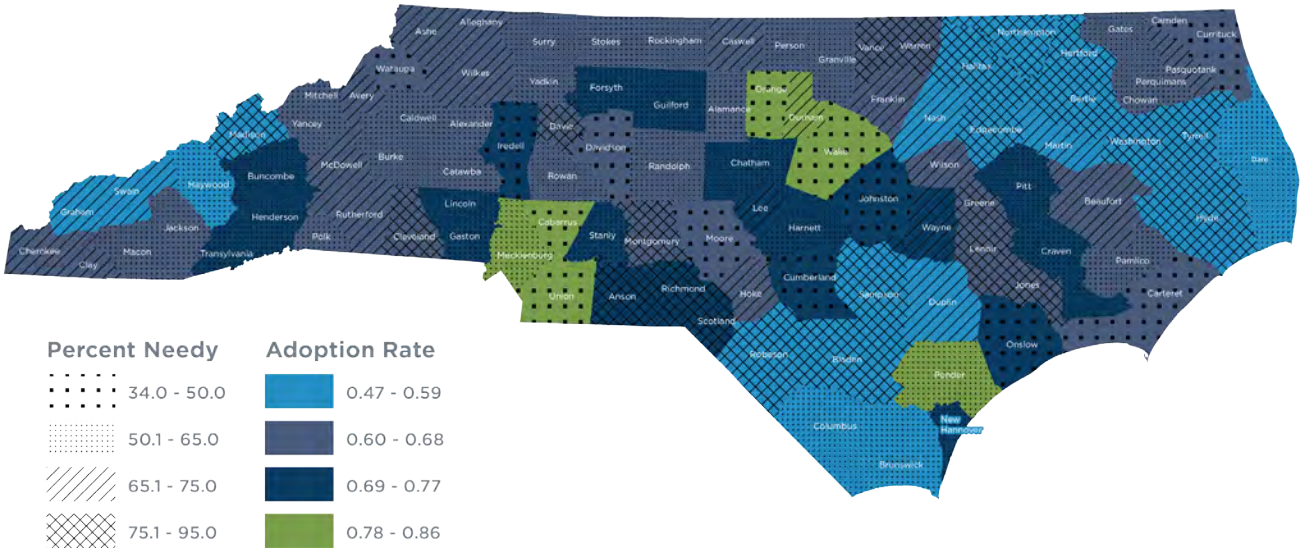
	2013	2015	% Change
65+	47%	45%	-2
Under $20K	46%	41%	-5
$20K-$50K	67%	63%	-4
$50K-$75K	85%	80%	-5
$75K-$100K	88%	88%	0
Over 100K	93%	90%	-3
High School Grad or less	50%	47%	-3
Some College/Assoc. Degree	80%	75%	-5
College+	93%	87%	-3
Rural	60%	55%	-5
Urban	70%	67%	-3
Suburban	74%	70%	-4

Source: Pew Research Center Surveys

Greater than 50 percent of teachers report that limited access to online resources at home presents a major challenge to integrating technology into the classroom.[lvii] Low-income homes with school-age children are four times more likely to lack broadband than middle or high-income families.[lviii]

While data on NC's homework gap is limited, several data sets inform where the state sees the largest divide. Figure 15 shows the areas of the state with the highest percentages of students participating in the Free and Reduced Lunch Program overlaid with broadband adoption data.

FIGURE 14. ESTIMATED HOMEWORK GAP IN NORTH CAROLINA



Source: https://www.whitehouse.gov/sites/default/files/wh_digital_divide_issue_brief.pdf
Note: These rates reflect the share of households per county with home Internet subscriptions.

Additionally, the DPI's *Annual Technology Survey* completed by school personnel shows where they believe significant gaps in home access or use exist as seen in Figure 15 below.[lix]

Not surprisingly these maps are similar; and they show which communities struggle with availability or affordable access.

The state's "Digital Learning Plan" recognizes the homework gap and recommends that BIO provides leadership at the state level to devise solutions.[lx] In addition, respondent's to BIO's 2015 survey ranked "ensuring that K-12 students have access to broadband at their homes" as the second most important broadband issue facing the state. It was second only to increasing access overall. As such, substantial time—multiple stakeholder sessions—and space in this plan is dedicated to creating solutions for this issue.

One standard solution will not fit every community, instead a menu of tailorable solutions should be made available to local school districts. Local leaders should embrace creativity and entrepreneurial solutions.

Homework Gap Recommendations

RECOMMENDATION 1: Leverage school's digital infrastructure for use by the community as a whole

HG1.1 The state should advocate for E-Rate reforms to allow for school districts negotiating internet service contracts or contract renewals to give greater preference to providers committed to serving the community.

- At this time, the FCC and Universal Service Administrative Company (USAC) approve funding for service contracts that award to the lowest bidder. This has created a market that encourages the cherry-picking of schools. In some cases, these providers—including start-ups created for the sole purpose of winning lucrative school contracts—by-pass unserved or underserved residents.

HG1.2 The DPI and the Friday Institute at North Carolina State University should provide instruction for school administrators on drafting Request for Proposals (RFPs).

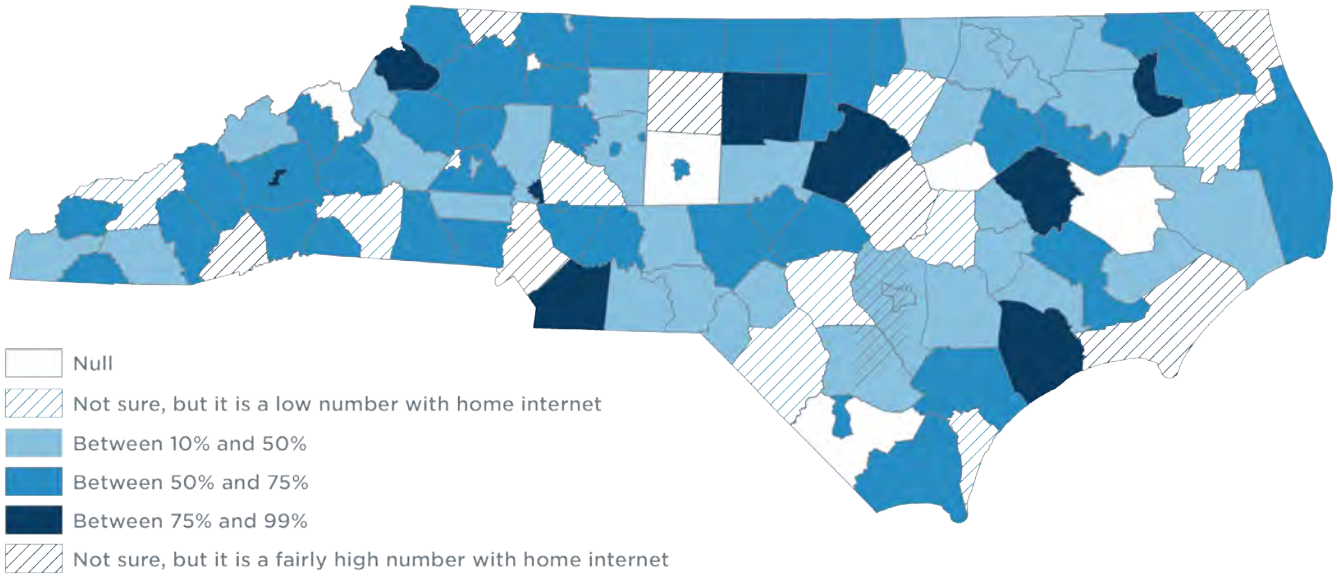
- The RFPs should appropriately give additional weight to ISPs that plan to provide service for the community within a designated area beyond the Wide Area Network (WAN). This

can include an RFP that incentivizes providers by combining service to libraries.

HG1.3 School districts and communities should invest in low-cost mobile service solutions.

- Many school districts around the state and country use fixed and mobile wireless solutions to provide access outside of the school. These include equipping buses with Wi-Fi access points, Mi-Fi checkouts through the schools, the libraries or non-profits, and faith-based organizations.
- Low-cost/low bandwidth cellular solutions are being piloted and could provide another solution. Bandwidth is limited and filtered for access to teacher approved sites. It prevents use to access data-rich sites or unapproved websites.

FIGURE 15. ESTIMATED PERCENTAGE OF K-12 STUDENTS WITH HOME ACCESS AT 3 MBPS



What percentage of students in your district do you estimate have home internet access of at least 3 Mbps, including cellular LTE that could be tethered to a school-issued laptop, Chromebook or tablet?

Case Study 5

Lee County Schools

Lee County Schools is a public school district of sixteen schools located in central NC and serves around 9,000 students. The county is home to 60,000 people and is located within 40 minutes of three major universities. More than 60 percent students have been approved for free or reduced price school meals.

Believing that early exposure to technology better prepares students for 21st century jobs, Lee County Schools developed an educational technology plan in 2014. As a result of the plan, middle and high school students can now earn high school credits through the North Carolina Virtual Public School, the second largest online public school in the nation. The district also has one of the largest one-to-one laptop programs in the state, with nearly 10,000 laptops distributed to students K-12 to date.

However, a significant number of students do not have internet access at home. This has led school officials to consider creative solutions. The county placed hotspots in municipal buildings to provide free access locations for students. But more needed to be done.

Supported by the Friday Institute and BIO, the district worked with several private sector partners, and developed an at-home cellular connection pilot program in early 2016. The E-Rate approved cache software offered by URCast, paired with a low-cost, low-bandwidth service from US Cellular allows students to complete assignments at home. Teachers control the content through the software and the low-bandwidth is enough for the students to access the necessary resources. The pilot will continue for several months and will be measured for effectiveness and impact. If successful, this model could be replicated and scaled across other districts.

- The planning and build-out of a nation-wide, interoperable wireless data network—FirstNet—is ongoing. The dedicated spectrum for FirstNet includes significant bandwidth. The state should advocate at the federal level that FirstNet and national leaders consider secondary or non-primary uses—SecondNet—of the network for educational purposes. FirstNet pledges approximately 100 percent coverage. Students without access should be able to access the network for completing homework or researching until an emergency incident or event.

HG1.4 The state should designate an E-Rate coordinator.

- This individual or office (could be the existing DPI coordinator) would provide one centralized place for knowledge to support all eligible institutions. This will ensure the state is fully leveraging E-Rate discounts for schools and libraries.

RECOMMENDATION 2: Better data on North Carolina's homework gap.

Further research and granular data are needed to enable policy makers and community leaders to focus resources and determine appropriate solutions.

HG2.1 The state should distribute a survey in the schools for parents to complete and return to obtain more granular data on where the homework gap exists. This could be a telephone, internet, or paper survey (or all of the above) targeted at parents. The Friday Institute at NC State University (NCSU) is regarded nationally for developing and evaluating these types of surveys.

HG2.2 Measure the Homework Gap using non-survey data, such as logs from Power School, speed tests, or other applications. MCNC measures and can analyze all school district data. The NC Government Data Analytics Center (GDAC) could assist with data gathering and analysis.

RECOMMENDATION 3: Enhance and expand adoption initiatives targeted at students and parents

HG3.1 The state should leverage the K-12 Education System to reach children and their parents.

- School or community-led initiatives should include consistent and continuous education for parents on technology tools their children should use in and out of the classroom. Schools and communities can host digital literacy training for parents at the schools or libraries during after-work hours. It can include remote video-based training.

HG3.2 Expand device delivery to low-income families, especially those with K-12 students.

- The state should explore amending the State Surplus law, NCGS 143-64.02,[lxi] to allow discarded devices to be donated to non-profits that refurbish and donate computers to low-income families and families with K-12 students in the home, which will increase device access. Universities should consider computer donations to non-profits.
- BIO should encourage the duplication of non-profits like the Kramden Institutes' (Durham, NC) and E2D (Davidson, NC) in other locations across the state through education efforts.
- Once the NC Digital Learning Plan is fully implemented DPI and school districts should use savings from text book purchases to purchase devices for the students without a device in the home.

Case Study 6

Non-Profits Bridging the Digital Divide in North Carolina

Ned Dibner was in middle-school when he noticed many of his classmates could not afford a home computer. Turning a father-son pastime repairing computers into a service project, Ned and Dad spent the next nine months refurbishing 50 computers for honor-roll students at his school. Within the year, the program helped every honor-roll student in grades six through eight acquire a computer.

That service project grew into what is now the Durham-based Kramden Institute. Kramden continues to refurbish and repair computers that are donated to students, families, and nonprofit organizations across North Carolina. The program has expanded its services to offer digital literacy and technology training for both adults and children. To date, the Kramden Institute has awarded more than 22,800 computers to 78 counties across the state.

Similarly, Pat Millen, inspired by a question his daughter asked about friends at school who could not afford computers, founded E2D in Davidson. The group's efforts to eradicate the digital divide in the Charlotte Mecklenburg School system has helped over 1,000 families bridge this divide through devices and training. Last year the National League of Cities, Next Century Cities and Google Fiber recognized E2D as "The Most Innovative Digital Inclusion" program in the country.

HG3.3 Encourage creation and/or expansion of tech-based curriculum in K-12 schools

- DPI should develop a curriculum with standard requirements for students with a technology proclivity or interest that includes the study and training of data analytics and coding. It should be a real time, modern, flexible, and personalized curriculum so students are exposed to the most current learning and information.
- It should also showcase technology employment opportunities to expose possibilities technical training enables.
- The state should create a technology apprenticeship program for high school students to receive course credit in exchange for working with or at technology companies.
- In addition, and in an effort to address the variety of technology job opportunities, DPI or school districts should explore the creation of a pilot curriculum or class at schools focused on computer repair and refurbishment. Schools can partner with community colleges, non-profits or device manufacturers in the state to develop the curriculum and provide instructors. Refurbished computers can then be donated to other students in need or to community organizations that facilitate access to devices for low-income individuals and families.

RECOMMENDATION 4: Greater use of the Lifeline program and low-cost provider programs.

HG4.1 BIO should partner with DPI, NC's Local Education Authorities (LEAs), and individual school districts to publicize the Lifeline program.

HG4.2 BIO should partner with DPI, LEA's, and individual school districts to publicize NC providers' low-cost broadband subscription programs.

Economic Development: Small Business Support and Workforce Development

Throughout history, one public policy issue has predicated the rise or fall of entire governments, had the power to make or break careers, and been the driving force behind innumerable laws, policies, and programs. The issue? The economy and how to ensure its growth and prevent its decline.

Broadband's impact on the economy is profound. Research has demonstrated, for instance, that greater broadband penetration rates are associated with per-capita GDP growth in a variety of countries including the United States, Germany, and Sweden, among others. A similar pattern has also been demonstrated at the state level.

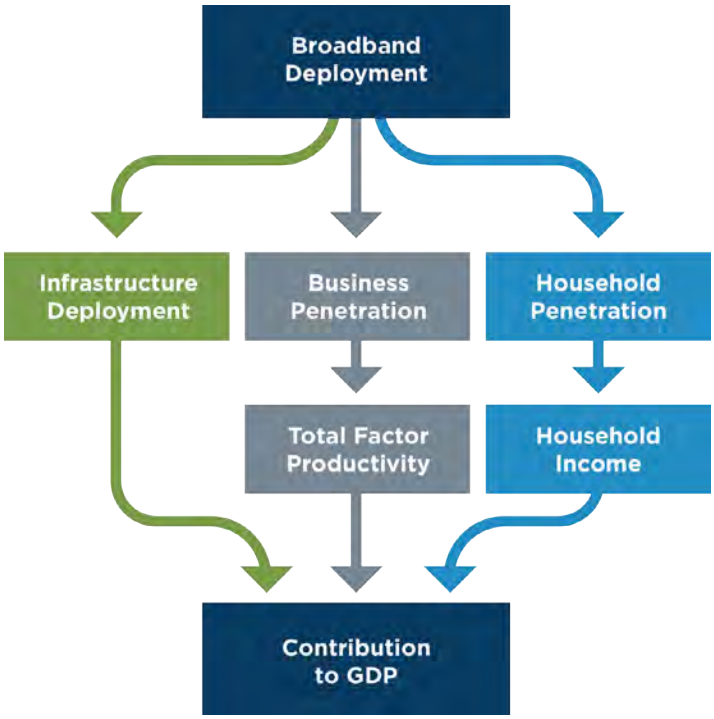
Research suggests that broadband and related ICT's may impact GDP through various pathways. First, the construction of broadband networks, like all infrastructure projects, directly affects economic activity by creating jobs but also impacts activity indirectly through increased adoption of broadband, reduced cost of existing goods and services, and other benefits such as increased commerce opportunities.

Second, broadband increases businesses' productivity through the adoption of more efficient business processes (e.g., streamlining supply chains, inventory optimization), and accelerates innovation through the introduction of novel consumer applications and services.

Third, the adoption of broadband at home may drive increases in household income and various other benefits whose link to GDP is less clear, such as greater access to entertainment, telehealth services, and public safety alerts. A simplified depiction of these relationships is outlined in Figure 16.

The act, implementation or study of policies, strategies, and techniques to improve the economy is often referred to as economic development. The U.S. Economic Development Administration (USEDA) defines economic development as, "creating the conditions for economic growth and improved quality of life by expanding the capacity of individuals, firms, and communities to maximize the use of their talents and skills to support innovation, lower transaction costs, and responsibly produce and trade valuable goods and services."[lxii]

FIGURE 16. BROADBAND'S RELATIONSHIP WITH GDP

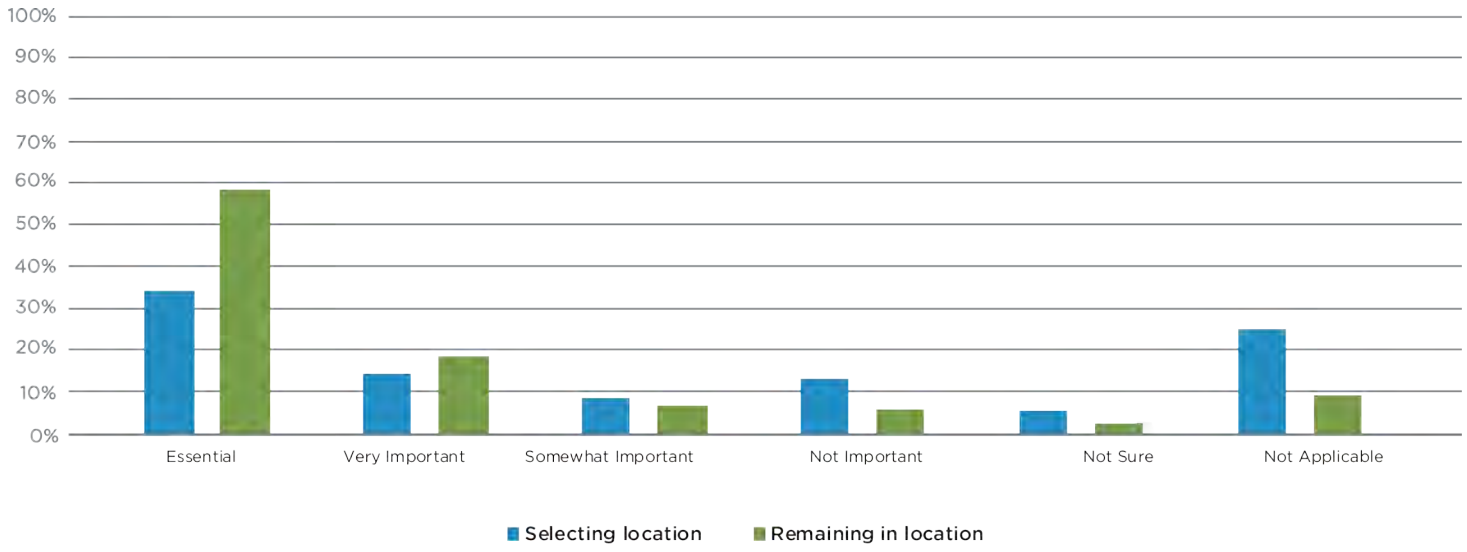


Source: International Telecommunications Union, www.itu.int/broadband

Within the discipline of economic development, multiple strategies exist. Small business support and development, or ensuring new and small businesses have the tools they need to thrive is considered one economic development strategy. Another strategy, workforce development, focuses on the human side of companies—the employees or future employees—and ensures they are adequately equipped to contribute to and participate in the local economy.

As with the economy, broadband's impact on economic development strategies and programs is profound. In a 2013 survey conducted by NC Broadband, nearly 44 percent of businesses reported that broadband access was a key factor in their location decision.[lxiii] In addition to its effect on business attraction and retention, broadband impacts the efficiency and effectiveness with which small businesses and NC's workforce can compete in today's global economy.

FIGURE 17. BROADBAND'S IMPACT ON BUSINESS LOCATION SELECTION AND RETENTION



Source: SNG/NC Broadband Survey, 2013

Respondents to BIO's "Broadband Deployment and Adoption Initiative" survey indicated that both increasing small business' broadband adoption and use, and preparing a digitally literate workforce should be among the state's top priorities.[lxiv] As such, this section provides background and recommendations for improving the connection between broadband deployment, adoption, and use, and economic development strategies, namely small business support and workforce development.

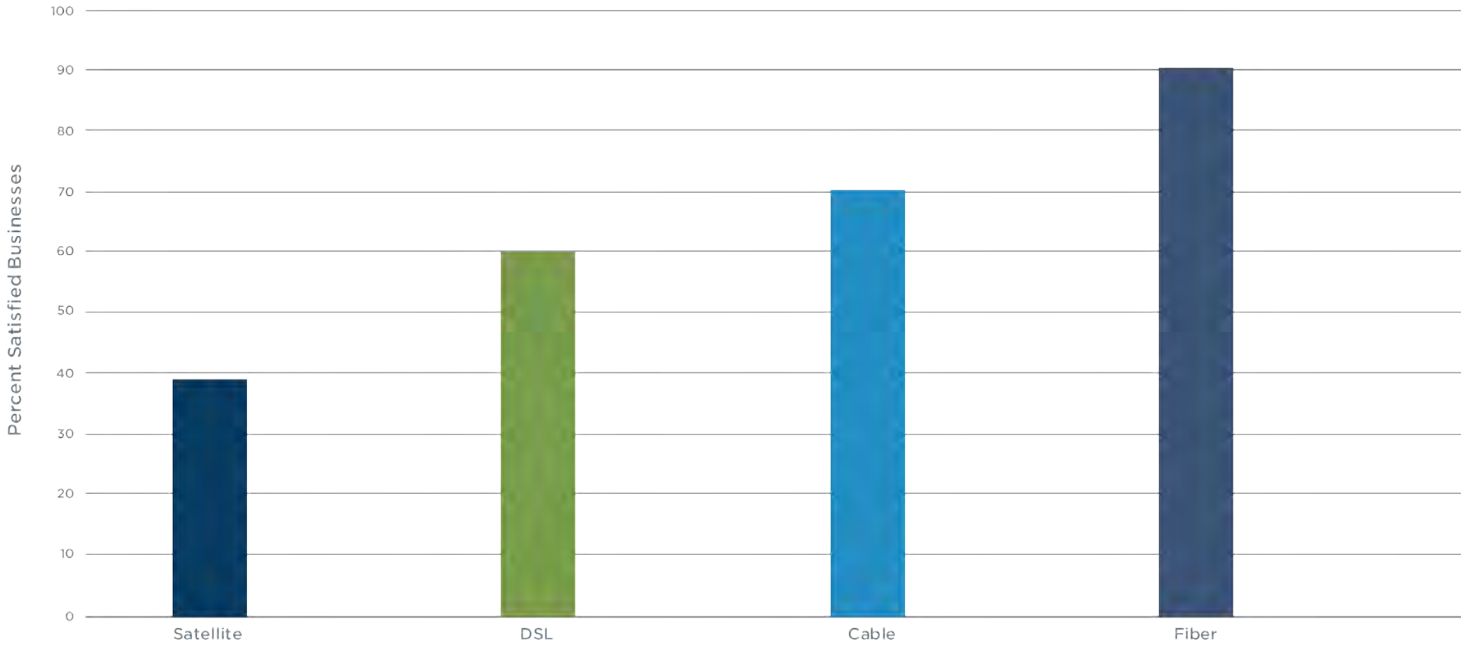
Small Business Support, Adoption, and Use

Small businesses—who create between 60 and 75 percent of new jobs in a given year—are integral to the US and NC's economy. According to the Kauffman Foundation, companies with fewer than fifty employees represent 95 percent of all U.S. companies;[lxv] and in NC, they represent 97.9 percent of all businesses, employ 1.6 million people or 45 percent of total business employment, and generate almost 50 percent of the state's GDP.[lxvi]

Because of their importance, a plethora of resources exist for supporting small business owners and entrepreneurs. At the federal level, the Small Business Administration (SBA) provides grants, loans, free educational tools, and other resources for new businesses. In addition to the NCDOC, NC boasts the Economic Development Partnership of North Carolina (EDP), the Small Business and Technology Development Centers (SBTDC), the Small Business Centers (SBCs), the state and local chambers of commerce, and countless other accelerators, non-profits, and grant-makers who seek to spur economic growth through the support of small businesses, startups, and entrepreneurism. Recently, NC's entrepreneurial ecosystem in the Research Triangle region has burst onto the national stage as a premier destination for high-tech, high-growth firms, and ventures to build their startup.[lxvii]

Today, nearly all NC businesses, 99.8 percent, subscribe to the internet.[lxviii] How satisfied the company is with their connection, however, highly varies depending on their technology type. While cable and DSL account for more than half of all business subscriptions, only 60 and 70 percent of companies (respectively) were satisfied with that service. Meanwhile, 90 percent of businesses with a fiber connection were satisfied with their service. The fact that most NC businesses were connected in 2013 is remarkable, but their satisfaction or dissatisfaction with their current service becomes increasingly more important as more operations and applications move online, and businesses require higher speeds and reliability to remain competitive.

FIGURE 18. PERCENT OF BUSINESSES SATISFIED WITH THEIR TYPE OF BROADBAND CONNECTION



Source: Strategic Networks Group, NC e-Strategy Report 2014

The amount which a broadband subscription increases their efficiencies and revenue heavily depends on how they use broadband in their businesses. While broadband is deemed necessary for operating a business—how to best utilize it to improve business operations and revenues—are not topics small-business support organizations cover in current trainings. And yet, in 2013, the primary barrier to strategic broadband utilization for small businesses was "lack of expertise" for 67 percent of NC small businesses.[lxix]

Thus, a need exists for the coordination of structured, targeted, training for NC small businesses who lack the fundamental digital literacy skills to take advantage of new broadband-enabled technologies to increase efficiencies and revenues.

Preparing NC's Workforce for 21st Century Jobs

Workforce development is an economic development strategy that attempts to enhance a region's economic stability and prosperity by focusing on people rather than businesses. It is essentially a human resources strategy. Policies and interventions often focus on training or retraining the workforce to better match available jobs or jobs the region wishes to attract. For example, NC's Community College system has worked with numerous companies over the years to equip their local job-seekers with the necessary skills to work at their specific company. As this example portrays, workforce development policies, agencies, and programs benefit a range of stakeholders. The individuals who receive training, the organizations who hire the newly trained individuals, the individuals who are now more employable, the employers, and the community or region in which they are based.

Case Study 7

Guilford Tech

Home to over 500,000 residents, Guilford County is the state's third most populated county. With the establishment and growth of Honda Aircraft Company and the expansion of FedEx, the county has positioned itself as a center for aviation manufacturing and service. Suppliers and other supporting businesses have located in the county.

Guilford Technical Community College is the third largest of 58 community colleges in the North Carolina Community College System and serves more than 40,000 students annually. To support the county's efforts the college began offering a curriculum to train students to support the growing aerospace industry.

Beginning in September 2015, GTCC expanded this curriculum to include the National Aviation Consortium. This program is funded as part of the $14.9 million federal grant from the U.S. Department of Labor, of which, GTCC received $1.4 million. GTCC joined four other community colleges across the nation who are part of this program. Students who participate in the program begin by working through a core set of online courses to develop the necessary skills and terminology. They continue online courses and add hand-on training.

The NAC intends to train at least 500 aviation workers by 2016. As more companies like Honda Aircraft Co., who developed a $4.5 million lightweight jet, continue to move their operations to Greensboro, GTCC's program to train and equip a workforce capable of participating in these aviation companies is essential to the economic development of the city, region and state. GTCC serves as one example of an educational institution partnering with local community to support a specific economic growth and industry initiative.

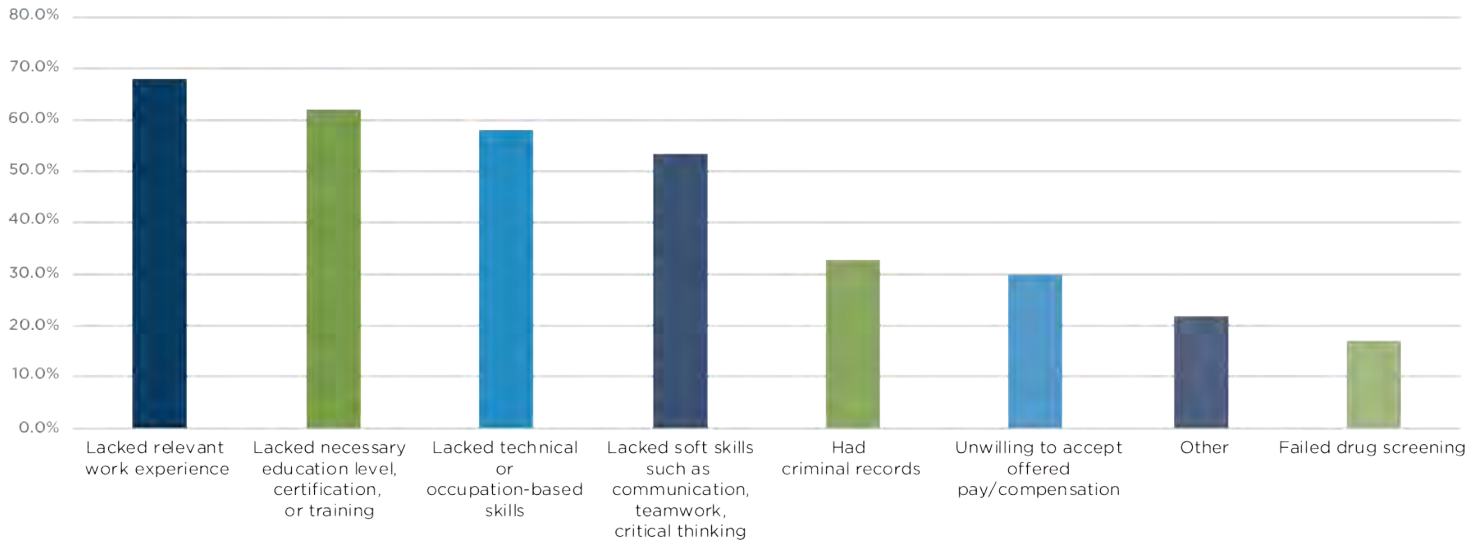
Other programs such as the "NCWorks Certified Work Ready Communities" initiative,[lxx] a collaborative effort of a wide variety of NC's workforce development organizations, encourage communities to emphasize their workforce's ability to meet the needs of potential employers. The initiative requires communities to undergo an application process to become a "Certified Work Ready Community," but once certified, the partners advertise the communities to potential employers as prime areas ready for investment.

The skills needed to excel in today's workplace are largely digital and technical. Regardless of whether an employee works in hospitality and customer service or a biotech research lab, they need to possess basic digital literacy skills to perform their duties.

In 2010, 22 percent of non-adopters cited a lack of digital literacy skills as a primary reason for not adopting broadband.[lxxi] A standard, consistent definition for digital literacy doesn't exist. But in general, digital literacy refers to "a variety of skills associated with using Information and Communication Technologies (ICT) to find, evaluate, create and communicate information." The term takes on different meanings at different stages of a person's life and career stage.[lxxii] For example, being a digitally literate elementary student requires different skills than being a digitally literate employee of a technology startup.

In 2014 and again in 2015, the Labor and Economic Analysis Division (LEAD) of the NC DOC administered a survey of NC employers to better understand whether they were having difficulties hiring employees and if so in which sectors were most affected and for what reasons. Of those surveyed,[lxxiii] 39 percent of employers had difficulty in hiring in 2015. Of those who had difficulty hiring, 58 percent cited being unable to find employees with adequate technical skills as a factor contributing to their hiring difficulties. A lack of technical skills received the third highest response, falling behind work experience and education, (67%), and certifications and training (61%), although respondents could select multiple choices.

FIGURE 19. HIRING DIFFICULTIES FOR NORTH CAROLINA EMPLOYERS IN 2015



Source: NCDOC Labor and Economic Analysis Division, 2016 Employer Needs Survey

As the need and importance of digital and technical skills increases, the need to address gaps in digital literacy and promote lifelong digital literacy training increases. The following recommendations are based on this need and the need to increase digital literacy and broadband utilization support to small businesses.[lxxiv]

Economic Development Recommendations

RECOMMENDATION 1: Incorporate Broadband into "Certified Work Ready" Communities Initiative.

ED1.1 Include broadband as an indicator in the "Certified Work Ready Community" initiative.

- Partner with NC Chamber of Commerce and other workforce development partners to incorporate broadband into existing "Certified Work Ready Communities" program

ED1.2 Advertise certified communities to providers as good areas for providers to invest and/or expand broadband infrastructure.

RECOMMENDATION 2: Launch a state-supported campaign to brand the state (internally and externally) as a national digital leader.

- BIO should collaborate with partners such as the NCDOC, NCEDP, the NC Chamber of Commerce, the North Carolina Technology Association (NCTA), and other stakeholders to develop a campaign to brand the state internally and externally as a leader in the creation and use of next-generation technologies.
- The campaign should complement and align with NC's current state brand, "Nothing Compares."

RECOMMENDATION 3: Leverage existing state agency small business and workforce development tools.

ED3.1 Catalogue, leverage, and build upon existing small business support organizations' current efforts to improve small businesses' broadband utilization.

- BIO should partner with other state agencies, local governments, non-profits, and NC's technology companies to create a database or portal of the existing efforts to improve broadband utilization and digital literacy among small businesses and individual citizens.

ED3.2 Leverage and build upon existing workforce education and training.

- In collaboration with the Community College System, BIO should leverage and build upon existing workforce development education and training for digital literacy, computer and technology skills, and various subjects via in-person and distance learning formats offered through the Community College System.
- In collaboration with other workforce development agencies, BIO should work with the NC Community College System to ensure partnerships are established with NC companies to prepare potential employees and job applicants for tech-based jobs.

ED3.3 Ensure the NC Works Career Centers' employees have adequate tools and training to assist customers with digital literacy needs

- BIO and other stakeholders should collaborate with the NC Division of Workforce Solutions to ensure the NC Works Career Centers have the necessary tools and training for their employees to adequately provide digital literacy training to incoming job-seekers.

ED3.4 Leverage NC Works portal and partner with NC DOC's Labor and Economic Analysis Division (LEAD) and Division of Employment Security (DES) to reach citizens in need of digital literacy skills with training opportunities.

RECOMMENDATION 4: Encourage communities to include broadband in their economic development plans

ED4.1 Encourage NC communities to include broadband in regional strategic planning like Comprehensive Economic Development Strategy (CEDS) plans.[lxxv]

- CEDS plans are "strategy driven plans for regional economic development" required to be updated every five years by the EDA[lxxvi] for regions that wish to qualify for EDA assistance under its Public Works and Economic Adjustment Assistance programs. CEDS plans are also a prerequisite for regions to receive the "Economic Development District" designation.
- Including strategies to increase broadband availability, adoption, and use in the regional CEDS plans will encourage regional focus and collaboration on increasing broadband availability, adoption, and use.

ED4.2 Encourage NC communities to include broadband in their local planning efforts.

- Often, communities create goals for their communities through strategic plans, comprehensive plans, or visioning documents or sessions. BIO should collaborate with other stakeholders such as the NC DOC, the Rural Center, other stakeholder organizations and key community leaders such as school superintendents or secondary educational institutions' leaders to assist communities as they develop their plans. In this collaboration, BIO should provide strategies to increase broadband deployment, adoption and use as an economic development tool.

Telehealth

At its core, the impetus for the development and expansion of telehealth over the past few years was simple—the US healthcare system is overly complex and expensive. Thus, a need for an innovation or technology that would streamline and expand service delivery options to increase positive health outcomes and decrease costs was born. ***Telehealth***, the virtual delivery of a wide variety of healthcare services, health information, and health education, is the technology through which new innovations are being developed to bridge the gap. Telehealth enables doctors to deliver healthcare services virtually, thus improving the health outcomes and the efficiency and effectiveness of the healthcare system.

However, incorporating telehealth into the current healthcare system is a complex, multi-faceted undertaking. Many variables—such as the speed at which the patient can access telehealth services via their broadband connection—directly effect's telehealth's potential impact on the healthcare system and health outcomes for patients.

While a diverse set of telehealth technologies and services like counseling and physical and occupational health can be delivered via telehealth, consumers cannot access these services without a mobile or home broadband connection.

TELEHEALTH

The virtual delivery of a wide variety of healthcare services, health information, and health education.

As healthcare providers increasingly provide healthcare services via telehealth technologies, the imperative to ensure broadband is available and adopted in all parts of the state increases. If broadband is unavailable, North Carolinians do not adopt it in their homes, or are unable to use the technology because they are digitally illiterate, telehealth's value is not fully realized.

The state's vulnerable populations who could benefit from telehealth services the most—those in rural areas without nearby access to healthcare providers, homebound patients, veterans, disabled or elderly patients—are often the populations that lack digital literacy skills and/or do not have access to broadband.[lxxvii] Because the availability, adoption and use of broadband directly impacts the telehealth effectiveness in improving health outcomes, BIO identified a need for new collaborations and policies that recognize the strong linkage between the two sectors. As such, this section focuses on the commonalities the two sectors share, the current state of its use in NC, and offers recommendations for ensuring its expansion will be fruitful.

Telehealth Defined

The Center for Connected Health Policy describes telehealth not as a single service or technology but as a collection of services to "enhance care and education delivery."[lxxviii] Although often conflated with telemedicine, telehealth and telemedicine differ in scope. Telemedicine encompasses fewer services—specifically remote clinical services only. While telehealth includes clinical services, it also includes education for patients and providers, public health, health administration, and other healthcare services and applications delivered over Information and Communication Technologies (ICTs).

Telehealth benefits the patient, the people, and facilities involved in providing healthcare. It benefits patients through increasing timely access to specialists, avoiding costly visits to emergency rooms or hospitals, and transfers to facilities far from home. Benefits to physicians include the ability to reach patients outside of their local area, increased ability to reach unserved and vulnerable populations, increased productivity, and increased ease in consulting with peers. Hospitals and clinics see increased efficiencies, increased revenue, and access to a larger specialist support network. Healthcare systems see increased efficiencies and revenues, as well as better health outcomes for their patients.

Telehealth intersects with a multitude of government programs, regulations, statutes, and policies related to health. For example, all telehealth solutions or companies must be HIPAA compliant; and if they want to receive insurance reimbursements, they must work within the existing Medicare and Medicaid regulations.

Telehealth services are delivered through four primary types of technologies or "modalities": live video, store and forward (i.e. Pre-recorded videos, x-rays etc.), remote patient monitoring (RPM), and mobile health (mHealth). Live video refers to a live, two-way interaction between a person (either the patient or their caregiver) and a provider using audiovisual telecommunications technology. Store and forward is the transmission of recorded health history (pre-recorded videos, x-rays) through a secure electronic communications system to a practitioner. Remote patient monitoring (RPM) is the personal health and medical data collection from a person via electronic communication technologies, which is transmitted to a provider for use in care and support. Lastly, Mobile health (mHealth) is "the use of mobile and wireless devices to improve health outcomes, healthcare services, and health research," and can range from text message reminders and check-in's to warnings or alerts delivered to a patient's mobile device about breaking health news consumers should be aware of like disease outbreaks.[lxxix]

In addition to the need for innovative, more efficient and effective healthcare delivery mechanisms, the rise of telehealth services[lxxx] was made possible by a number of simultaneous trends in the healthcare sector. Among them is the increasing move from paying for how much care healthcare providers provide to paying for their quality of care. For the past several years, healthcare systems, organizations, and individual providers have begun moving from a "fee-for service" health care model to a "value-based care" model, where healthcare providers are reimbursed by insurance providers for better health outcomes instead of the services provided. In addition to this shift within the healthcare industry, the Affordable Care Act,[lxxxi] and other regulations incentivize providers to move towards value-based care models. As such, the value-based care model will likely continue to replace the standard "fee-for-service" model over the next few years. Telehealth services are one potential tool for healthcare providers to use to provide preventative care and other care actions that increase positive health outcomes and follow the value-based care model.

The technology or "devices" required to receive telehealth services varies, but can be as simple as a mobile phone, computer, or wearable device[lxxxii] such as a Fitbit or Jawbone wristband. Many devices are not reimbursed by healthcare plans, but some health plans provide discounts for wearables or other health-related technology.[lxxxiii]

NC possesses many institutional telehealth assets. In addition to the world-class hospitals, physicians and clinicians housed in the state, several other NC-based organizations dedicate resources to telehealth expansion and provision. Among them are the North Carolina Telehealth Network (NCTN), North Carolina Healthcare Information and Communications Alliance (NCHICA), the North Carolina Institute for Public Health, and state agencies such as the North Carolina Department of Health and Human Services. Additionally, many telehealth-focused startups are forming and growing in North Carolina. For example, Triangle-based Touchcare and RelyMD are video-based apps that connect patients to doctors in real-time. Akili Software, a company operating from Raleigh, developed Savii Care, a tool for home-health practitioners to use to collect and record data on their patients in the field.

With all of these assets, NC is well-positioned to lead the nation in expanding the use of telehealth technologies to increase positive health outcomes. However, to do so, the intersection between telehealth and broadband availability, adoption and digital literacy must be strengthened. The following recommendations are aimed to strengthen the collaboration between telehealth providers and advocates, and broadband providers and advocates.

Case Study 8

RelyMD

RelyMD is a Raleigh-based telehealth startup founded by a group of almost 100 emergency room physicians who staff nine emergency departments in Wake, Johnston, and Granville counties. In 2013, the physicians identified a gap in the healthcare system: a lack of affordable and efficient methods of receiving emergency care for non-acute needs. Rather than wait for someone else to fill the gap, the physicians designed their own platform to provide remote care.

The platform enables an interaction between patient and doctor that is as seamless and simple as using FaceTime, but more secure, HIPAA compliant, and able to transfer documents and prescriptions. It's intended for "unscheduled care" or when a person is unexpectedly sick or injured, but is unwilling or unable to travel to an ER.

The application requires very little to no bandwidth. Some "visits" can be conducted over the phone so no broadband service would be required. Those conducted online require only a 350 Kbps symmetric connection. So far, the company has over 30 corporate clients, including the nearly 10,000 employees that work for recently-announced partners UNC Rex and Capital Broadcasting Company.

Telehealth Recommendations

RECOMMENDATION 1: Better Leverage the Healthcare Connect Fund.

TH1.1 In collaboration with NC's telehealth organizations, BIO should improve education of and marketing for the Health Care Connect Fund (HCF) among hospitals and healthcare organizations.

TH1.2 The state should advocate that the FCC allow HCF to subsidize internal broadband connections and equipment (within buildings/networks).

RECOMMENDATION 2: Create telehealth best practices for healthcare providers.

TH2.1 In collaboration with NCHICA and other NC telehealth organizations, BIO should endorse and assist in distributing best practices developed by telehealth experts for healthcare providers.

- The best practices would include information on how best to incorporate ICT and telehealth services efficiently and effectively into their operations.
- Include a list of things they should explore as they explore improving ICT in their healthcare practices.
- The best practices should be created by peers, funders, and thought leaders in the healthcare industry.

RECOMMENDATION 3: Broadband to all healthcare facilities.

- NCGA should review healthcare facility building requirements to assess how broadband infrastructure and connectivity can be incorporated into the construction of healthcare facilities and mandate construction codes or requirements be updated to accommodate broadband infrastructure.

RECOMMENDATION 4: Healthcare providers market low-cost options for broadband at patients' homes.

TH4.1 In collaboration with telehealth experts and healthcare organizations, BIO should provide education on the reformed Lifeline program to healthcare patients as they leave their place of care.

TH4.2 In collaboration with telehealth experts and healthcare organizations, BIO should provide education on providers' low-cost broadband subscription programs to healthcare patients as they leave their place of care.

RECOMMENDATION 5: Remote Monitoring Pilots.

- In collaboration with telehealth experts and healthcare organizations, BIO should design and pilot programs in which healthcare providers send a mi-fi/air card home with patients for remote monitoring during recovery and/or home-based medical care.

RECOMMENDATION 6: Medical reimbursements for broadband service.

- The state (Governor, DHHS, and BIO) should advocate for medical reimbursement change to the federal government to allow for reimbursements for broadband service when patients are using it to monitor their heath and improve health outcomes.

RECOMMENDATION 7: Develop public-private partnerships to increase infiltration of telehealth services into the healthcare system.

TH7.1 BIO will collaborate with DHHS and other stakeholders to develop public-private-partnerships to increase telehealth service offerings throughout NC to decrease healthcare costs to the organizations and individuals, increase positive health outcomes, and reach unserved and vulnerable populations.

TH7.2 The state should allot additional staff to DHHS's Office of Rural Health to increase health IT technical assistance to community partners.

Public Safety

NC is home to hundreds of local public safety agencies and several state and federal response agencies. Ubiquitous, reliable communications systems are essential to their operations. But because local, state, and federal response agencies are not required to coordinate these systems, inefficiencies, and operational challenges are inherent and plentiful.

As the Internet of Things (IoT), community cameras, vehicle cameras, body cameras, NextGeneration911 (NG911), and FirstNet develop and become more pervasive, it will be imperative for communication systems to be interoperable and dependable.

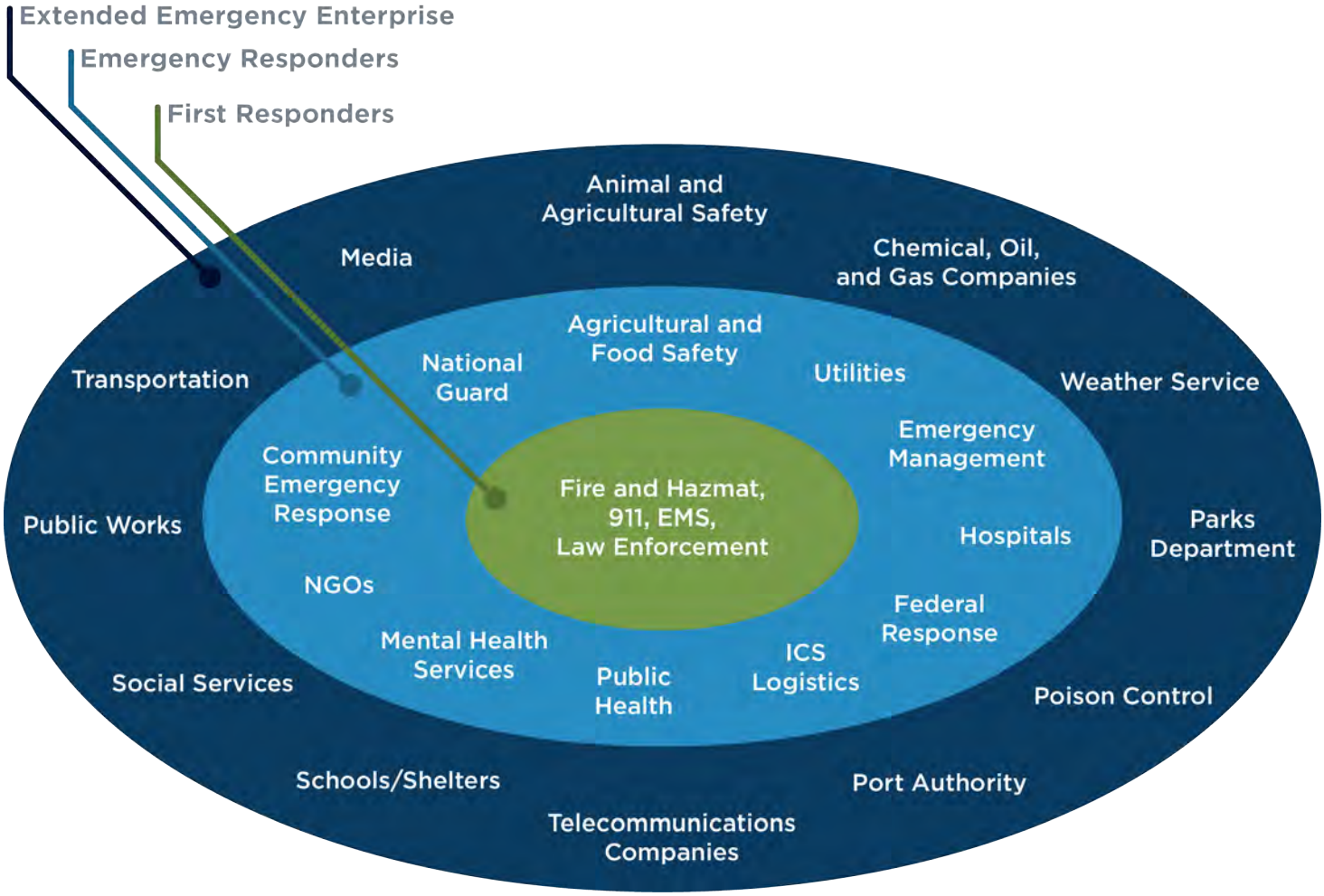
Historically, public safety connectivity was either voice radio communications (also known as Land Mobile Radio or LMR systems) to a Public Safety Answering Point (PSAP or 911 center), or to a jurisdiction-specific dispatch center. Data connectivity was a slow connection to mainframe computers in fixed locations (public safety offices, dispatch centers, or PSAPs).

Over the past few decades, NC channeled federal and state funds into building the Voice Interoperability Plan for Emergency Responders (VIPER), one of the largest interoperable standards-based LMR systems in the country. Public safety professionals around the state at all levels of government are able to use VIPER over a large expanse of geography and at a low cost compared to peer states. However, VIPER only streamlines calls to and from first responders. Mobile data does not transfer over VIPER's networks.

The standard for mobile data transfer is to use commercial cellular data, but it has limitations for public safety use. Commercial mobile data connectivity (cellular) is not designed with public safety needs in mind.

For example, public safety centers typically have generators at radio sites, whereas commercial cellular carriers typically do not. In addition, when using commercial cellular carriers, public safety needs cannot be sufficiently prioritized in emergencies or during large events like festivals, races, or concerts. Events like these cause congestion through extraordinary loading of the commercial cellular service, and limit the effectiveness and utility of commercial service.[lxxxiv]

FIGURE 20. FIRSTNET NC USERS



Finally, most problematic for many NC Public Safety broadband users in sparsely populated areas is coverage. Cellular carriers build where the business case is clearly demonstrated. The business case for saving lives is a different calculation than typically made by stockholders.

FirstNetNC

The Middle Class Tax Relief and Job Creation Act of 2012[lxxxv] established responsibility for building and operating a Nationwide Public Safety Wireless Broadband System. FirstNet will be a national 4G LTE wireless data communications cellular network providing emergency responders with a robust data interoperability capability. This network will be prioritized for emergency responders and will provide coverage for sparsely populated and urban areas. The network will be created through a public-private partnership. A vendor selection process will finalize at the end of 2016, and network deployment is to begin in 2018.

FirstNetNC supports the federal FirstNet effort in NC. FirstNetNC provides education and outreach on the FirstNet project to the first responder agencies throughout all levels of government in NC.

When completed, FirstNet promises to offer high-speed wireless data connectivity for emergency responders to supplement their LMR systems. However, agencies are not mandated to join the network. As such, FirstNetNC's focus on education and outreach is essential to build awareness of the opportunity and benefits of joining the network when it is built.

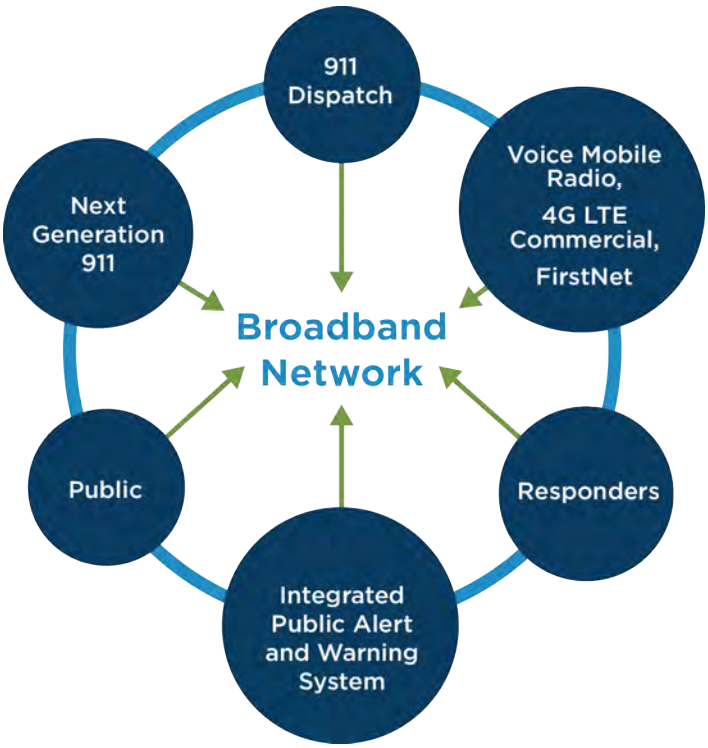
Concurrent with LMR and mobile data, there is a growing need for improved public communications with 911 centers, and between 911 centers and dispatch centers. To date, 911 has largely been merely a voice call from the public to public safety. The growing need by both the public and the response community to handle text messages, Voice over Internet Protocol (VoIP) calls, smartphone images, smartphone video, and transferred calls and data between 911 centers and other public safety dispatch centers has spurred the development and integration of a Next-Generation 911 (NG911) system for NC.

Following the terrorist attacks in 2001, the US Department of Homeland Security (DHS), based on the 9/11 Commission findings, required states to designate a Statewide Interoperability Coordinator (SWIC) and form a State Interoperability Executive Committee (SIEC). North Carolina made the SWIC position into a full-time role under North Carolina Emergency Management (NCEM), and this position serves as the Executive Director for the SIEC.

This recognition of the SWIC's importance has been positive for the state and the emergency response community who rely on the SWIC for assistance in coordinating communication issues throughout the state. The SIEC supports communications in the state by conducting regular meetings with its current membership representing a wide cross section of different disciplines from across the state. The SIEC is also seated on a sub-committee of the State Emergency Response Commission (SERC), which was created in response to the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 to help communities plan for emergencies involving hazardous substances.

The SIEC does not have any regulatory authority, but in collaboration with it's members it created guidelines, procedures, and recommendations for its members. The SIEC has been instrumental in coordinating radio communications throughout the state over the past decade, breaking down silos, and sharing communication assets across various levels of governments and response agencies.

FIGURE 21. BROADBAND'S PUBLIC SAFETY USERS



Future

Where 25 years ago a telephone call to 911 initiated the dispatch of Police, Fire, and EMS who communicated only by voice radio, tomorrow's public safety correspondence will look much different. As such, increased coordination and direction from the state are needed.

Public safety is quickly advancing into the 21st century—a century that requires information highways every bit as capable as the physical highways of the 20th century. But for public safety to use these new information highways, they must be large and secure enough to ensure the effective execution of public safety agencies' missions. The flashing lights on police, fire, and EMS vehicles prioritize safety vehicles on NC roads. Similarly, public safety will require priority of data transport on the new information highways of the 21st century to ensure their life-saving services are delivered efficiently and effectively.

Hospitals can get continuous medical information from the scene of an emergency; building sensors (ex: thermostats) can relay temperatures to fire-fighters; security and

surveillance cameras can allow police to better respond to malls, banks, and schools; and body worn sensors can better warn public safety leadership as to health conditions of firefighters and law enforcement. This is just the beginning of a new paradigm in better response from public safety personnel predicated on increased need for wireless connectivity. Without a better interoperable network, these types of activities will not be possible.

Public Safety Recommendations

RECOMMENDATION 1: The state should continue to work with its federal partners on the national effort to build a state-wide, interoperable data network.

PS1.1 Continue to support the FirstNetNC office by utilizing this resource for any information related to the FirstNet effort.

PS1.2 The state should create an office for Public Safety Communications Technologies within the DIT to work closely with: The Criminal Justice Information Network (CJIN), Criminal Justice Law Enforcement Automated Data Services (CJLEADS), the North Carolina 911 Board, and the DIT Broadband Infrastructure Office -FirstNet North Carolina. This office would support the Department of Public Safety, Department of Health and Human Services - Office of EMS, Department of Insurance - Office of State Fire Marshall, and the many public safety agencies throughout the state especially smaller entities that are not able to explore emerging communications technologies.

RECOMMENDATION 2: The state should continue to pursue and fund the Next-Generation 911 initiative using existing funding.

RECOMMENDATION 3: The state should work with all public safety and first responder agencies to continue eliminating silos and encourage sharing networks.

PS3.1 Continue support for the SWIC position under NCEM.

PS3.2 The state should consider elevating the SIEC to a formally recognized body of communication subject matter experts representing various disciplines across the state. No funding is needed to implement this.

IMPLEMENTATION

> One lesson from the last year is that in a few years, the gigabit divide will not be about wealth or density; it will be between those communities that had a plan and those who didn't.
>
> Blair Levin
> *Former Executive Director of the National Broadband Plan*

To achieve the goal of ensuring every North Carolinian has affordable broadband access by June 2021, the plan must be implemented. This effort requires the pursuit of each of the recommendations by the assigned "owner" named. These duties are divided among the stakeholders who directly impact the broadband ecosystem. They include the executive branch, the General Assembly, local and community leaders, non-profits, and the broadband service providers.

The Broadband Infrastructure Office continues to work closely with communities around the state to enhance or expand service offerings. Through this work and using the knowledge of experienced staff, the office has developed a process to assist communities to meet their objectives. The office will take the lead on implementing and measuring the recommendations it has taken responsibility for in this plan.

In addition, the office will take the responsibility for measuring and tracking the progress of all of the recommendations.

Implementing Across the State's Diverse Regions

BIO continues to work in communities across the state, and every community and county is different. Their infrastructure, assets, leadership, industry, and wealth all contribute to the deployment and adoption of high-speed internet.

Obvious attributes like population density define the challenges between the urban and sparsely populated communities, which have been identified and will be considered during implementation.

Urban areas tend to attract multiple providers. Competition drives innovation and affordability in these areas.

The low number of customers in sparsely populated areas fails to attract multiple providers. Therefore, alternative approaches and strategies must be implemented. There may be communities where competition discourages deployment.

Case Study 9

Jackson

Jackson County is home to 41,000 residents and Western Carolina University. While scenic, the county's broadband infrastructure development was hindered by local ordinances designed to protect scenic mountain views that require high fees for tower development. Jackson's mountainous terrain and the logistical challenges of finding and erecting towers has also limited deployment options.

To address the issues, the county leaders evaluated their ordinances and permitting requirements and considered alternative ways to use new in technologies.

Within the last year, the Jackson County Planning Board adopted new ordinances that allow for omission of permitting fees on small towers. Smaller towers, a recent innovation, allow for more local wireless coverage without substantially impacting the skyline as compared to larger cellular towers.

The ordinance change and the elimination of high permitting fees incentivized entrepreneurs and new ISPs to enter the marketplace. They have since erected multiple small towers with limited-to-no impact on the skyline. These fixed-wireless services continued to rapidly add customers, offering high-speed internet connectivity the county once lacked.

Several large providers play prominent roles in sparsely populated communities and have for many years. After costly build outs, the need for a short turn-around on those investment, and increased demand and competition in urban areas have slowed upgrades for their rural networks. Without a justifiable business case many cannot afford to expand or enhance their networks in these areas.

The FCC's Connect America Fund program attempts to help telephone companies by subsidizing upgrades or expansion in designated "high cost areas." Providers commit to a five-year schedule to provide minimum speeds of 10Mbps download and 1Mbps upload. Five ISPs will receive almost $20 million a year to invest in the state.

This program will assist those homes and businesses that lack adequate broadband in some of the hardest to reach areas of the state. However, many public entities and private businesses in these areas demand greater bandwidth at faster speeds. This program is inadequate to serve those demands.

In these areas, reliance on small, independent providers and cooperatives may be the best option for service. Many of these providers are in a better position to accept government grants and loans; their business models allow them to endure a longer return on investment; and the demands for profit margins are lower than national providers. Telephone cooperatives, all offering high-speed internet services, demonstrate the success of this model.

Another new but popular model involves public entities opening up their infrastructure for private-provider use. This significantly lowers the deployment costs for providers. Most providers prefer to build and own their own networks to ensure uniform engineering and design standards and operational control, as well as competitive reasons.

Case Study 10

Holly Springs

As the Town of Holly Springs considered how to best leverage their communications network, they encountered a difficult decision many municipalities face, should the town own or rent their communications network? But in Holly Springs' case, the answer was neither. Instead, the town took a hybrid approach, building an affordable, "open access" network for internal use and leasing to interested parties.

After developing a robust business model and approval from the town council, the town designed, engineered, and constructed a backbone fiber network to connect municipal buildings. Recognizing the potential benefits for other entities, including private ISPs, the town built extra capacity throughout the network.

The local government also developed policies and strategies to attract private broadband investment. As a result, in 2015 a private ISP signed an "Indefeasible Right of Use" agreement with the town to leverage the fiber backbone to offer symmetrical gigabit internet access to homes and businesses.

Key to the ISP's decision was not only the use of existing broadband infrastructure, but the town's efficient government processes, sharing of information and facilities, and ongoing support. Notably, the use of this infrastructure is not exclusive to this private provider.

However, new market entrants, smaller providers, and a few national providers are adopting this model. Cost savings and market penetration are driving these decisions. Most ride others' networks, in many cases that led to increased comfort in using open access networks.

Despite the different challenges or barriers faced by urban and rural areas, adoption barriers remain fairly consistent between the two. Therefore, the recommendations and strategies for increasing adoption are fairly consistent and rely on localized implementation.

Based on the successful efforts in many NC communities, BIO designed a strategy, in which the state is divided into regions based on the current COGs map. A team of technical assistance and development experts will work with each COG to assess service needs, inventory assets, aggregate demand, identify funding sources, and draft a plan (Figure 22).

The COGs and the communities will take responsibility for implementing the plan. This will ensure these communities are an active participant and have 'skin in the game.' BIO will provide guidance and resources.

FIGURE 22. BROADBAND PROCESS TOOLKIT

CONCLUSION

The benefits of high-speed internet access are well documented through the statistics, academic studies, figures, and data cited throughout this plan. But it is not the greater economic and societal benefits that inspired this plan. Rather, it is the North Carolinians behind these numbers—and the trials and obstacles they face as a result of the digital divide—that invigorates and inspires this plan.

The stories told by hundreds of North Carolinians during the drafting of this plan are sometimes heartwarming but often disheartening. Parents tell stories of driving their children to the local coffee shop or McDonald's every night to find an internet connection to complete homework assignments. Business owners cite struggles competing because their internet service is inadequate. Job applicants convey frustration because they couldn't find an open library or other community anchor institutions after school or work hours to complete job applications.

Dr. Valerie Truesdale, the Chief Officer of Technology, Personalized Learning, and Engagement for the Charlotte-Mecklenburg Public School System, tells a story of Jose, a young student. As part of the district's digital learning initiative, he and his classmates received school-issued laptops. She recounts meeting him in the hallway, the thin device tucked snuggly under his arm. She excitedly asked him what about his life had changed now that he had his own computer. He stopped, looked up at her and in an earnest tone said, "Now I can be curious any time I want."

Curiosity shouldn't be limited to school hours. Learning happens all day long, every day. Curious children who wish to continue their education outside of the school building shouldn't be restricted from doing so because of a lack of broadband access.

In Beaufort County just outside of Chocowinity, farm ownerJane Boahn saw few promising prospects for her farm after the tobacco market collapsed a few years ago. To preserve her family's rural lifestyle with few resources, she converted her farm into a country store, learning center, and venue available for events such as parties and weddings. Seventy-five percent of her advertising, marketing, and event sales are through her website. However, her connection is inconsistent and too slow to scale her business. There are no options for better service available.

These two stories motivate and inspire this plan's objective for ubiquitous access. High-speed internet service can both bridge and widen the digital divide. It provides economically disadvantaged areas with unprecedented opportunities to support business growth and improve the standard of living. But for households without access, it widens the economic and social divide.

The state's current broadband infrastructure serves as a robust foundation for achieving this objective. The economic climate, geographic location, the abundance of middle-mile assets, and investment in digital learning, telehealth initiatives, and public safety communications contribute to that end.

Regardless of the state's current status, the state must position itself for the future.

Future networks will rely heavily on wireless connectivity. As noted above, trends show the public moving to mobile devices, particularly among lower income populations. Wireless providers and handset makers are working to release 5G networks, claiming download speeds hundreds of times faster than current speeds. Wireless backhaul will require next generation infrastructure and equipment, namely fiber-optic cables.

As quickly as technology is changing, the business models supporting broadband services and the infrastructure used to deploy broadband are evolving just as quickly. Reliance on the "way things are done" or outdated laws and regulations will hamper the state's growth and leadership role in this area. Law makers must seriously consider and be amenable to the market-driven commoditization of broadband infrastructure.

Other states and countries around the world are leading initiatives to respond to rising demand. If the state's infrastructure does not support the ever increasing need for greater bandwidth and speeds, people and businesses will move.

This plan charts a pathway to the future. It takes the next steps needed by offering recommendations and models that allow communities and providers to adapt to a constantly changing ecosystem. Based on the belief that active, organized, and informed communities will bridge the digital divide, this plan serves as a resource for state and local leaders.

Achieving the state's goals to eliminate the digital divide and ensure affordable broadband access is available to all citizens by 2021 demands the collective action of state and local leaders, and key stakeholders. Leaders implementing this plan can ensure access to 21st Century infrastructure for all North Carolinians.

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ii. Cisco. Cisco Visual Networking Index: Forecast and Methodology, 2014–2019 White Paper. May 2015. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white_paper_c11-481360.html (accessed February, 2016).

iii. Federal Communications Commission (FCC). 2016 Broadband Progress Report, Appendix E. Washington D.C.: 2016. https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2016-broadband-progress-report (accessed January, 2016).

iv. Wilson and Powers. "Digital Technology and Internet Access Trends in North Carolina: 1999-2013." 2014.

v. At whatever is the current definition of broadband in 2022.

vi. Session Law 2015-241 House Bill 97 Section 7.23 (a)

vii. For the charts in this report, a speed of 25 Mbps (download)/3 Mbps (upload) or faster is used, which is a speed that reflects service levels available to users today and is the Federal Communication Commission's (FCC's) most recent recommended "availability" target recommended in 2015. As a point of reference, a speed combination of 3 Mbps/768 kbps allows a user to access a basic set of applications that include sending and receiving email, downloading Web pages, photos, and video, and simple video conferencing. Applications such as distance learning, telemedicine, and high-quality video conferencing require much faster speeds. In addition, if more than one person shares a connection (e.g., two parents and two children in a household), the group will need greater bandwidth to maintain the same experience level that a single user has over the same connection.

viii. 47 U.S.C.§ 1302(d)(1) ("The term 'advanced telecommunications capability' is defined, without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology.").

ix. N.C.G.S. §62-3(1).

x. Federal Communications Commission, 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment. Washington, D.C., 2015, 3.

xi. Federal Communications Commission, Connecting America: The National Broadband Plan. Washington, D.C., 2010), 138.

xii. FCC, 2016 Broadband Progress Report, 24.

xiii. The FCC increased the threshold as part of the recommendation in its National Broadband Plan (NBP), published in 2010. At that time the NBP recommended the universal target of 4Mbps of actual download speed and 1Mbps of actual upload speed, characterizing the target as "aggressive" and claiming it would be one of the highest targets in the world. It based the target, in part, on the comparable speed the typical broadband subscriber in 2010 received and given past growth rates, what consumers would use in the future. It also made the recommendation to allow the FCC to guide public funding. The NBP recommends the FCC review and reset this target every four years.

xiv. U.S. Department of Commerce. National Telecommunications & Information Administration. U.S. Broadband Availability: June 2010-June 2012: A Broadband Brief. Washington, D.C.: 2013. http://www.ntia.doc.gov/files/ntia/publications/usbb_avail_report_05102013.pdf (accessed January 2016).

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xviii. Last Mile refers to the final leg of the telecommunications network delivering communications connectivity to retail customers-the part that actually reaches the customer.

xix. Federal Communications Commission. "Nationwide Mobile Wireless Coverage." https://www.fcc.gov/reports-research/maps/nationwide-mobile-wireless-coverage-july-2015

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xxiii. Ibid.

xxiv. North Carolina Department of Commerce. North Carolina Science, Technology and Innovation Division. Tracking Innovation North Carolina Innovation Index. Raleigh: 2015. https://www.nccommerce.com/Portals/6/Documents/Resources/TI_NC_2015_Report.pdf (accessed December 2015).

xxv. FCC. 2016 Broadband Progress Report.

xxvi. Pew Research Center. Home Broadband 2015. Raleigh: 2016. http://www.pewinternet.org/2015/12/21/home-broadband-2015/ (accessed March 2016).

xxvii. NC Broadband collected broadband availability data from broadband service providers at a combination of census block, street segment, address levels, and wireless footprints under the requirements of the NTIA's mapping program to reflect coverage of North Carolina households with and without access to broadband. Per the NTIA's methodology, the data may depict access for an entire census block or street segment even if a provider services only a portion of the census block or street segment. Therefore, the coverage may be overstated in some areas.

xxviii. Federal Communications Commission Website. https://www.fcc.gov/ (accessed February 2016).

xxix. General estimates flexible plastic conduit costs around $0.62 per foot and PVC or steel conduit at higher costs. Cable and copper are less expensive than fiber-optic, which is comparatively inexpensive at just over $1 dollar per foot.

xxx. This law has often been debated and as of this publication is embroiled in litigation. In 2015, the FCC issued an order pre-empting the law after the City of Wilson and their municipally owned broadband network, Greenlight, petitioned the FCC to preempt the law.

xxxi. Charles M. Davidson, Michael J. Santorelli. "Understanding the Debate over Government-Owned Broadband Networks: Context, Lessons Learned, and a Way Forward for Policy Makers." The Advanced Communications Law and Policy Institute. New York Law School (2014). https://ncconnect.sharepoint.com/sites/it_teamsites/bb_infra/Documents/Broadband%20Plan/Writing/Research/ACLP-Government-Owned-Broadband-Networks-FINAL-June-2014.pdf (accessed November 2015).

xxxii. George Ford. "The Impact of Government-Owned Broadband Networks on Private Investment and Consumer Welfare." State Government Leadership Foundation. 2016. http://sglf.org/wp-content/uploads/sites/2/2016/04/SGLF-Muni-Broadband-Study-1.pdf (accessed November 2015).

xxxiii. S.L. 2013-185.

xxxiv. North Carolina League of Municipalities. 2013 Legislative Bulletin. http://www.nclm.org/programs-services/publications/bulletins/2013/Lists/Posts/DispForm.aspx?ID=159 (accessed November 2015).

xxxv. FCC. https://ww.fcc.gov/broadband

xxxvi. Social Science Research Council. "Broadband Adoption in Low-Income Communities." Version 1.1. 2010. http://webarchive.ssrc.org/pdfs/Broadband_Adoption_v1.1.pdf (accessed October 2015).

xxxvii. Raul Katz (2012). "Impact of Broadband on the Economy." ITU. 2012. https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf (accessed October 2015).

xxxviii. Federal Communications Commission. https://www.fcc.gov/broadband

xxxix. Pew Research Center. Home Broadband 2015.

xl. FCC. 2016 Broadband Progress Report.

xli. The most recent adoption data published and available is from 12/31/14.

xlii. Thom File and Camille Ryan. Computer & Internet Use in the United States: 2013. American Community Survey Reports. Washington, D.C.: 2013. https://www.census.gov/history/pdf/2013computeruse.pdf (accessed October 2015).

xliii. Pew Research Center. Home Broadband 2015.

xliv. Wilson and Powers. "Digital Technology and Internet Access Trends. 5.

xlv. Pew Research Center. Home Broadband 2015.

xlvi. NC Broadband. LITE-UP Study. 3

xlvii. Federal Communications Commission News. "FCC Modernizes Lifeline Program for the Digital Age." March 31, 2016. http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0404/DOC-338676A1.pdf (accessed April 2016).

xlviii. CenturyLink Website. http://www.centurylink.com/help/index.php?assetid=11 (accessed April 2016).

xlix. Tom Risen. "Google Fiber Gives Free Internet to the Poor." U.S News and World Report, February 3, 2016. http://www.usnews.com/news/articles/2016-02-03/google-fiber-gives-free-internet-to-the-poor (accessed April 2016).

l. Shannon Tufts. "Golden LEAF Rural Broadband Initiative Evaluation: 2015 Annual Report." UNC School of Government. Center for Public Technology. February 1, 2016.

li. Wilson and Powers. "Digital Technology and Internet Access Trends." 5.

lii. Digital Literacy Task force (2011). What is Digital Literacy? Office for Information Technology Policy.

liii. Wilson and Powers. "Digital Technology and Internet Access Trends." 5.

liv. S.L. 2013-12. "SECTION 1. It is the intent of the General Assembly to transition from funding for textbooks, both traditional and digital, to funding for digital materials, including textbooks and instructional resources, to provide educational resources that remain current, aligned with curriculum, and effective for all learners by 2017."

lv. Friday Institute. North Carolina Digital Learning Plan. 2015. http://ncdlplan.fi.ncsu.edu/ (accessed January 2016).

lvi. John Horrigan. "The Numbers Behind the Broadband 'Homework Gap.'" Pew Research Center. April 20, 2015. http://www.pewresearch.org/fact-tank/2015/04/20/the-numbers-behind-the-broadband-homework-gap/ (accessed January 2016). FCC commissioner, Jessica Rosenworcel: "That's because today roughly seven in ten teachers assign homework that requires access to the Internet. But data from where I work -- the Federal Communications Commission -- suggest that as many as one in three households do not subscribe to broadband, due to lack of affordability and lack of interest. Where these figures overlap is what I call the Homework Gap." http://transition.fcc.gov/files/documents/Bridging-the-Homework-Gap-Rosenworcel-Editorial.pdf

lvii. Horrigan. Homework gap.

lviii. CoSN (Consortium for School Networking). 'Digital Equity Action Toolkit." February 2016. http://www.cosn.org/focus-areas/leadership-vision/digital-equity-action-agenda (accessed February 2016).

lix. Data informally provided by technology-related professionals in 113 LEAs from a December 2015 survey conducted by the Friday Institute.

lx. North Carolina Digital Learning Plan, September 2015, pp.29-30. "4. Participate in multi-agency efforts to provide broadband access for all homes. As schools transition to more use of digital resources and tools, students without home access will be increasingly disadvantaged, resulting in a serious lack of equity in educational opportunities. In the near term, schools are using caching technology (so students can download what they need before leaving school) and careful selection of content that allows "offline" usage to help alleviate the problem, but a long term solution is needed both for families that cannot afford Internet access and families in remote areas in which Internet access if not available. This issue of universal home access to the Internet is also critical to the community college and university systems, as well as many other government services.

It is vitally important that LEAs cooperate with county agencies, public safety networks, community colleges, libraries, and other community anchors to ensure the maximum network coverage for the communities that the schools serve. No single government entity will be able to solve the remote residential broadband challenge, but by pooling resources, communities can work together to maximum opportunities for public school students as well as other residents of the communities in the difficult to reach locations.

At the state level, the Office of Digital Infrastructure [Broadband Infrastructure Office] is charged with providing for better coordination and resource sharing across state agencies around broadband and digital infrastructure. The newly created office reports to the state Chief Information Officer and incorporates the former Department of Commerce NC Broadband organization and the FirstNet wireless network for first responders. NCDPI's School Connectivity Initiative team has engaged with Office of Digital Infrastructure and we recommend that NCDPI and NCDLC play an active role with the Office moving forward."

lxi. 143-64.03. Powers and duties of the State agency for surplus property. (a) The State Surplus Property Agency is authorized and directed to: (1) Sell all State owned supplies, materials, and equipment that are surplus, obsolete, or unused and sell all seized vehicles and other conveyances that the State Surplus Property Agency is authorized to sell; (2) Warehouse such property; and (3) Distribute such property to tax-supported or nonprofit tax-exempt organizations. (b) The State Surplus Property Agency is authorized and empowered to act as a clearinghouse of information for agencies and private nonprofit tax-exempt organizations, to locate property available for acquisition from State agencies, to ascertain the terms and conditions under which the property may be obtained, to receive NC General Statutes - Chapter 143 Article 3A 2 requests from agencies and private nonprofit tax-exempt organizations, and transmit all available information about the property, and to aid and assist the agencies and private nonprofit tax-exempt organizations in transactions for the acquisition of State surplus property. (c) The State agency for surplus property, in the administration of Part 1 of this Article, shall cooperate to the fullest extent consistent with the provisions of Part 1 of this Article, with the departments or agencies of the State. (d) The State agency for surplus property may sell or otherwise dispose of surplus property, including motor vehicles, through an electronic auction service. (1991, c. 358, s. 2; 2003-284, s. 18.6(a); 2015-241, s. 27.3(f).)

lxii. U.S. Economic Development Administration website. https://www.eda.gov/ (accessed March 2016).

lxiii. Strategic Networks Group (SNG). "eSolutions Benchmarking Report 2014." 2014. 28.

lxiv. On a scale of 1 to 5, "Increasing small businesses' adoption of broadband in NC" received a mean score of 4.53,

lxv. Jason Wiens and Chris Jackson. "The Importance of Young Firms for Economic Growth." Ewing Marion Kauffman Foundation. September 13, 2015. http://www.kauffman.org/what-we-do/resources/entrepreneurship-policy-digest/the-importance-of-young-firms-for-economic-growth (accessed March 2016).

lxvi. NC Small Business and Technology Development Center. "2015 State of Small Business and Entrepreneurship." 2015. http://www.sbtdc.org/pdf/ssb.pdf (accessed May 2016).

lxvii. Donna Harris and Patrick McAnaney. "Innovation that Matters." U.S. Chamber of Commerce Foundation, 1776, Free Enterprise. 2016. http://40uy5g2te0h53zha643shzzp.wpengine.netdna-cdn.com/assets/uploads/2016/05/Innovation-that-Matters-2016.pdf (accessed May 2016).

lxviii. SNG. E-Solutions Report. 17

lxix. Ibid.

lxx. North Carolina Chamber of Commerce Website. https://ncchamber.net/foundation/ncworks-certified-work-ready-communities/ (accessed May 2016).

lxxi. FCC. National Broadband Plan. 168.

lxxii. Ibid.

lxxiii. Surveyed businesses with 10+ employees only.

lxxiv. Because broadband adoption and digital literacy are so inextricably linked, some recommendations promoting the increase of digital literacy in K-12 students and NC households is found in other sections of the plan such as the Adoption and K-12 Homework Gap sections.

lxxv. U.S. Economic Development Administration Website. "CEDS Content Guidelines." https://www.eda.gov/ceds/ (accessed March 2016).

lxxvi. U.S. Economic Development Administration Website. "What is Economic Development?" https://www.eda.gov/index.htm (accessed March 2016).

lxxvii. The Henry J. Kaiser Family Foundation. "Disparities in Health and Health Care: Five Key Questions and Answers." November 30, 2012. http://kff.org/disparities-policy/issue-brief/disparities-in-health-and-health-care-five-key-questions-and-answers/ (accessed March 2016).

lxxviii. Center for Connected Health Policy, the National Telehealth Policy Resource Center. "What is Telehealth?" http://cchpca.org/what-is-telehealth (accessed March 2016).

lxxix. HIMSS website. "Definitions of mHealth." http://www.himss.org/ResourceLibrary/GenResourceDetail.aspx?ItemNumber=20221 (accessed March 2016).

lxxx. Brendan FitzGerald. "Why a 3 percent rise in telehealth usage makes a big difference." Healthcare IT News. September 30, 2015. http://www.healthcareitnews.com/blog/why-3-percent-rise-telehealth-usage-makes-big-difference (accessed March 2016).

lxxxi. The Patient Protection and Affordable Care Act, P.L. 111-148

lxxxii. Wearable devices are clothing and accessories incorporating computer and advanced electronic technologies.

lxxxiii. Parmy Olson. "Wearable Tech is Plugging into Health Insurance." Forbes. June 19, 2014. http://www.forbes.com/sites/parmyolson/2014/06/19/wearable-tech-health-insurance/#141db31f5ba1 (accessed March 2016).

lxxxiv. Total possible core users: 115,575. The approximate numbers of the following categories of personnel in NC Fire & Hazmat, Law Enforcement, 911 Centers, and Emergency Medical Services: Local Firefighters and Hazmat, 52,000; Law Enforcement, 504 agencies, 23,442 sworn officers and staff; EMS, 39,533 as of 9/21/2015; 911 Centers, 600.

lxxxv. PL 112-96. Feb. 22, 2012

Glossary and Defenitions

Broadband Adoption	The proportion of citizens subscribing to internet service.
BIO	Broadband Infrastructure Office
CAGR	Compound Annual Growth Rate
CAPX	Capital expenditures
CDBG	Community Development Block Grant
CEDS Plans	Comprehensive Economic Development Strategy Plans
COG	North Carolina Council of Governments
DES	Division of Employment Security
DHS	U.S. Department of Homeland Security
Digital Divide	The gulf between those who have ready access to computers and the internet, and those who do not.
DSL	Digital Subscriber Line
EDP	NC Economic Development Partnership
EPCRA	Emergency Planning and Community Right-to-Know Act
FCC	Federal Communications Commission
FirstNet	The forthcoming nation-wide interoperable wireless data network for first responders
FTTH or FTTP	Fiber to the Home or Premises
FTTN	Fiber to the Node
Gbps	Giga-bit per second
GDAC	North Carolina's Government Data Analytics Center
GDP	Gross Domestic Product
HCF	Healthcare Connect Fund
ICT	Information and Communication Technologies
IoT	Internet of Things
IP	Internet Protocol
ISP	Internet Service Provider
LEA	Local Education Authority
LEAD	Labor and Economic Analysis Division of the NC Department of Commerce
LMR	Land Mobile Radio
Mbps	Mega-bit per second
mHealth	Mobile Health
NC DPI	North Carolina Department of Public Instruction
NC DPS	North Carolina Department of Public Safety
NC LITE-UP	North Carolina Linking Internet to Economically Underprivileged People
NCACC	North Carolina Association of County Commissioners
NCDOC	North Carolina Department of Commerce
NCDOT	North Carolina Department of Transportation
NCEM	North Carolina Emergency Management
NCGA	North Carolina General Assembly
NCHICA	North Carolina Healthcare Information and Communications Alliance
NCLM	North Carolina League of Municipalities
NCSU	North Carolina State University
NCTA	North Carolina Technology Association
NCTN	North Carolina Telehealth Network
NG911	Next Generation 911
PSAP	Public Safety Answering Point
PUC	Public Utility Commission
RFP	Request for Proposal
ROI	Return on Investment
ROW	Right of Way
RPM	Remote Patient Monitoring
SBA	Small Business Administration
SBC	Small Business Centers
SBTDC	Small Business and Technology Development Centers
SCIO	State Chief Information Officer

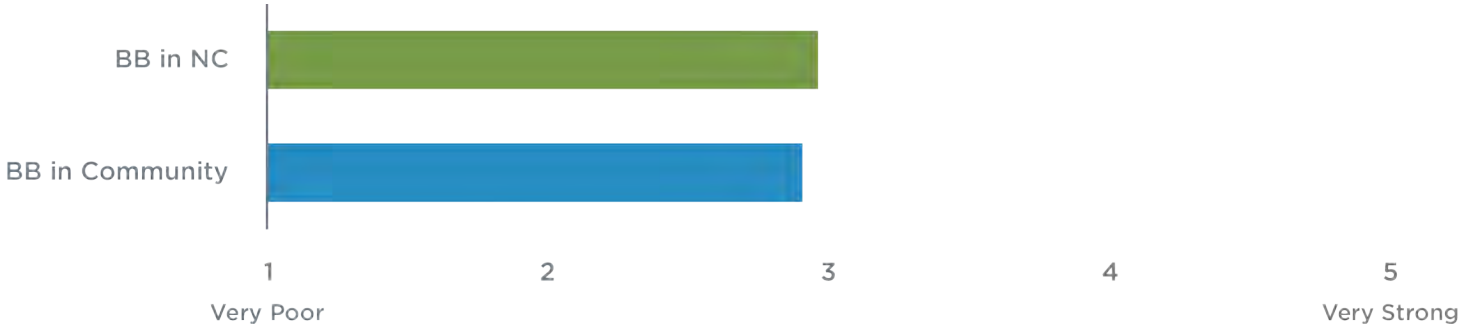
SERC	State Emergency Response Commission
SIEC	State Interoperability Executive Committee
SWIC	Statewide Interoperability Coordinator
USAC	Universal Service Administrative Company
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USEDA	U.S. Economic Development Administration
VIPER	Voice Interoperability Plan for Emergency Responders
VoIP	Voice over Internet Protocol
WAN	Wide Area Network
WISP	Wireless Internet Service Provider

Appendix A

Broadband Deployment and Adoption Survey Results

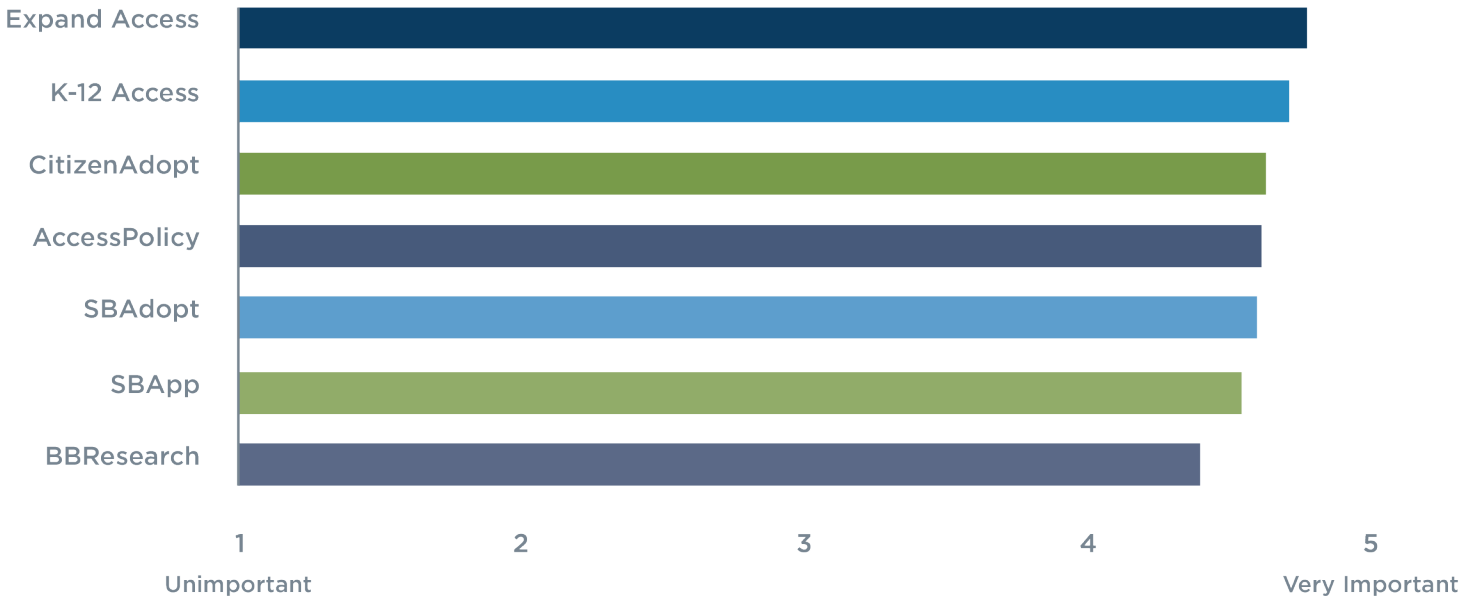
BROADBAND STREGNTH

	Mean	SD
Broadband Internet in NC is...	2.96	0.71
Broadband Internet in my community is...	2.91	1.19



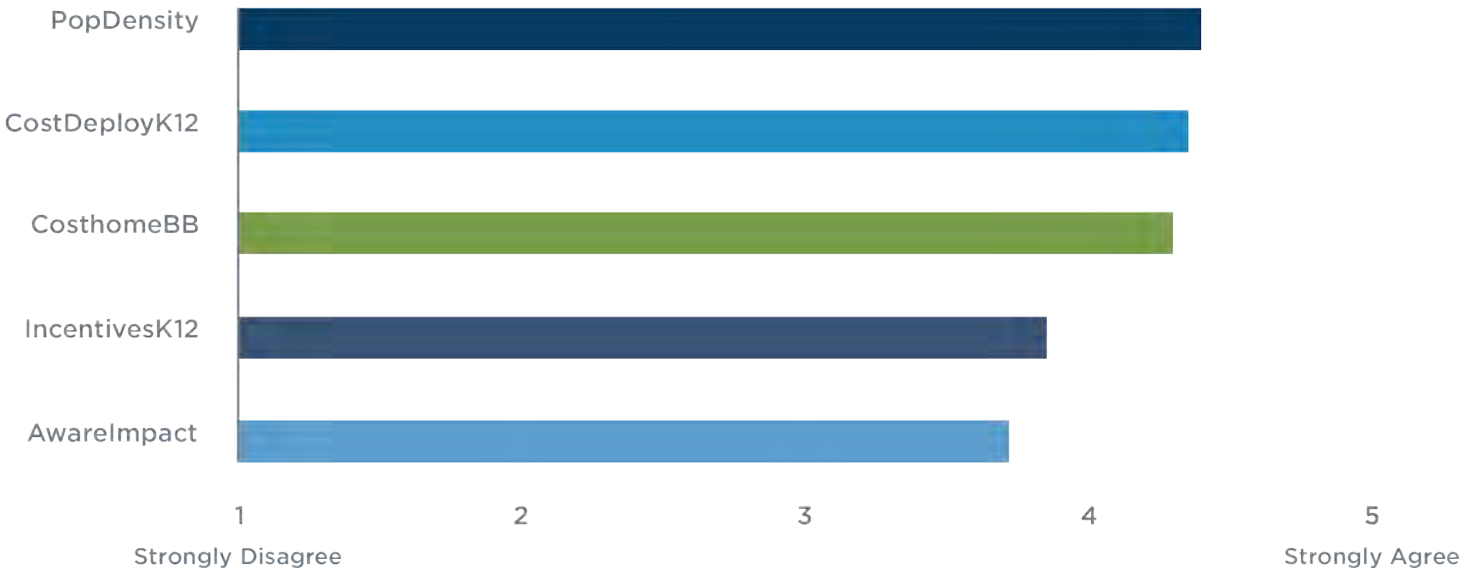
BROADBAND ISSUES

	Mean	SD
Expanding Access to broadband in NC is...	4.70	0.61
Ensuring that K-12 students have access to broadband in their homes is...	4.64	0.68
Increasing citizens' adoption of broadband in NC is...	4.55	0.71
Developing statewide policies that enhance access to broadband in NC is...	4.54	0.82
Increasing small businesses' adoption of broadband in NC is...	4.53	0.70
Improving small businesses' ability to use web-based apps is...	4.47	0.74
Conducting research on the state of broadband in NC is...	4.32	0.88



CHALLENGE: K-12 STUDENTS' ABILITY TO ACCESS BROADBAND AT HOME

	Mean	SD
Low population density in unserved areas.	4.42	0.83
Cost to deploy infrastructure to each household.	4.37	0.90
Cost of household broadband subscriptions.	4.31	0.84
Lack of incentives offered for the deployment of broadband.	3.87	1.03
Awareness about how broadband impacts students' education.	3.74	1.13

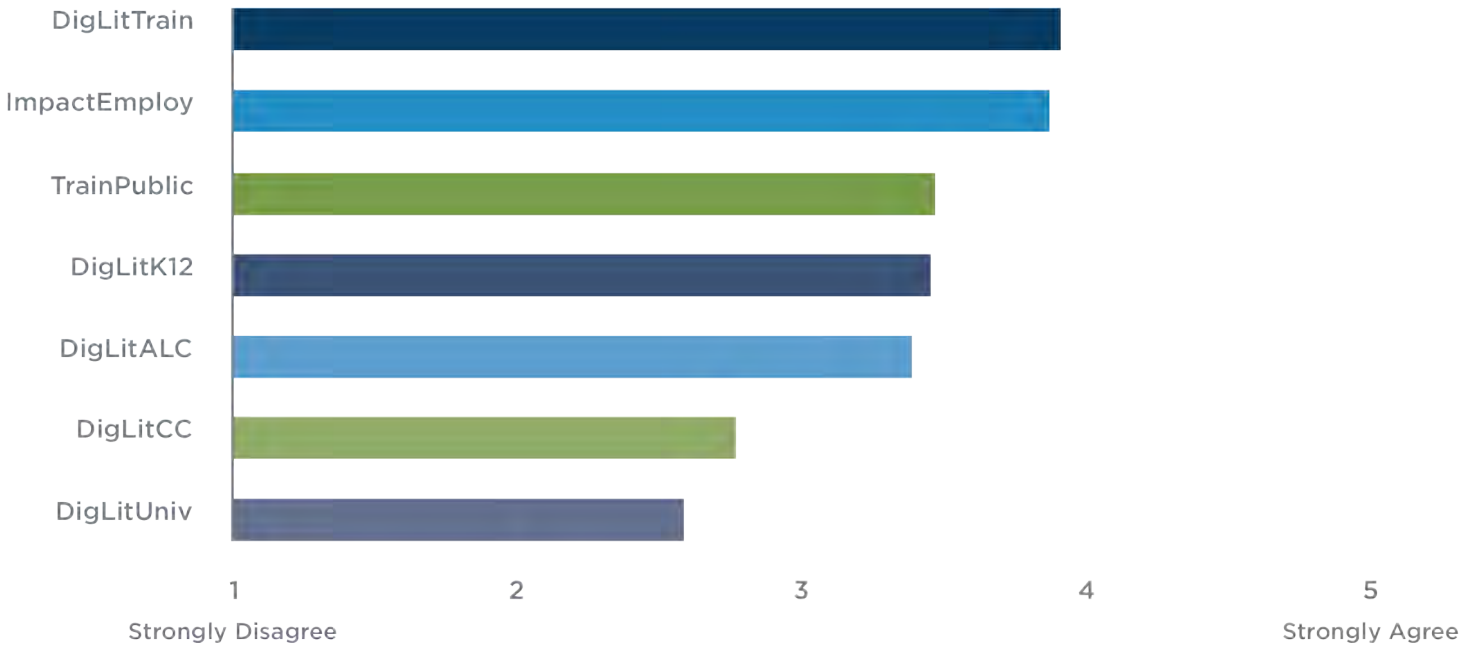


Qualitative Responses

- Lack of competition to drive down prices driven by legislation that inhibits competition.
- Less regulation for the providers to broaden their reach.
- I think we should offer it to every student but it should be monitored and limits set on use.
- Lack of provider competition increases cost
- Everyone knows the impact of not having broadband affects students but the incentives are not there for deployment.
- Desire by households to use broadband internet
- Cost of devices such as computers.

CHALLENGE: DEVELOPING A DIGITALLY LITERATE WORKFORCE

	Mean	SD
Public's awareness of digital literacy training services.	3.91	0.83
Public's awareness of how digital literacy skills impact employment.	3.87	0.91
Inability of existing training programs to meet the public's needs.	3.47	0.98
Inability of the public K-12 system to prepare digitally literate job seekers.	3.45	1.14
Inability of Adult Learning Centers to prepare digitally literate job seekers.	3.39	1.01
Inability of Community Colleges to prepare digitally literate job seekers.	2.77	1.07
Inability of public universities to prepare digitally literate job seekers.	2.59	1.10

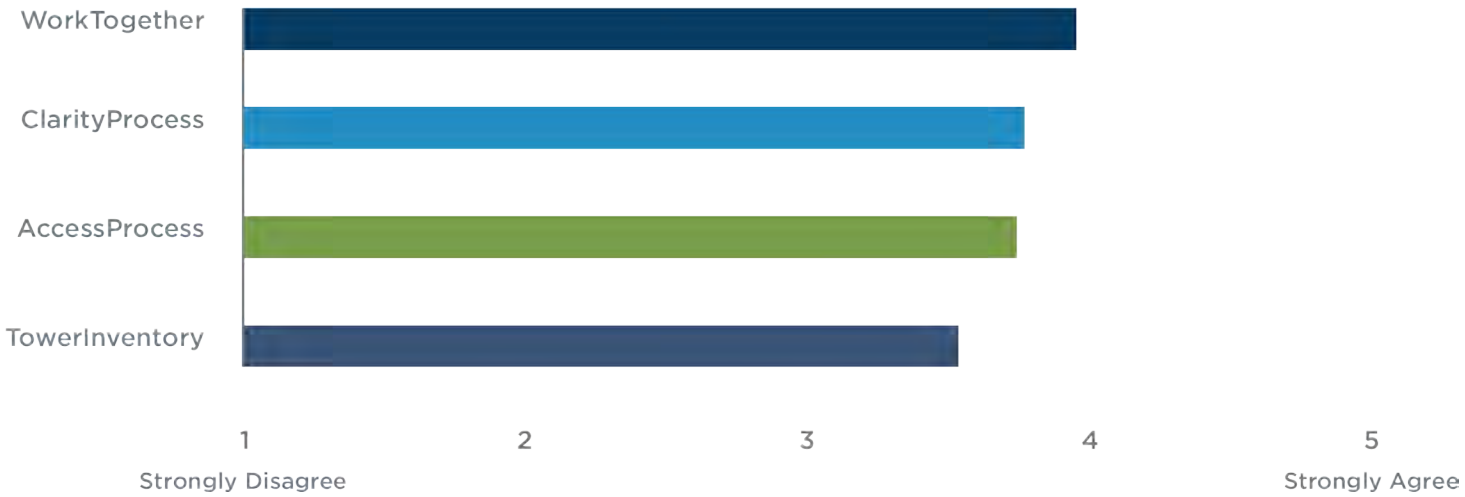


Qualitative Responses

- Many don't want to learn and will not take advantage of the training offered.
- Lack of broadband access to homes is the most important factor inhibiting digital literacy.
- Lack of K12 school oversight and control of internet access (filters, etc.)
- It is not the role of the government to tell the people what they should or should not learn.
- Do not forget the role of public libraries for providing access.
- Communication between the public and private sector is paramount. Public sector cannot offer services if it is unaware of the need. Likewise, private sector can't reach out to the public sector if they are not aware that it is available.

CHALLENGE: LEVERAGE EXISTING TOWER INFRASTRUCTURE TO INCREASE BROADBAND ACCESS

	Mean	SD
Willingness of public and private tower owners to work together to expand access	3.97	1.00
Clarity of state policies for accessing towers	3.78	0.93
Process for accessing towers	3.75	0.98
Inability to locate an inventory of towers throughout the state	3.55	1.09

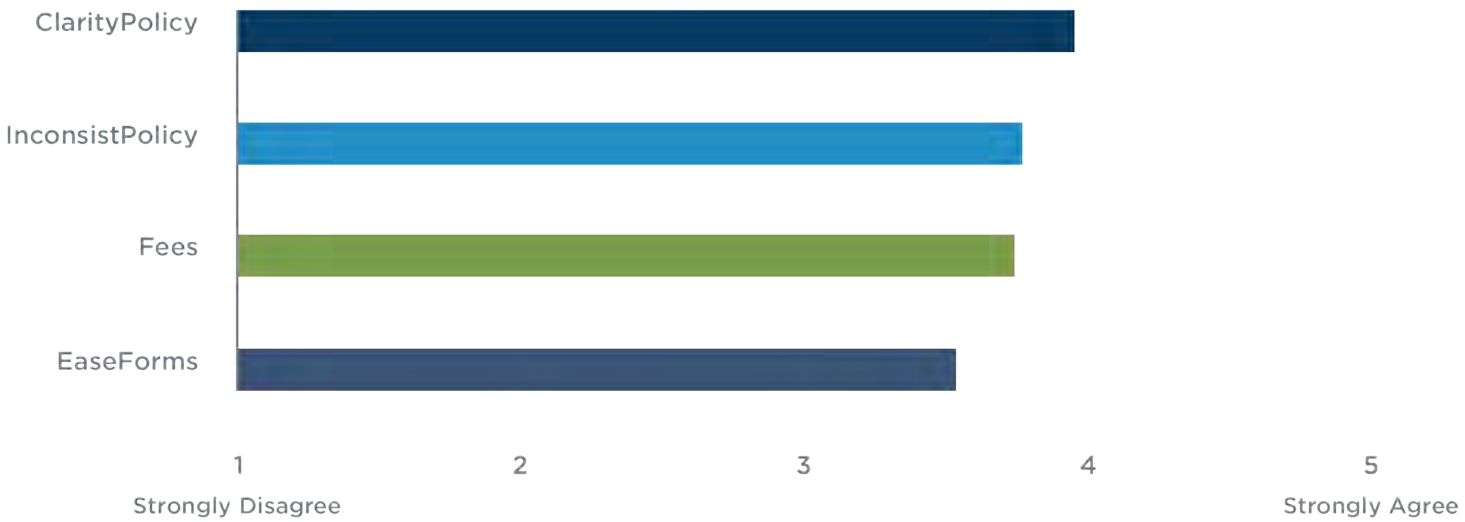


Qualitative Responses

- Backbone infrastructure providers have no incentive to offer access to towers.
- Willingness of citizens to allow such towers in their communities.
- Cost schedules applicable to major carriers are too expensive for small, rural carriers.
- There has to be collaboration for the project to succeed.
- Assumes cell phone and radio signals reach everywhere - please visit WNC to see examples of entire communities and large areas where no cell phone or radio signals work.
- Marty Randall and Capt. Blanks have been extremely helpful in working with Person County on our efforts to lease tower space to a private provider.
- The county owns numerous assets that could help in deployment. However due to legislation there is gray area as to how we can affordably get broadband to our rural citizens without upsetting the private businesses or accused of offering broadband internet as “infrastructure”. That legislation makes the who process very dicey and unappealing for local governments.

CHALLENGE: ACCESS EASMENTS FOR BROADBAND PROVIDERS

	Mean	SD
Clarity of existing easement policies.	3.68	0.91
Inconsistency of easement policies across the state.	3.66	0.92
Cost of fees for obtaining easements.	3.58	1.02
Inability to locate the forms necessary to obtain easements.	3.27	0.97

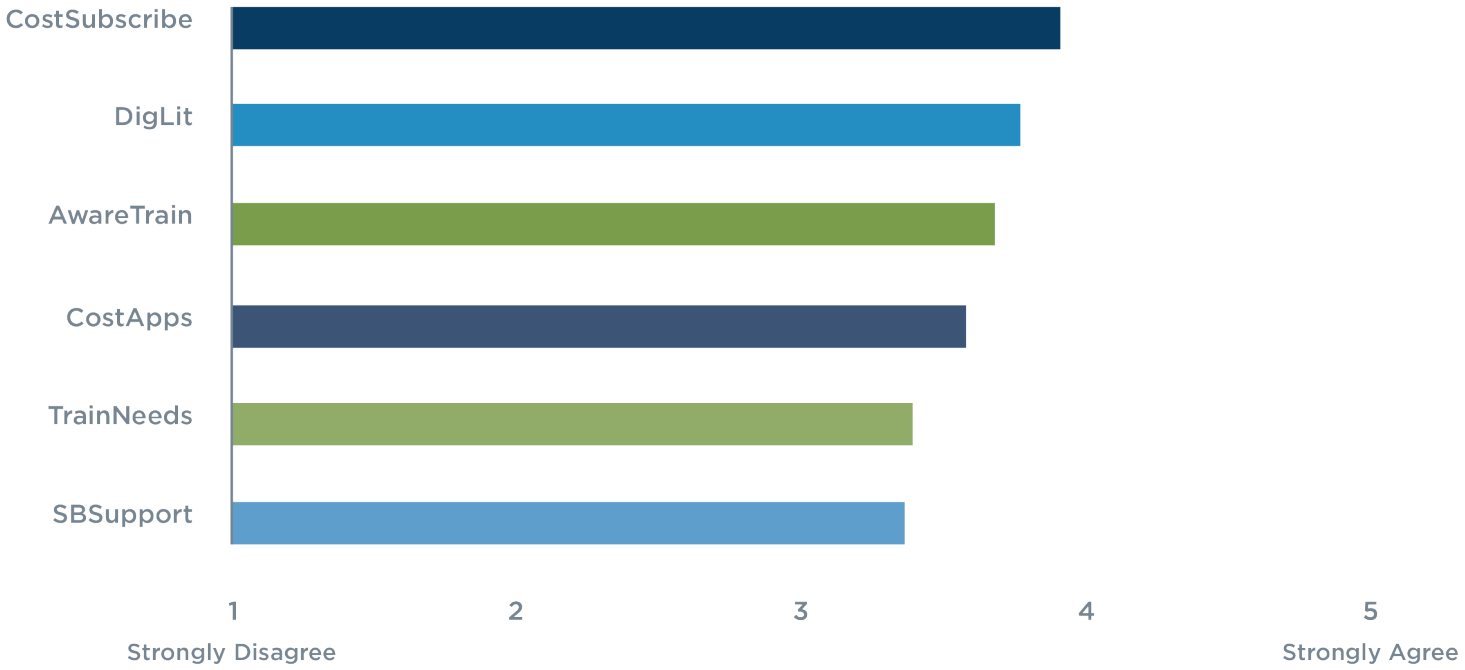


Qualitative Responses

- Cities and owner of pole should be paid for attachment ATT and TWC pay.
- Internet providers are not willing to work together, trying to protect their turf. They try to hold others hostage with use of existing poles/easements.
- Willingness and/or ability of agencies to streamline the permitting processes required to grant access to easements (cut time consuming red tape).
- Use of subcontractors who don't follow easements and accepted practices when installing items for franchisees.
- Refusal from citizens to allow easements for this use on their property.
- The narrow limitations on existing easements for their use - for example inablity to use a waterline or road easement to also place underground cable.

CHALLENGE: SMALL BUSINESSES' ABILITY TO USE BROADBAND INTERNET AND RELATED TECHNOLOGY

	Mean	SD
Cost of broadband subscriptions.	3.89	1.00
Businesses' digital literacy levels.	3.75	0.97
Businesses' awareness of existing digital literacy training programs.	3.66	0.93
Cost of web-based applications.	3.57	1.01
Inability of existing digital literacy training programs to meet business needs.	3.37	0.93
Willingness of small business support organizations to work together to improve utilization.	3.35	0.94

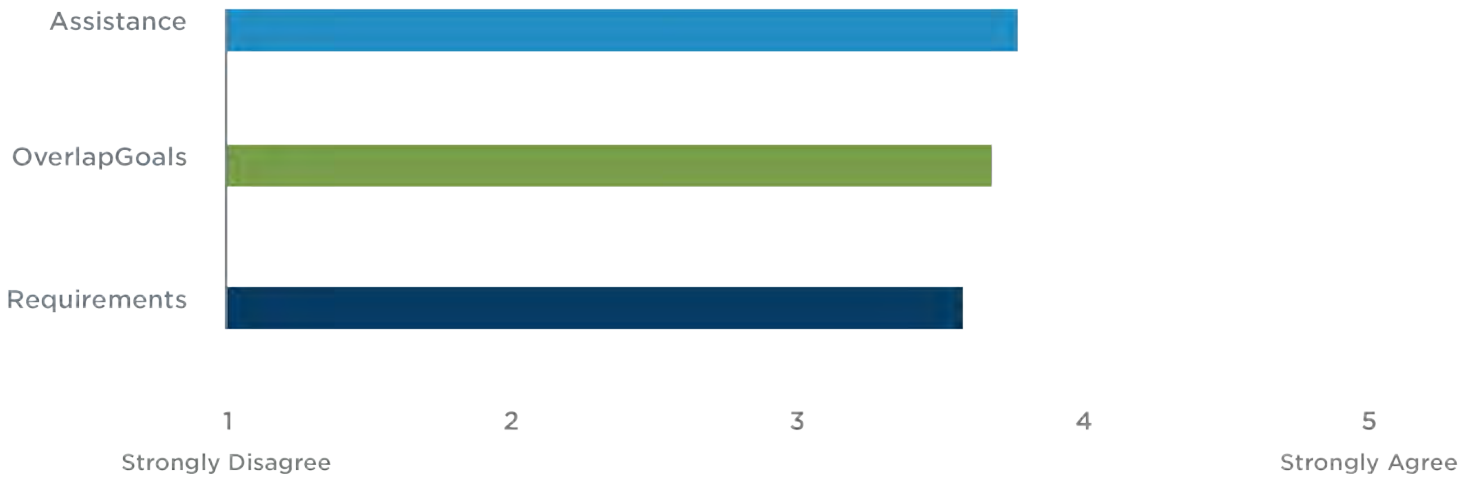


Qualitative Responses

- Many computer illiterate business owners over age 50 have no interest in taking the time or spending the money to learn how to use a computer or the internet.
- Access is the issue, not whether businesses are willing to indulge in digital literacy training, it is available.
- Incentive programs need to support the need and training.
- Lack of broadband access, especially inhibits home businesses.
- Discriminatory pricing of internet access to small businesses.
- The availability of competitively priced gigabit fiber would likely help stimulate small business support organizations to assist small businesses with the adoption of new technologies.

CHALLENGE: STATE AND PRIVATE SECTOR COLLABORATION TO EXPAND BROADBAND INFRASTRUCTURE

	Mean	SD
Amount of assistance available for expansion of infrastructure.	3.91	0.90
Inability of the state and private sector to identify overlapping goals.	3.76	0.83
Requirements that must be met for using incentive funds.	3.73	0.96



Qualitative Responses

- Lack of authority given to local government (especially counties) to facilitate deployment.
- State assistance should only be provided to local government to help enable deployment. No assistance should be provided to private providers.
- Education of willing investors when large telecoms will not invest in last mile.
- Government grants are not the answer.
- There are large swathes of this state where no private sector providor serves; or only one is available and believes 3/10 is broadband. It's not. I would like every state official and internet providor executive to spend a week trying to operate with a slow and inconsistent internet connection.
- The willingness of the STATE LEGISLATURE to recognize that broadband internet service is the rural electrification issue of the 21st century and the willingness to ignore the impact that not expanding broadband to rural areas has on the lives of rural North Carolinians and the state in general.
- Private sector's relluctance to expand infrastructure due to lack of competition.
- The ability to lease existing dark fiber in traffic signal system networks to private carriers in order to build out broadband infrastructure.

Appendix B

Stakeholder Sessions and Participants

K-12 HOMEWORK GAP 1

Participants:

- MCNC
  - Jean Davis, President and CEO
  - Mark Johnson, Chief Technology Officer
- Friday Institute
  - Phil Emer, Director Technology Planning and Policy
  - Jeni Corn, Director of Evaluation Programs
  - Ray Zeisz, Director, Enterprise Infrastructure Programs
- Kramden Institute
  - Michael Abensour, Executive Director
- Golden Leaf Foundation
  - Dan Gerlach, President
  - Mark Sorrells, Senior Vice President

K-12 HOMEWORK GAP 2

Participants

- Department of Public Instruction (DPI)
  - Verna Lalbeharie, Digital Teaching and Learning Director
  - Michael Ramsey, Network Analyst
- NC Virtual Public School
  - Mia Murphy, Director Outreach and Support
  - Tonya Easterwood, Director of Technology

AVAILABILITY 1: PROVIDERS

Participants:

- AT&T Legislative and External Affairs
  - Trey Rabon, Executive Director of Governmental Affairs
- Time Warner Cable
- CenturyLink
  - Steve Brewer, State Government Affairs
- Frontier
  - Susan Miller, Government and Regulatory Affairs Manager

AVAILABILITY 2: PROVIDERS AND EXPERTS

Participants:

- NC Wireless
  - Josh Strickland, Co-Founder
- Verizon Wireless
  - Earl Struble, National Account Manager
  - Bradley Friang
- Sky Runner
  - Jonathon Wood, Marketing and Outreach Manager
- Wireless Research Center
  - Gerard Hayes, President and CEO
  - Larry Steffann, General Manager

AVAILABILITY 3: LOCAL GOVERNMENT EXPERTS

Participants:

- North Carolina Association of County Commissioners
  - Johanna Reese, Director of Government Relations
  - Hugh Johnson, Government Relations Coordinator
- North Carolina League of Municipalities
  - Erin Wynia, Legislative Council
- North Carolina State University
  - Marc Hoit, Vice Chancellor for IT and CIO
- Village of Bald Head Island
  - Calvin Peck, Village Manager
- Invited but did not attend:
  - NCNGN

AVAILABILITY 4: LEVERAGING STATE AND REGIONAL ASSETS EXPERTS

Participants:

- State Librarian's Office
  - Cal Shepard, State Librarian
- FirstNET NC
  - Alan Sadowski, SPOC
  - Glenn Knox, Network Analyst

- Yancey County Economic Development Commission
  - Wanda Proffitt, Director
- Invited but did not attend:
  - North Carolina Local Government Information Systems Association
  - City of Conover IT Department

REGIONAL PROVIDERS

Participants:

- North State Communications
  - Will Greene, Account Executive
- Greenlight
  - Will Aycock, General Manager
- Country Cable
  - Dean Russell
- PANGAEA Internet
  - Ron Walters, Executive Director

ECONOMIC DEVELOPMENT 1: SMALL BUSINESS SUPPORT EXPERTS

Participants:

- UNC Kenan Institute of Private Enterprise
  - Mark Little, Interim Executive Director
- North Carolina Chamber of Commerce
  - Gary Salamido, Vice President, Government Affairs
- North Carolina Economic Development Partnership
  - John Loyack, Vice President, Global Business Services
- North Carolina Rural Center
  - Barry Ryan, Senior Director of Programs
- Invited but did not attend
  - Small Business and Technology Development Centers
  - North Carolina State University Industrial Expansion Services

WORKFORCE DEVELOPMENT EXPERTS

Participants:

- Lenovo
  - Ryan Rand, Account Executive
- The NC Department of Commerce Labor and Economic Analysis Division
  - Joshua Levy
- The Office of Science, Technology and Innovation
  - Scott Doran, Associate Director
- Cisco
  - Amy Stevens, Community Relations
  - Jeff Moore, Manager
- North Carolina Community College System
  - Anne Bacon, Director of Strategic Innovations
- North Carolina Department of Commerce Division of Workforce Solutions
  - Mark Edmonds, Chief Operating Officer
- The Research Triangle Park Foundation
  - Brett Brenton, US2020 STEM Outreach Project Director
- Bandwidth/Tech Girlz
  - Dierdre Clarke, Director of Product Marketing and Strategy
- RedHat, Inc.
  - Thomas Mirc, Senior Manager
- Invited but did not attend:
  - The Iron Yard

TELEHEALTH EXPERTS

Participants:

- NC Healthcare Information and Communications Alliance (NCHICA)
  - Jennifer Anderson, Executive Director
- Office of Research, Demonstrations, and Rural Health, NC Department of Health and Human Services
  - Anne Braswell, Manager, Integrated Health Systems
- Appalachian Regional Commission
  - Mark DeFalco, Manager, Program Operations
- Rural Economic Development Division, NC Department of Commerce
  - Olivia Collier, Appalachian Regional Commission Program Manager
- MCNC
  - Mark Johnson, CTO
  - Laura Horne, Senior Customer Service/Sales Representative
- North Carolina Telehealth Network
  - Dave Kirby, Project Manager and President of Kirby Management Consulting
- Invited but did not attend:
  - Blue Cross Blue Shield

Appendix C

Individual Stakeholder Meetings

Andrew Cohill, CEO, Wide Open Networks

Angela Bailey, former Director, NC Broadband

Blair Levin, Senior Fellow, Brookings Institution

Brooks Raiford, President and CEO, North Carolina Technology Association

Bruce Clark, Digital Inclusion Project Manager, James L Knight School of Communication

David Sobotta, Vice President of Marketing, Wide Open Networks

Deborah Watts, former Research Director, NC Broadband

Eric Cramer, President and CEO, Wilkes Communications

Erik Garr, Regional Manager, Google Fiber

Joe Freddoso, Chief Operating Officer, Mighty River LLC.

Jane Smith Patterson, President, View Forward-Go Forward

Joe Starks, President, ECC Technologies

Joe Magno, Executive Director, The North Carolina Center of Innovation Network

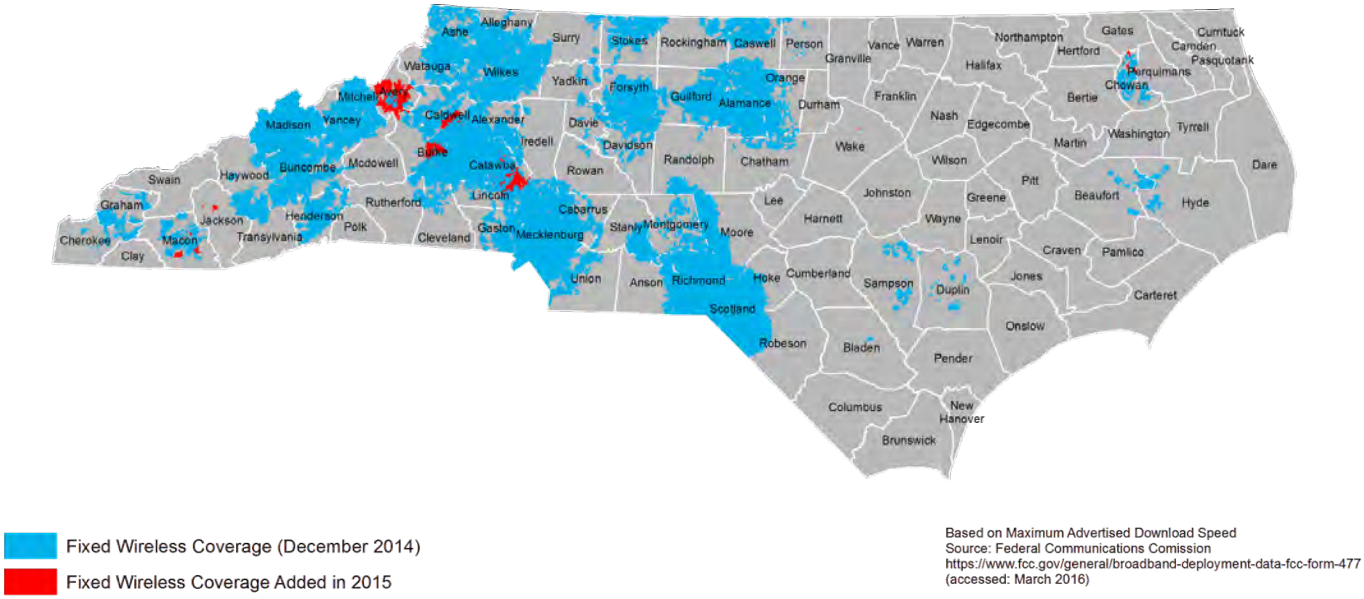
Patricia Mitchell, Assistant Secretary of Commerce, Rural Division, North Carolina Department of Commerce

Shannon Tufts, Assistant Professor and Director, UNC-Chapel Hill School of Government Center for Public Technology

The North Carolina Councils of Governments

Appendix D

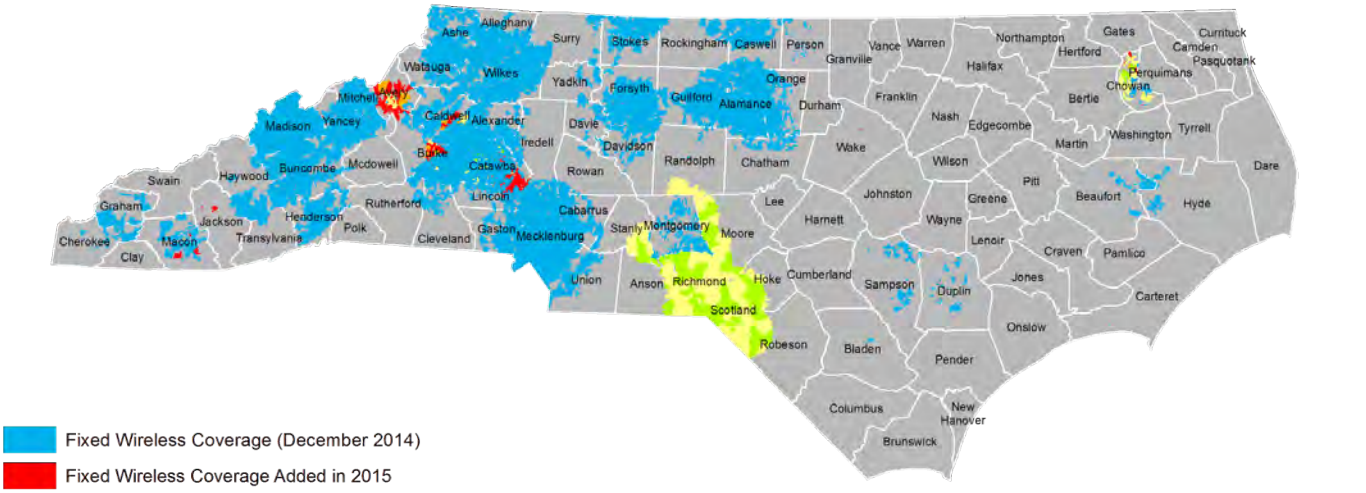
Infrastructure Expansion by Technology, 2014-2015



Fixed Wireless Coverage (December 2014)

Fixed Wireless Coverage Added in 2015

Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



Fixed Wireless Coverage (December 2014)

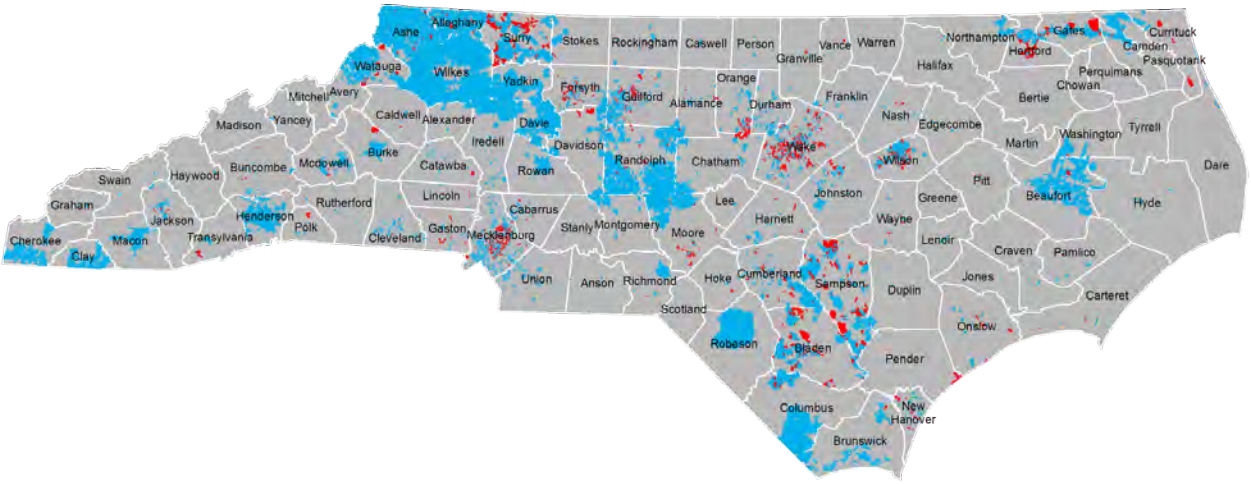
Fixed Wireless Coverage Added in 2015

Fixed Wireless Coverage with Increased Speed* from 2014 to 2015

Low to Moderate Income Areas with Fixed Wireless Coverage Added in 2015

Low to Moderate Income Areas with Fixed Wireless Coverage with Increased Speed* from 2014 to 2015

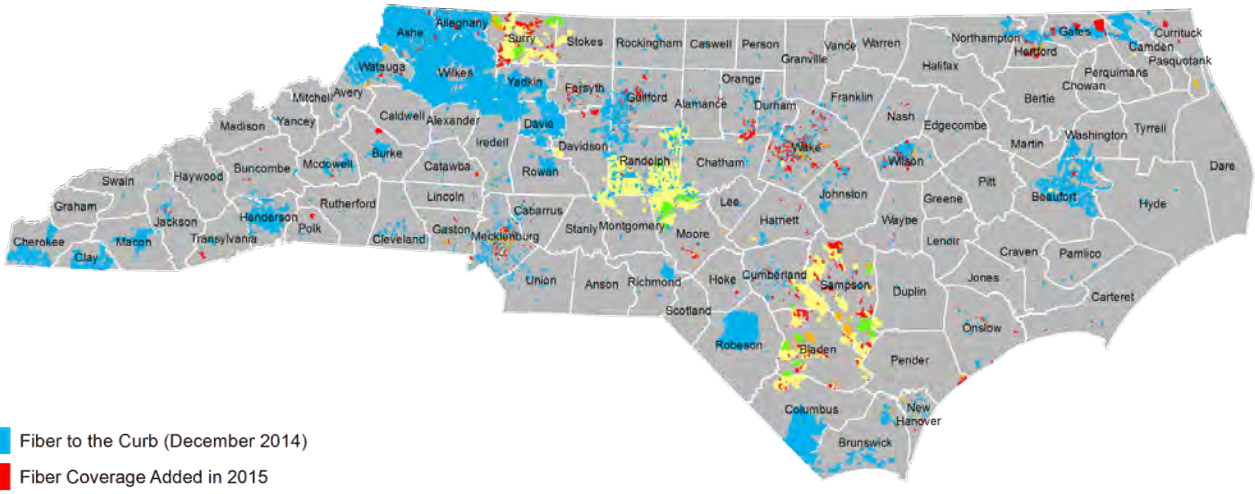
Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



Fiber to the Curb (December 2014)

Fiber Coverage Added in 2015

Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



Fiber to the Curb (December 2014)

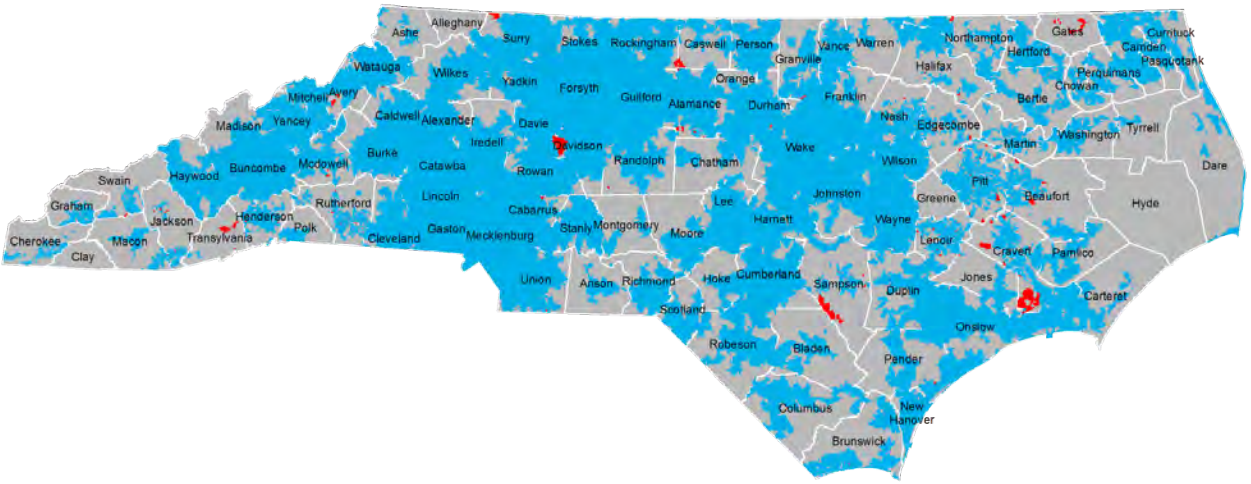
Fiber Coverage Added in 2015

Fiber Coverage With Increased Speed* from 2014-2015

Low to Moderate Income Areas with Fiber Coverage Added in 2015

Low to Moderate Income Areas with Increased Fiber Coverage Speed* from 2014-2015

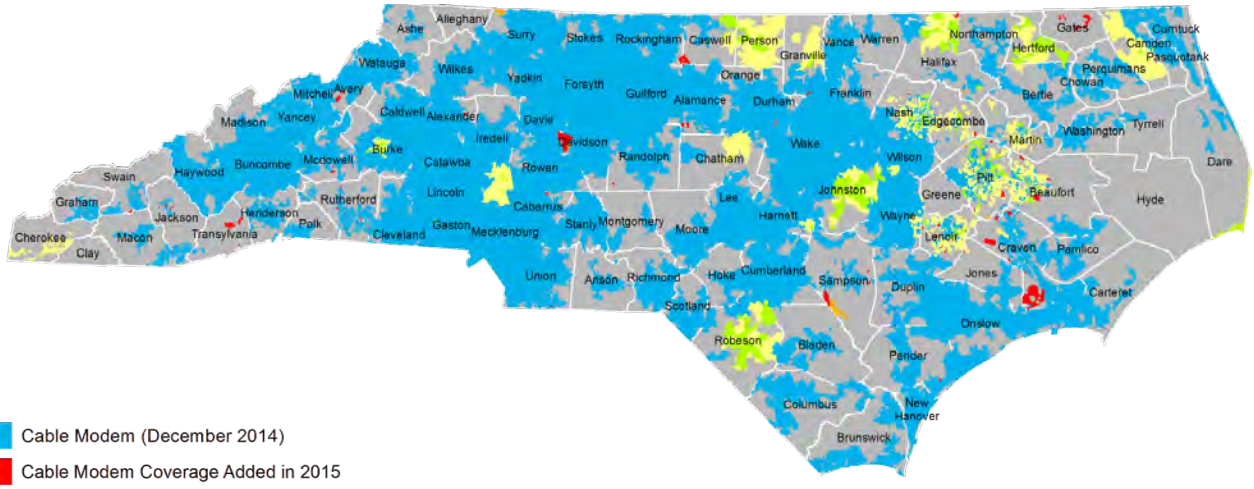
Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



Cable Modem (December 2014)

Cable Modem Coverage Added in 2015

Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



Cable Modem (December 2014)

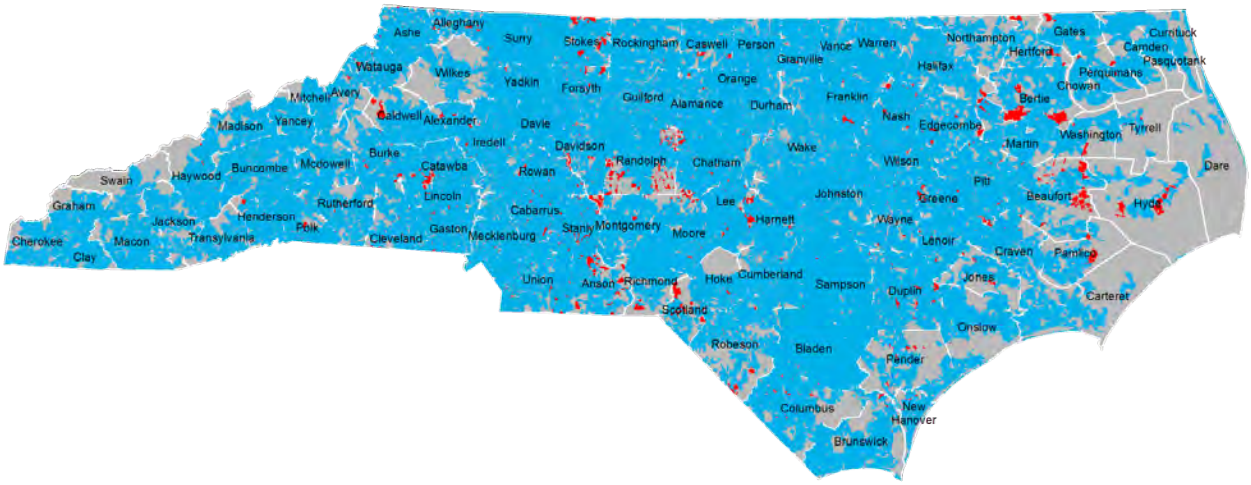
Cable Modem Coverage Added in 2015

Cable Modem Coverage with Increased Speed* from 2014-2015

Low to Moderate Income Areas with Cable Modem Coverage Added in 2015

Low to Moderate Income Areas with Cable Modem Coverage with Increased Speed* from 2014-2015

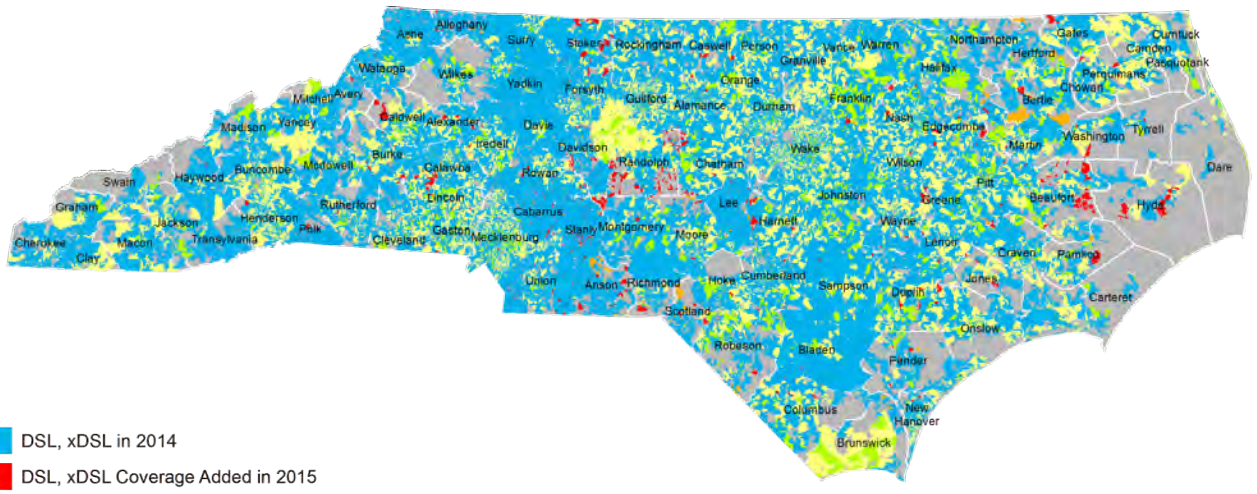
Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



DSL, xDSL in 2014

DSL, xDSL Coverage Added in 2015

Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)



DSL, xDSL in 2014

DSL, xDSL Coverage Added in 2015

DSL, xDSL Increased Speed* from 2014 to 2015

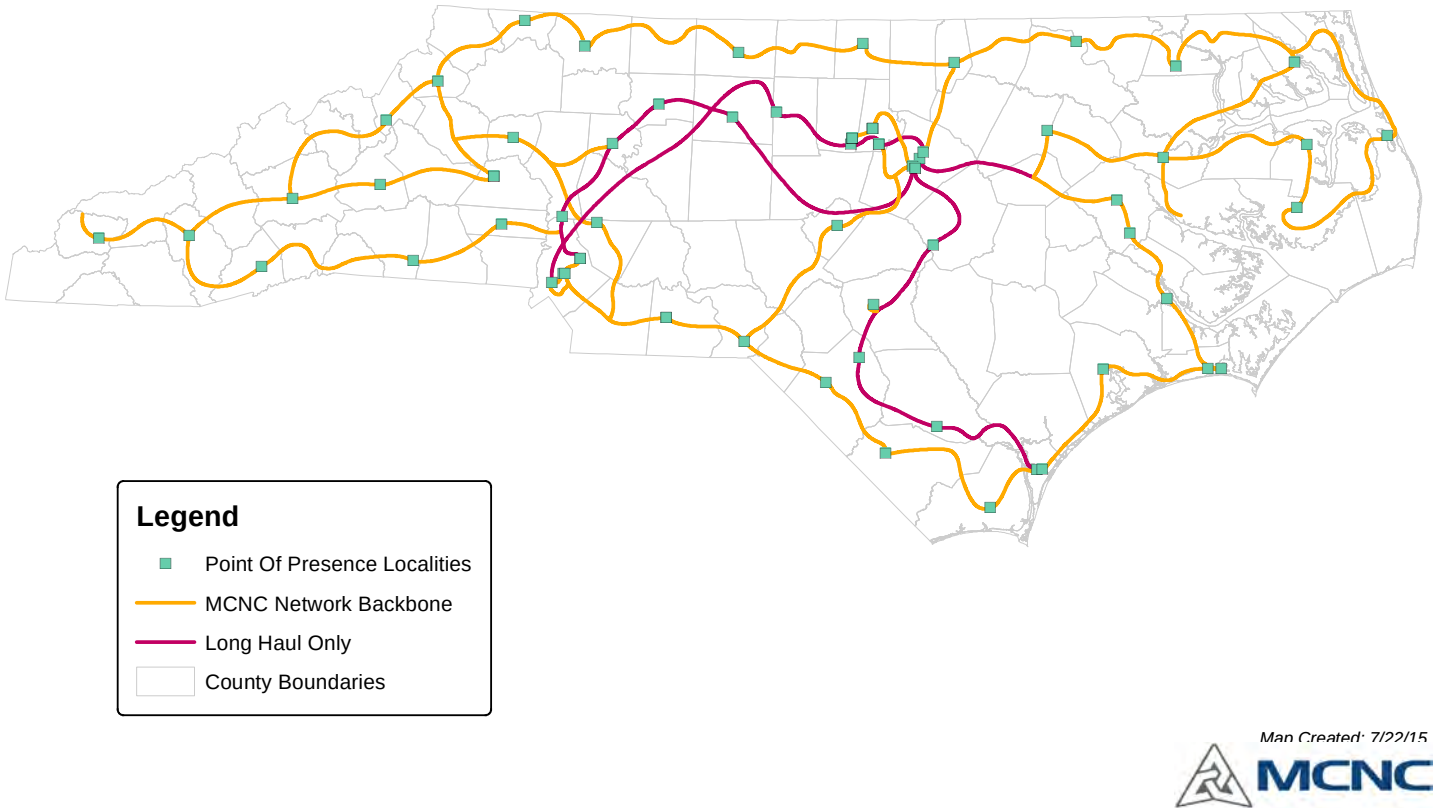
Low to Moderate Income Areas with DSL, xDSL Coverage Added in 2015

Low to Moderate Income Areas with DSL, xDSL Increased Speed* from 2014 to 2015

Based on Maximum Advertised Download Speed
Source: Federal Communications Comission
https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477
(accessed: March 2016)

Appendix E

MCNC Fiber Network for Public View



Appendix F

Shift from Fixed to Mobile Broadband

SPECIFIC POPULATIONS SHIFTING FROM FIXED TO MOBILE BROADBAND

	Broadband at Home			Smartphone (No Broadband)		
	2013	2015	% Change	2013	2015	% Change
All Adults	70%	67%	-3%	8%	13%	+5%
African Americans	62%	54%	-8%	10%	19%	+9%
Rural Residents	60%	55%	-5%	9%	15%	+6
Household Income						
$20K+	46%	41%	-5%	13%	21%	+8%
$20K-$50K	67%	63%	-4%	10%	16%	+6%
$50K-$75K	85%	80%	-5%	5%	10%	+5%
Parents	77%	73%	-4%	10%	17%	+7%
High School Degree or less	50%	47%	-3%	11%	18%	+7%

Source: Pew Research Center Surveys

Data on mobile broadband subscriptions is more limited. The 2013 Citizens Survey found that 32 percent of North Carolinians reported having a mobile subscription, up from 13 percent in 2011. However, little is known about the kinds of people who adopt mobile internet. Some initial evidence suggests that certain groups rely on handheld devices (e.g., smartphones, tablets) more than others.[1] Specifically, individuals that are younger, lower income, and Black or Hispanic report owning only handheld devices. This could indicate that these groups rely more heavily on mobile broadband subscriptions; however, additional research is needed to confirm this hypothesis.

1 Kenneth Wilson and Rebecca Powers. "Digital Technology and Internet Access Trends in North Carolina: 1999-2013." 2013.

Thank You and Acknowledgements

Compiling this plan was a team effort. BIO would like to thank the many stakeholders who contributed their time and ideas to the formation of this plan.

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Amy Stevens *Cisco*

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Barry Ryan *North Carolina Rural Center*

Betty Huskins *NC Council of Governments*

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Bradley Friang *Verizon Wireless*

Brett Brenton *RTP & US2020 STEM*

Brooks Raiford *North Carolina Technology Association*

Bruce Clark *James L. Knight School of Communication*

Cal Shepard *North Carolina Librarian's Office*

Calvin Peck *Village of Bald Head Island*

Curtis Wynn *Roanoke Rapids*

Dan Gerlach *Golden Leaf Foundation*

Dave Kirby *North Carolina Telehealth Network*

David Sobotta *Wide Open Networks*

Dean Russell *Country Cable*

Deborah Watts

Dierdre Clark *TechGirlz/Bandwidth*

Earl Struble *Verizon Wireless*

Eric Cramer *Wilkes Communications*

Erik Garr *Google Fiber*

Erin Wynia *North Carolina League of Municipalities*

Gary Salamido *North Carolina Chamber of Commerce*

Gerry Hayes *Wireless Research Center*

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Jeni Corn *NC Friday Institute*

Jennifer Anderson *NC Healthcare Information and Communications*

Joe Freddoso *Mighty River LLC.*

Joe Magno *The North Carolina Center of Innovation Network*

Joe Starks *ECC Technologies*

Johanna Reese *North Carolina Association of County Commissioners*

John Hardin *North Carolina Office of Science, Technology and Innovation*

John Loyack *North Carolina Economic Development Partnership*

Jon Wood *SkyRunner Internet*

Josh Strickland *NC Wireless*

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Steve Brewer *CenturyLink*

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Thomas Mirc *RedHat, Inc.*

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Verna Lalbeharie *Department of Public Instruction*

Wanda Proffitt *Yancey County Economic Development Commission*

Will Aycock *Greenlight*

Will Greene *NorthState*

About the Broadband Infrastructure Office

The Broadband Infrastructure Office was established by Governor Pat McCrory in early 2015 as a statewide resource for broadband availability and adoptions initiatives. The mission of the Broadband Infrastructure Office is to provide policy recommendations and planning guidance to community and state leaders to foster the expansion of high-speed internet access with the objective of improving global competitiveness, education, public safety, health care, and government efficiency. In keeping with the belief that organized and informed communities will bridge the digital divide, a technical and community assistance team partners with willing communities to provide on-the-ground assistance to implement those policies and plans.

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