ESCAMBIA COUNTY, FLORIDA

Broadband Assessment & Feasibility Study

Magellan ADVISORS

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Over 3,000 communities in the US have invested in fiber networks to support internal and community needs. In doing so, they have been able to expand this fiber to support other internal and community needs, from connecting County and City facilities, to providing fiber access to schools, to connecting traffic signals, streetlights and public safety cameras.

In some cases, municipalities and county governments have expanded their fiber to increase access to high-speed internet services in areas where existing broadband services do not meet one of the four dimensions of internet service, which include speed, reliability, customer service and/or affordability. Economic development has been a major beneficiary of this strategy as the small and medium business sectors are generally the largest contributor to the economy yet are challenged to find affordable high-speed internet services. Education, healthcare, transportation and housing have also benefited from new access to broadband services, enabled by these organizations. And, some communities have crafted their own policies to consider internet access a utility, similar to electric and water. In doing so, these communities have built their broadband networks to reach all citizens and businesses in their jurisdictions.

Communities have used differing techniques to expand broadband, from making fiber available to local providers, to developing public-private partnerships, to delivering high-speed internet services themselves. Each community must decide for itself the role it wants to play in broadband, depending on its unique issues, available funding, tolerance for risk, capabilities to compete and desire for overall control. About 500 municipal utilities, cities and cooperatives play a role in expanding broadband within their communities today.

Escambia County commissioned this Broadband Feasibility Study to evaluate the broadband gaps and opportunities to enhance broadband services within the community. Magellan Advisors, a broadband development firm that provides broadband planning, engineering and implementation and who has worked with over 400 municipalities in the US, was hired by Escambia County in 2020 to perform the Study.

Magellan Advisors conducted a thorough assessment of broadband demand and supply in Escambia County. The process involved conducting a community survey, gathering data about assets, identifying key areas and sites to connect, interviewing key stakeholder representatives, and researching broadband

infrastructure and service offerings.

The Study found that the County has large broadband gaps and faces the challenge of many diverse communities. In the rural northern portion of the county most communities lack access to true broadband services. Broadband is defined by the Federal Communications Commission (FCC) as 25 Mbps download and 3 Mbps upload. Nearly all communities in Northern Escambia lack access to broadband speeds that meet this standard.

Northern Escambia County faces the dual challenges of many rural areas: high per-capita cost to build network infrastructure and low capacity to pay for service. Consequently, the area is simply not an attractive market for most private sector service providers. Most companies will not invest what is needed to provide broadband services because they simply can't make adequate profits. These parts of Escambia County are not an economically feasible location for most private, for-profit internet service providers.

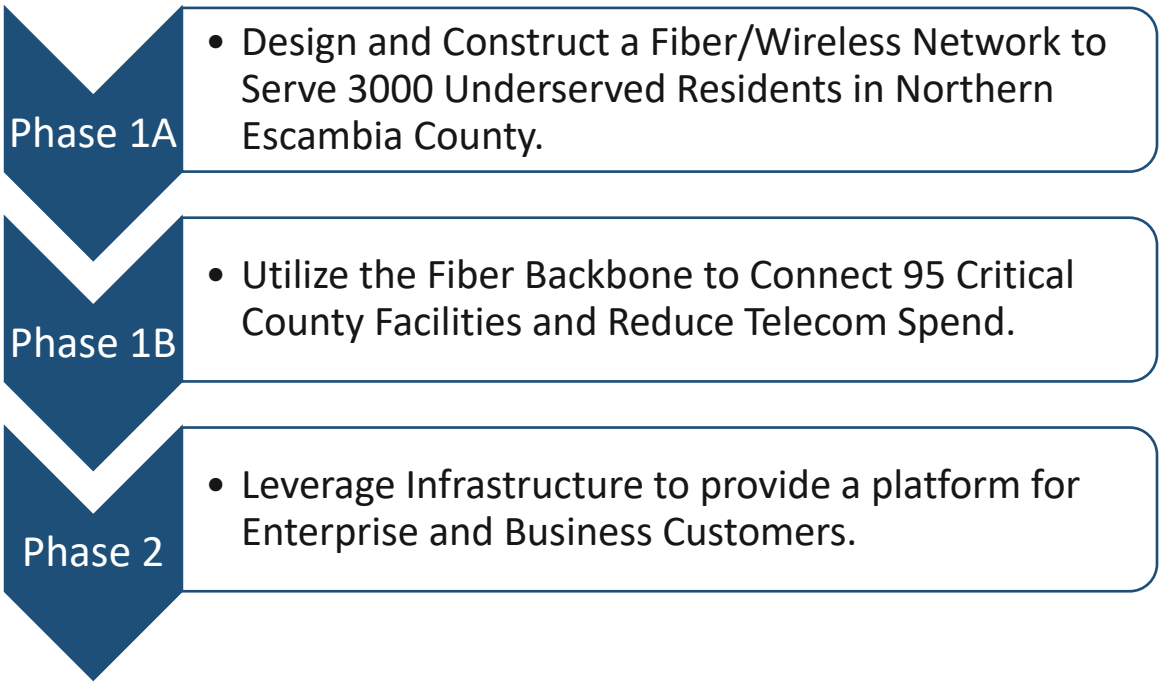
In Southern Escambia County broadband speeds are greater due to increased density and the population center of Pensacola, but competition is lacking. Many locations are limited to two choices of providers with only one that meets true broadband speeds. Additionally, as providers have improved their speeds utilizing new technology, the infrastructure they deliver these services on are aging leaving the services unreliable and susceptible to outages and slowdowns.

The current broadband environment in Escambia County has direct impacts on its citizens' and businesses' abilities to compete for economic development opportunities, gain access to online education and healthcare, and participate in the same quality of life afforded to residents in communities with affordable, reliable and accessible broadband. Escambia County leadership is at a critical juncture in which they must decide how to make strategic investments in broadband infrastructure to ensure its communities are competitive today and into the future.

With the right plan and phased investments Escambia County has the ability to change the market equation so it is more attractive for private companies to invest and provide services, while also reducing its telecommunications spend, providing better connectivity to community buildings, providing a platform for Smart City applications and delivering redundancy for other public networks and stakeholders.

The plan below sets out a plan for phased investment in broadband infrastructure that will directly benefit, and impact Escambia County's

underserved community and reduced telecommunication spend for the County. The network will serve the residents through a combination of fiber-optic and wireless infrastructure, and build a fiber backbone that is not only futureproof, but will enable technology and Smart City applications, drive investment from private providers, and support the economic development efforts throughout the County now and in the future. Magellan Advisors recommends the following phases of investment and network development in public broadband infrastructure:



2. Introduction

PROJECT PURPOSE AND GOALS

Escambia County contracted with Magellan Advisors for a sustainable strategy to promote comprehensive broadband access. We assessed broadband demand, supply, and related assets, as well as the regulatory environment, to determine the County's needs and opportunities. Community stakeholder representatives from local business, education, local government, social services, and utilities, as well as community members, provided input on needs and opportunities.

We created a conceptual network design based on standards that meet the County's general requirements. The range of possible broadband business models was evaluated for fit with the community, including financing and operational options. From this we formulated a general plan, cost and return on investments with policies and timetables. This document reports our findings, lays out the strategy, and builds the business case for Escambia County to develop broadband.

WHAT IS FIBER-BASED BROADBAND?

Broadband Internet services provided over fiber-optic cables is commonly referred to as fiber-based broadband, fiber to the home or fiber to the premise. In each of these cases, individual strands of glass are brought to homes and businesses through cables installed on utility poles or buried underground. Fiber-based broadband provides a superior technology to enable high-speed Internet services, over traditional telephone or cable lines, bringing symmetrical bandwidth (the same upload and download speeds), more reliability, over greater distances and more scalability to providers' networks and their customers.

Fiber has become the de facto standard for municipal communications, broadband services, and Internet access. Fiber is used to transmit large amounts of data securely over long distances with high reliability. It supports a wide range of applications and is scalable to support nearly unlimited data capacity. Cities that own fiber consider it a capital infrastructure asset similar to water, roads, and electric infrastructure. Some of the key reasons why local governments have chosen to invest in this technology include the following.

WHY DO GOVERNMENTAL ENTITIES INVEST IN FIBER?

Community owned fiber-optic networks provide a platform for municipal efficiencies, smart city networks, utility cost savings, opportunities to enhance private providers' local networks and overall economic development and quality of life for residents. Fiber networks, when designed correctly, provide ample connectivity opportunities for multiple agencies both public and private, providing the most benefits to the community.

MUNICIPAL CONNECTIVITY

Leveraging new fiber assets to connect public institutions throughout the Escambia County community creates opportunities to establish collaborative technology programs across multiple organizations. Establishing institutional access to Escambia County's planned conduit, fiber and wireless networks would create an inter-governmental backbone through which public organizations have access to network connectivity with very high capacity that can be continuously upgraded at relatively low costs. This enables municipal and community organizations to futureproof their connectivity needs and reduce ongoing operational expenses for their connectivity.

Rather than paying providers for this connectivity, users pay the County to share in overall costs of maintaining the County-owned system. In most cases, building and maintaining this fiber provides a substantial savings over leasing these services from providers.

Connecting schools, libraries, local governments, public safety agencies, and community organizations to one another also facilitates the sharing of technology resources among the organizations. Fiber connectivity offers virtually unlimited bandwidth and security that would not be available otherwise.

ECONOMIC DEVELOPMENT

Increasing the availability of high-speed broadband in Escambia County's corridors provides an opportunity to enhance local economic development efforts. Through the deployment of fiber technology, Escambia County can designate these areas as being fiber-ready, allowing any business moving to Escambia County to recognize that fiber services are readily available and prevalent at competitive rates. Access to high-speed Internet is a significant economic driver for communities looking for ways to attract and retain business. A side benefit is the ability to compete with regional communities like

Chattanooga, Huntsville, and Jacksonville who all have and operate their own ultra-high-speed networks.

Magellan's team met with the Escambia County planners who emphasized several new development and growth areas around the County that would be best suited for fiber development to attract new businesses and residents.

EDUCATION

Educational institutions around the country have become the greatest beneficiaries of locally owned fiber networks. Education has become a broader community responsibility, with organizations such as libraries and non-profits providing support, internships and alternatives as education extends beyond the traditional classroom environment – as students perform assignments outside of school and as adults look to continue lifelong learning.

Connecting to innovative educational programs and tools requires high-speed, reliable and affordable connectivity. As virtual support moves online, and access to free, world-class educational resources expand, so does a community's responsibility to provide for all its learners beyond the school day.

Access to broadband is an important component of education, inside the classroom and in the home. Online applications used to support education and training efforts require high-speed broadband, with services that meet performance requirements to support real-time video and voice applications for distance learning and teleconferencing. Today's teaching resources incorporate multimedia—sound, graphics, video, and data, while the use of online digital textbooks continue to expand.

Many communities have built fiber-based broadband networks to connect local schools to one another and to the Internet backbone. By deploying these networks, schools get access to high-speed connectivity at often times lower prices than if they leased access from existing providers. Since municipal fiber networks are utilized for multiple purposes and often financially supported across many classes of users, cities can extend fiber to school districts at the marginal cost of extending their fiber backbone to reach each school.

Some examples include:

- **The City of Hillsboro and Hillsboro City Schools**
  In 2018, the City and School District partnered and shared the cost of a Citywide fiber backbone buildout to connect the district's 34 schools, bringing 10 gigabit connectivity to every school and reducing the school

district's ongoing communications costs by millions a year. This network is now also being used to bring fiber to the home broadband services to the City's residents and businesses, under the City's new Internet service provider business, HiLight.

- **The City of Lakeland and Polk County School District**
  Over the past 20 years, the City of Lakeland, FL (Lakeland Electric) has connected over 70 Polk County Public School locations with fiber. Schools receive dark fiber connectivity, giving them access to near limitless speeds and control over their connectivity needs, while keeping recurring telecommunications costs low for the District. The City's investments in this fiber have kept budgets down and investments local to the area.

HEALTHCARE

> "We are embarking on new initiatives with our local school district and regional colleges and universities to leverage broadband and to facilitate discussion between schools and the business community to strengthen, retain, and attract a quality workforce."
>
> - Dana McDaniel, Deputy City Manager of Dublin, Ohio

In Danville, VA, their municipal broadband has long served the Danville Regional Medical Center, one of the city's largest employers. Medical companies, Ohio Health and Cardinal Health; Battelle Memorial Institute, a non-profit that relies on quantum computing to encrypt information; and numerous educational facilities use the Dublin, OH municipally owned fiber network for their healthcare, education, and research needs.

Remote aspects of healthcare, both monitoring and acute care, increase demand on bandwidth through the use of robotics and haptic devices. All telehealth fields are growing, including teletherapy and telepsychiatry, with universities and colleges needing real time access to licensed counselors for interventions. Policies in remote imaging, cardiology, and transmission of Electronic Health Records are expected to increase demands further with needs for low latency becoming increasingly critical.

"Aging in place" is a term used to describe seniors living in the place of their choice for as long as possible, while getting the services they require, and all needs met without moving in with children or being placed in a nursing or assisted living facility. New gadgets and technological advancements have been made to make "aging in place" easier and more attainable for the growing population of seniors. Home-based telehealth, or home health monitoring solutions, keep physicians in touch with patients and monitor their health without visiting an office. There have been other advances including but not limited to fall detection systems, wearable sensors that collect real time health data, and stove guards. Reliable, high-speed Internet access is required for these new technological advances, and the retirees of Escambia would see value in being able to utilize these products and services.

Smart City

In considering opportunities for Escambia, the fiber network can be the foundation for programs that increase efficiencies, lower costs, reduce environmental impacts and enhance quality of life by relying more on technology.

With a fiber network in place, and as Escambia expands its online services, all applications migrated to a community network enjoy greater availability and increased bandwidth. Limitless bandwidth and capacity create more effective and efficient civic organizations, with reliable broadband enabling organizations to:

- Improve operational efficiencies
- Reduce direct and indirect costs
- Provide enhancements to public safety
- Provide more information to citizens
- Enable interactions with organizations
- Respond quickly to the local needs
- Better serve the needs
- Better serve the local community

Organizational applications drive the promise of the Smart City through consumer technologies and connectible devices. Such devices scattered by the hundreds, if not thousands, throughout a community are networked seamlessly and generate an enormous amount of data. Individually, Smart City savings might only be measured in the hundreds of dollars, such as to help wineries monitor their water usage in order to reduce the number of gallons used to create wine. Collectively, however, these savings

can add up.

Scaling local level economic impacts to the service area level or even the state level and to a national level could be staggering. Gartner Research reports that IoT supported spending should reach $772[2] billion globally, with IoT spending in the US to total $194 billion this year, with consumer IoT spending to be $62 billion of that. Looking globally, a McKinsey report says that efficiencies and opportunities created by IoT may have a collective financial and nonfinancial benefits of as much as $11 trillion per year by 2025 across all sectors.[3]

The Smart Cities Council publishes a "Smart Cities Readiness Guide" with detailed information on Smart City drivers and barriers, benefits, and responsibilities.[4] From that guide, select opportunities are outlined as follows:

- Smart Buildings: Using sensors, meters, and software to monitor and control a range of building functions including lighting, energy, water, HVAC, communications, video monitoring, intrusion detection, elevator monitoring and fire safety.
- Health and Human Services: Transform the delivery of essential health and education services, since "an educated and healthy city is a successful and wealthy city."
- Energy: A priority for Smart Cities, which typically start with smart energy systems.
- Digital City Services: Services to increase citizen engagement, employee productivity, competitiveness, citizen satisfaction and cost reduction, delivered via smartphones.
- Mobility and Logistics: Provides safer, more efficient transportation and parking. While this can ease commuting times for individuals, the macro cost savings are tremendous for a municipal government.
- Public Safety: Infrastructure and staff to keep the public safe, fostering quicker and smarter responses without duplicated effort to save lives, property, and resources.
- Smart Payments and Finance: Digital disbursements and collections generate significant savings and increases operational efficiency.
- Smart People: A new City Hall mindset that is more open, transparent, and inclusive to build two-way communications and create stronger initiatives.
- Telecommunications: An adequate infrastructure is vital for business and community development and underlies the Smart City.

- Waste Management: Collect and process efficiently, recovering materials that have value, while benefitting public health and the environment through zero waste efforts.
- Water and Wastewater: Where it takes water to produce electricity, and electricity to pump water, the Smart City provides for production of both energy and water.

LEVERAGING FIBER NETWORKS FOR BROADBAND

Communities that have built their own fiber networks sometimes expand them to support the broadband needs of their communities. Communities have used many different strategies to expand broadband, from simply leasing dark fiber to broadband providers, to deploying wholesale, open-access networks, to providing retail Internet services themselves. In each case, many factors influence their strategy and approach to expanding broadband, including:

- State regulatory requirements
- Federal regulatory requirements
- Economic development focus
- Lack of existing broadband services
- Financial capabilities
- Political will
- Competitive environment
- Opportunity cost of funding

3. Broadband Market and Needs

Fast, economical, reliable internet access is essential for participation in today's digital world. Other forms of connectivity are also necessary, mobile phone service and also low power "Internet of Things" connections for applications in agriculture, government, manufacturing, services, etc. Any study of broadband feasibility should consider other technologies because they are complementary and use common infrastructure. Wireless connections require fiber, and fiber is regularly used for wireless backhaul (connection from the access or aggregation point to a provider's core network).

Magellan Advisors engaged various key community stakeholder representatives in discussions about their connectivity needs and issues. We sought out representatives of stakeholders in education, government, healthcare, small business, social services, and utilities. The discussions started with the types of internet access their organizations have, how they use it, and how it works. We then asked about short-term changes and plans. Discussions wrapped up on big picture, long-term issues and trends.

STAKEHOLDERS' CURRENT BROADBAND SITUATION

Stakeholders in Escambia County, like many larger organizations, have been able to create well connected networks despite some challenges. Stakeholders have built networks through a combination of owning and leasing fiber infrastructure from the regions metro fiber networks including Uniti, Southern Telecom, and Cox. Stakeholders noted that redundancy was an issue and recent fiber cuts in combination with a hurricane highlighted the need for new network routes. All stakeholders noted that connectivity in the north is limited and challenging and the need exists for greater network infrastructure in the region.

Business and Economic Development

Escambia County's business and economic development agencies are a future-focused group who understand the need for high-speed, reliable, redundant, and affordable connectivity for all current and future businesses and business growth throughout the county. Multiple members from the economic development agencies engaged with the Magellan team including the Chamber of Commerce, Florida West, and First Place Partners to discuss the current businesses landscape in the county, the competition to drive new businesses and development to the County, and the need for advanced broadband

infrastructure to support their efforts.

Representatives explained that Countywide connectivity and economic development is primarily divided by north of I-10 or South of I-10.

South of I-10 the overall speed and reliability has been mixed. ***Over the nine years I've been here we have had a mix of existing providers and there has been a lot of outages and slow speed complaints from businesses***. It was noted that the complaints from businesses in the southern corridor has gotten a bit better with some infrastructure improvements. The southern corridor is ripe with business investment and development and a push towards a tech ecosystem. The proliferation of startups and the transition to a more digital economy has increased interest in economic development through creating a tech ecosystem that attracts tech-based companies and creates an environment for new ones. Supporting start-ups, a tech workforce, investors, incubators, accelerators, and youth/adult tech programs are key to the creation and nurturing of tech ecosystems within communities, and access to broadband is a fundamental need.

Figure 1: Components of a Tech Ecosystem

There is a technology campus under development in the downtown waterfront area, as well as an innovation district being developed south of the Civic Center, which includes a plan for innovative technology-based companies in a high-density development designed for live, work, and play. With these plans, and the push towards walkability downtown, the need for reliable public access is

considered to be extremely important as the downtown growth continues.

The University of West Florida continues to grow and there are concerns that the area's technology infrastructure is not on pace to keep up with the growth and demand for bandwidth and innovation.

It is believed that the business parks in the south are receiving dedicated circuits either through fiber or T-1's, but the actual speeds and reliability are unknown and there is some concern that they may be lacking the ability to keep pace with current and future broadband needs.

North of I-10 contains several business parks, land for expansion and economic development, as well as the current large industrial sites and employers in the county. There are major concerns that the northern region is lacking in the same access to connectivity as the southern regions. There are several commerce parks in the area and the team is unsure how they are being served if at all. It is believed that they are not receiving the same kind of dedicated circuits that the southern parks have access to. Areas off of 29 including Molino and Cantonment is considered to be next to impossible for broadband or cellular service for residents and businesses. The lack of access for both becomes a larger problem than pricing in these areas.

The general feel for the County's connectivity is that the larger companies are paying the prices for access to connectivity and are dealing with it, but the smaller business parks are struggling because they are having difficulty accessing and paying the cost for their own competitive line. It was noted that one of the ISPs did a project where the stakeholder talked to them and was quoted a few hundred thousand dollars to run a line. Through the economic development agencies, a deal was made where all businesses in the park would sign up for service. There is a process ongoing to doing the same in the Century park. Currently, conversations are ongoing with three or four existing businesses that are all running off of hotspots, and the team is working with a service provider to run a line. The agencies feel that current ongoing management of these issues is a band aid for a comprehensive plan and solution.

Municipal Needs

Magellan Advisors engaged with the City of Pensacola to understand their current infrastructure, gaps, and future needs. The City of Pensacola is well served by the current provider but does not own any fiber-optic infrastructure. Much like Escambia County, the city is leasing dedicated dark fiber from Uniti, a regional ISP. The city leases roughly 28 circuits and is able to connect other locations who are in close proximity to the circuits off of each other.

The city receives a gig of internet service to its locations through Uniti, and has a backup connection through Cox at the airport. The city also purchases Wi-Fi connectivity for public access at the community centers from Cox.

The city has recently reached a point where they have noticed an issue with the fiber rings' architecture and ability to withstand incidents or breaks. A car accident broke the line just prior to hurricane Sally's impact on the city, which left the city without connectivity at its critical facilities. The city has a desire to develop a mesh network for more reliable redundancy at three to four critical facilities.

The city does anticipate some additional connectivity needs in the near future. Although the city is not an electric or water provider, they are a provider of natural gas and have some SCADA connection needs. They are also interested in providing public Wi-Fi on a more robust basis. There currently is one pilot project for outdoor public Wi-Fi at the park by the port, but it is not well supported. The city is being asked to take over some smart parking initiatives including an app that would show available locations. The conversations and logistics are still in development, but the downtown parking may spur some initial smart city initiatives in the City of Pensacola.

Education

Escambia County Schools serve the educational needs of the county. The school district engaged with Magellan for a brief discussion on connectivity. Escambia County Schools are generally well connected. The school has fiber-optic connectivity to each school, 70 – 75% of which is owned by the district. The other 25% of schools are connected through leased fiber. The district's fiber ring has each school connect back to a central office and they are currently developing a new hub. All schools received nine gigabits of bandwidth, and all schools have Wi-Fi inside the buildings. The district is also transitioning to VOIP and are two years into a five-year strategic plan to transition.

The district's leased fiber is all paid for under the Universal Services E-Rate program. The schools connected by the leased fiber are serviced by Southern Light Telecom. The school district has submitted for $238,000 from Universal Services Administration Company (USAC) to cover the costs of these connections. The district also covers an additional 10% out of pocket. The total spend for these connections is around $250,000 for the 2020 school year. The district noted that it would be interested in additional redundancy for its leased circuits and would be willing to work alongside the County to achieve this.

The COVID-19 pandemic has highly impacted education. The Escambia County School District shifted its focus to online education as the pandemic began. They utilized CARES funds and the Sprint One Million Project to supply devices for students to access Google Classrooms. They have also supplied hotspots to students who had no access to broadband. There have been stories of students, and particularly of faculty, who have not been able to access internet-based education due to lack of connectivity available at their homes. The school representative noted that when you get to areas of the county including Century, Walnut Hill, and Molino the access is difficult. The district has had difficulties there with providers, but that is mostly solved now through leased fiber, however historically it has been challenging to get service there, including telephone services.

Healthcare

Baptist Healthcare operates a regional healthcare network including hospitals and medical clinics across Northwest Florida and South Alabama. Baptist Hospital is located in Pensacola, and a representative from the hospital's IT department engaged in conversations with Magellan Advisors about their current and future connectivity needs.

Baptist's network maintains fiber connectivity through a fiber ring with their provider, Cox. They have a combination of 10G circuits and leased dark fiber. With such a large network they also maintain some connectivity through Uniti, an additional fiber provider. According to conversations Baptist has found that Uniti does not have the same footprint throughout Pensacola that Cox does and therefore utilizes a majority of their connectivity through Cox. Cox does have some weaknesses in their system in that it is mainly aerial, which leaves it vulnerable to the weather, and the Baptist system was impacted when a recent cut happened, and then a hurricane delayed its repairs.

The healthcare association seems happy with the connectivity they are receiving. They feel it is currently meeting their needs. When the pandemic hit

Baptist was well prepared for the pandemic with its connectivity and telemedicine practices. The impact COVID-19 created with connectivity was more so with staff's ability to connect from home. ***The lack of access in the community was noticed when staff moved to remote workforce.***

Utilities

Escambia County's power is supplied by Gulf Power. Gulf Power is a large utility company based in Pensacola. It is owned by NextEra Energy. Representatives from NextCity Networks, a subsidiary of NextEra discussed connectivity and infrastructure in Escambia County with Magellan representatives. NextCity was recently created to address telecommunications infrastructure and demand in Gulf Power territories.

NextCity Networks went public in February 2020 and is a fiber optics-based company with a focus towards telecom. They have a narrowed focus on Smart City and rural broadband and provide an entire suite of services that go hand in hand in the infrastructure play. In Pensacola and Escambia, Gulf Power and Florida Power and Light (FPL) combined own around 500,000 streetlights and utility poles. This is a large advantage to deploying Smart City and fiber infrastructure for telecommunications.

In addition to vertical assets the power company has some fiber optics, a combination of which is on pole lines and some underground, all of which is currently owned and operated by Gulf Power. NextCity does have the ability to expand upon those or build new fiber infrastructure if the right situation arises, but since the assets were not built for telecommunications it is questionable how much would be usable for a broadband purpose and what would need to be built new. When building new fiber infrastructure, NextCity plans to build all new assets, primarily underground, and particularly in areas like Escambia County that are prone to severe weather events.

The company also has a focus on wireless and working with wireless companies helping to deploy 5G and 4G utilizing their infrastructure assets. They work as a turnkey service for the wireless companies including changing out poles for new ones to make the assets sustainable for wireless deployments for small cells, and building fiber to the poles for connectivity. Secondarily, they have a focus on wireless and Smart City. For Smart City, NextCity Networks is working with communities across the state in a variety of solutions which could be as simple as the need for fiber between city and County facilities, building fiber for public Wi-Fi in the parks to putting up 4K cameras on light poles for traffic analytics.

In discussion of deploying fiber and broadband in Escambia County, NextCity noted they are prepared to be owners and operators of their networks. If the County owned fiber assets they would not utilize them in a partnership. Representatives noted that they are interested in continued discussions with the County, and that they have built a team that is working with municipalities to solve broadband issues like Escambia faces including its issues of lack of quality broadband in its rural areas.

NextCity sees the rural broadband solutions as a mix of fiber and wireless solutions including the possibility of CBRS (Citizens Broadband Radio Service) and/or LTE. They have a staff of grant experts that is working with municipalities to assist them in gaining access to federal and state dollars that would expedite the deployment of rural networks and offset the costs to make the networks more feasible for the company's return on investment. The real issue for Escambia County is how much control, if any, NextCity would need. From Magellan's experience in similar situations the answer is little to none. Magellan strongly recommends that Escambia County meet with them to understand NextCity's business model and explore any possibility of a partnership or common use of current or future assets to help expand broadband opportunities in the county.

BROADBAND MARKET ASSESSMENT

To fully understand the Escambia County broadband market, Magellan Advisors surveyed households and organizations about their broadband services, uses, and related issues. We gathered information about network infrastructure and service offerings by network service providers and pulled information and mapping from Federal data bases and online resources.

Escambia's broadband market is a mix of urban areas with high speeds and low competition to rural areas with poor access and provider options that don't meet the FCC's definition of broadband.

The Northern part of the county is devoid of internet speeds that meet the FCC definition of broadband. This is 50% of the land area of the county. While not densely populated, the residents of this area have the same needs for broadband internet as the rest of the county including to promote telehealth, distance learning, quality of life and attract new business to the area.

According to Broadbandnow.com,[1] the average download speed in McDavid is 7.94 Mbps, which is 92% slower than the average in Florida and 97.3% slower than the national average. In Century, 72.2% of consumers or roughly 4,000 people only have access to 1 or fewer wired internet providers at their address. In Molino, the average download speed is 18.81 Mbps, 82.2% slower than the average in the state of Florida and 35.3% slower than the national average.

The central and southern part of the county have better access, but like many tier two and three cities, struggle with competition. The layout of many broadband markets has left areas like southern and central Escambia County with access to only 2 providers, a duopoly of a cable provider and a DSL provider. This leaves only 1 provider in many areas that meets the FCC definition of broadband. This void in competition can lead to higher pricing and unresponsiveness of providers to expand and provide better services.

Further investigation shows that Escambia County has roughly 8,000 residents that lack access to a wired service provider with speeds meeting 25 Mbps, and 4,000 residents lack access to any wired provider.[2]

Incumbent Service Providers

Escambia County's broadband coverage is provided by a variety of wired and wireless providers. Despite the variety of providers, territories are defined and rarely overlap or compete.

Spectrum Charter Communications provides service to the Century area in the Northeast corner and the Central section of the county. Spectrum offers internet plans and bundled TV/Internet/Phone in the Escambia area. Prices for Internet range from 100 Mbps at $49.99 to 940 Mbps at $109.99 per month.

Cox Communications is the dominant provider in the southern Escambia region. Cox covers most of the Pensacola area with high-speed internet. The primary technology used is cable, but some service is listed as Cox Fiber. Cox offers multiple bundled packages including voice, television and internet. The internet only package with 940 Mbps download is offered at $99.99. Cox also offers business service.

The Mediacom primary service area is the beaches. They provide coverage to Pensacola Beach and Gulf

[1] https://broadbandnow.com/Florida/Pensacola?zip=32501

[2] https://broadbandnow.com/Florida/Pensacola?zip=32501

Breeze. Mediacom offers many bundled packages for voice, TV and internet. The delivery technology is cable. They offer internet only packages from 60 Mbps upload at $29.99 to 1000 Mbps download and 50 Mbps upload at $79.99. All Mediacom offers come with data caps. The 1000 Mbps offer comes with at 6000 MB data cap. Mediacom also offers business service in the area.

AT&T offers service in the southern part of the county and Pensacola proper. They have multiple bundles of voice, TV and internet. The technology is primarily DSL, but also offers AT&T Fiber over a significant portion of the area. They offer speeds up to 1000 Mbps download and 1000 upload via fiber at $60.00 in some limited areas and DSL 100 Mbps download and 250 Mbps upload for $35.00 month. AT&T also offers business service in the area.

Frontier Communications is the dominant internet provider in the Northern area. Frontier is currently in bankruptcy and is restructuring to reduce debt. The company is not expanding or providing new service but is selling territories to other vendors and reducing service area. Frontier uses DSL over copper wires to provide internet to homes and businesses in this area. The speeds listed in the northern Escambia area are mainly 18 Mbps to 3 Mbps download speeds. The higher speeds are listed at $34.99 per month for internet only plus an additional $10.00 per month for a DSL modem. There is an $85.00 one-time activation charge. Internet speed/pricing is measured in cost per megabit. For 18 Mbps the cost per megabit is $2.50.

Uniti Fiber provides business and enterprise fiber in several states. They have fiber coverage in Escambia County primarily in the Pensacola area but also some fiber in the northeast part of the county. They offer dark fiber leasing and lit fiber communications service. Uniti is a spinoff of Windstream Communications.

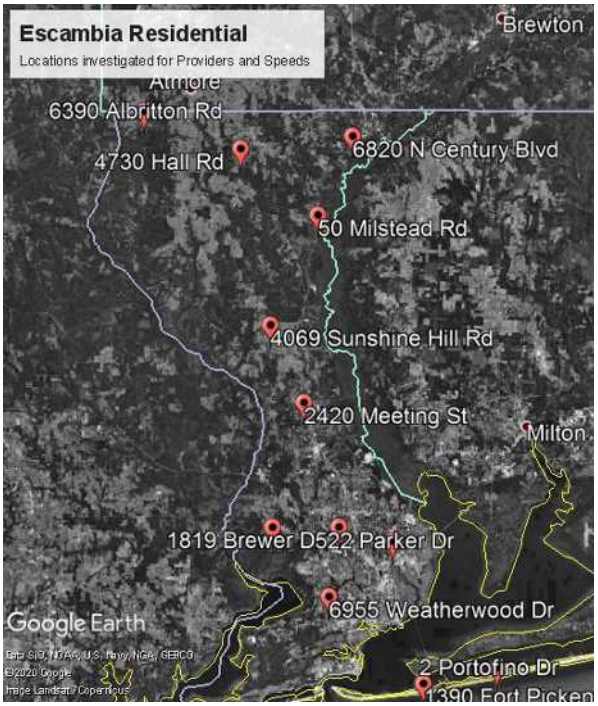
ViaSat is a satellite communications provider that covers the entire Escambia market. It advertises speeds up to 100 Mbps download and 3 Mbps upload. Plans range from 12 Mbps and a 40 GB data cap for $70.00 to the premium plan being 150 GB of data for $200 per month after 3-month introductory period. This plan provides for 40-50 hours of streaming per month, after that data is slowed. Latency is approximately .5 seconds for a round trip. This makes gaming difficult and could affect voice calls.

HughesNet offers similar plans as ViaSat in the Escambia market, but with lower speeds and data caps. All HughesNet plans are 25 Mbps download speed with different data caps. The plans range from 10 GB data cap for $59.99 after promo discount to 50 GB data cap for $149.99 per month. Offers are for a 2-year contract.

Provider Service Offerings

In order to investigate incumbent providers' coverage, speed and pricing 12 locations were randomly selected across different areas of the county. The providers' websites and direct calling was used to determine the advertised throughput and pricing for service at each of the locations. This data is based on the provider conversations and availability at this time and allows an analysis of prices and speeds at specific locations in the county. Below is a map of the locations.

Figure 2: Map of Addressees for Market Analysis



Below is a table indicating the providers available at each location, the maximum speed of the offering and the price for that offering.

Table 1: Residential Address Locations and Broadband Availability

ADDRESS	AT&T	FRONTIER	COX	SPECTRUM	MEDIACOM
6390 ALBRITTON RD. WALNUT HILL, FL 32568	No Service	18 Mbps $34.99/mo.	No Service	No Service	No Service
4730 HALL RD. MC DAVID, FL 32568	No Service	18 Mbps $34.99/mo.	No Service	No Service	No Service
6820 N CENTURY BLVD. CENTURY, FL 32535	No Service	No Service	No Service	100 Mbps $49.99/mo.	No Service
50 MILSTEAD RD. MCDAVID, FL 32568	75 Mbps $45.00/mo.	No Service	No Service	No Service	No Service
4069 SUNSHINE RIDGE CT. MOLINO, FL 32577	No Service	18 Mbps $34.99/mo.	No Service	100 Mbps $49.99/mo.	No Service
2420 MEETING ST. CANTONMENT, FL 32533	75 Mbps $45.00/mo.	No Service	No Service	100 Mbps $49.99/mo.	No Service
5161 WHEELER WAY PENSACOLA, FL 32526	1000 Mbps $79.00/mo.	No Service	No Service	940 Mbps $109.99/mo.	No Service
1819, BREWER DR. PENSACOLA, FL 32526	No Service	No Service	940 Mbps $99/mo.	No Service	No Service
522 PARKER DR. PENSACOLA, FL 32504	50 Mbps $45.00/mo.	No Service	940 Mbps $99/mo.	No Service	No Service
6955 WEATHERWOOD DR. PENSACOLA, FL 32506	100 Mbps $45.00/mo.	No Service	940 Mbps $99/mo.	No Service	No Service
2 PORTOFINO DR. GULF BREEZE, FL 32561	10 Mbps $45.00/mo.	No Service	No Service	No Service	940 Mbps $79.99/mo.

ADDRESS	AT&T	FRONTIER	COX	SPECTRUM	MEDIACOM
1390 FORT PICKENS RD. PENSACOLA BEACH, FL 32561	25 Mbps $45.00/mo.	No Service	No Service	No Service	940 Mbps $79.99/mo.

Of the 12 addresses, eight of the addresses have only one choice of a service provider that delivers broadband speeds, five had only one option for a broadband provider and two of those addresses did not have any wired service available that meets the definition of broadband. Indeed, most of the northern part of the county lacks true broadband access. In the density of Pensacola many providers have upgraded their systems and provide higher speeds, but competition is lacking.

For businesses in Escambia nine addresses were chosen from around the County. Table 2 below highlights the gaps in connectivity in the county. Of the nine addresses chosen, almost half have either no access to broadband from traditional wired providers, or only one choice of service. The majority of addresses that lack service or options are located north of I-10, and match the gaps shown by the FCC and Magellan's survey methods. Addresses in Pensacola and South of I-10 have better choices, including three addresses where AT&T has upgraded their infrastructure giving an opportunity for small and medium businesses to receive symmetrical broadband up to 1 Gig (1000 Mbps) over fiber optics. Additionally, we located one address that had two options for gigabit services. Navy Blvd. in Pensacola had a choice between up to a gigabit over fiber from AT&T and Cox's gigabit service (940 Mbps) over cable. Although the Cox option is not a true gigabit service and is not symmetrical it does provide upgraded bandwidth.

Table 2: Business Address Locations and Broadband Availability

ADDRESS	AT&T	FRONTIER	COX	SPECTRUM	MEDIACOM
1817 E LLOYD ST. PENSACOLA, FL 32503	Business Fiber 1000/1000 $640/mo.	No Service	200/20 Mbps $174/mo.	No Service	No Service
8450 N CENTURY BLVD. SUITE 730 CENTURY, FL 32535	No Service	No Service	No Service	No Service	No Service
3832 W NAVY BLVD. PENSACOLA, FL 32507	Internet Basic 12 $40/mo.	No Service	940/35 Mbps $640/mo.	No Service	No Service
2748 ASHBURY LN. CANTONMENT, FL 32533	Internet 25 $40/mo.	No Service	No Service	No Service	No Service
10010 PILGRIM TRAIL. MOLINO, FL 32577	LTE only – up to 100 Mbps $300 a mo. 50GB data	No Service	No Service	No Service	No Service
8333 N DAVIS HWY. # 800 PENSACOLA, FL 32514	Business Fiber 1000 Mbps $640/mo.	No Service	200/20Mbps $174.99/mo.	No Service	No Service
7950 PITTMAN AVE. PENSACOLA, FL 32534	Business Fiber 1000 Mbps $640/mo.	No Service	200/20Mbps $174.99/mo.	No Service	No Service
3300 GODWIN LN. PENSACOLA, FL 32526	Internet 5 Mbps $40/mo.	No Service	No Service	No Service	No Service

Broadband Availability

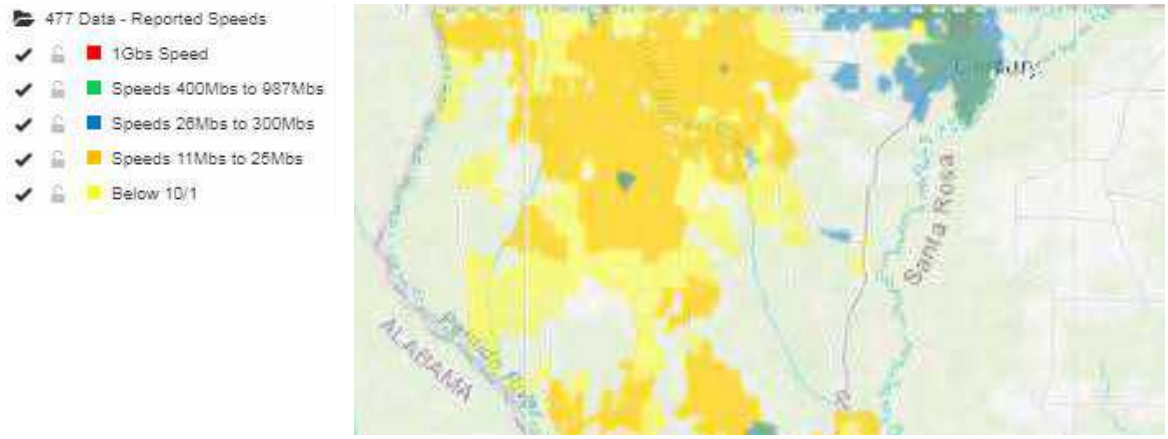
Escambia County's broadband market is divided into three distinct broadband areas - north, middle and south. The northern portion of the county is rural and more sparsely populated. The middle of the county is more densely populated but also contains a large forested area. The south end of the county is where the majority of the population resides and is home to the City of Pensacola, tourism and beach areas. The area has different broadband compositions based on incumbent providers deployed broadband assets.

The map above is provided by the Federal Communications Commission's (FCC) 477 broadband maps. Each census block contains the highest reported broadband speed listed by the incumbent service providers.

Northern Escambia

Northern Escambia County is lacking in internet speeds that meets the FCC definition of broadband (currently 25 Mbps download and 3 Mbps upload). The area is composed of rural areas and forests. There are small towns and farms throughout the area. Century is the largest population concentration in the area. The town of Century in the northeast corner has the highest speeds in the area.

Figure 3: Reported Broadband Speeds in Northern Escambia County

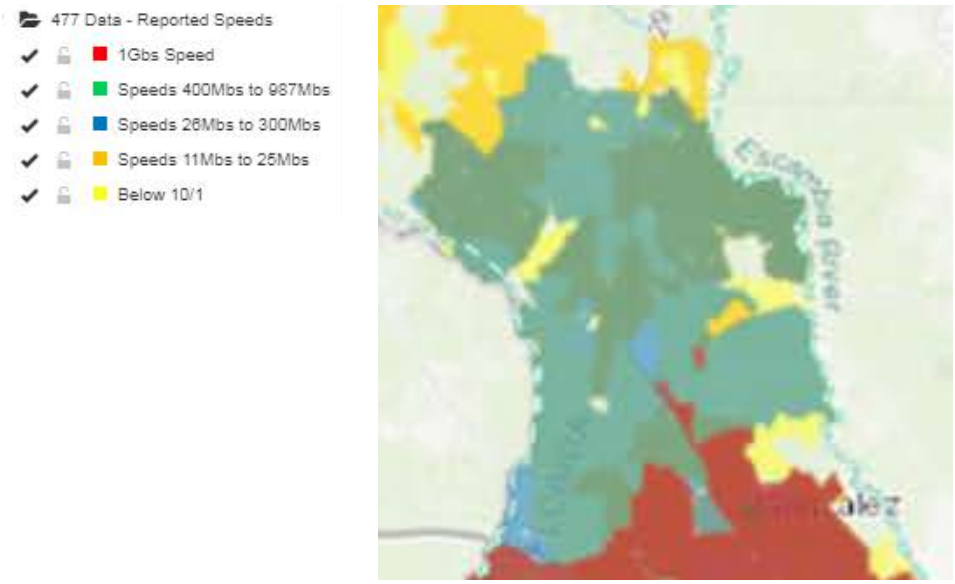


Central Escambia County

In the central area of the county the population increases, and some higher speeds are available to consumers. Charter Spectrum is the dominant provider in this area with Frontier Communications also having DSL coverage in the area. Charter Spectrum has up to 400 Mbps cable speeds available in most of the

area. The price for 400 Mbps service from Charter is $69.99 in Molino, FL. Frontier has lower speed DSL available (up to 18 Mbps) in most of this area.

Figure 4: Reported Broadband Speeds in Central Escambia County

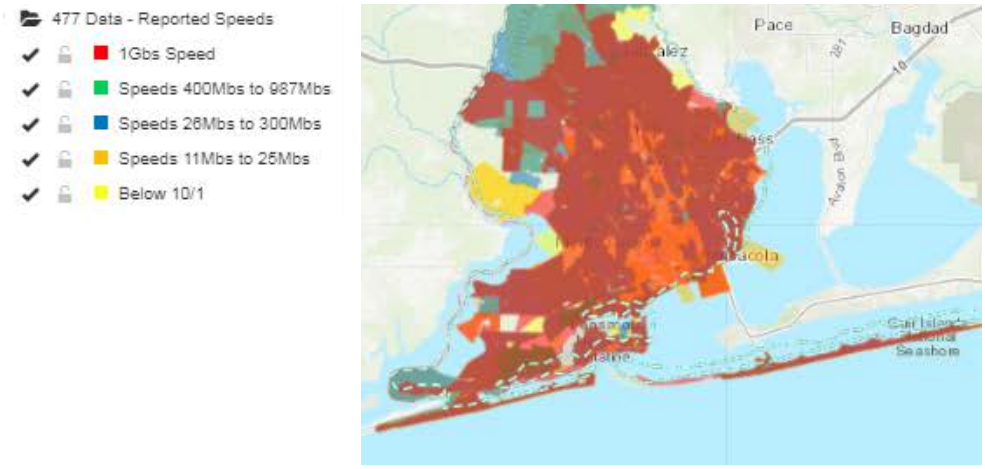


Southern Escambia County

The southern part of the county is more densely populated. It has urban city and tourist beach areas. There is also a Naval Air Station and Municipal Airport. Cox Cable is the dominant residential provider in the City of Pensacola area. Cox offers cable service up to 940 Mbps in most areas of the city. AT&T has fiber that also offers up to 1 Gbps service in several locations. Mediacom provides service along the beach areas. That service is also up to 940 Mbps.

Even with multiple providers and high speeds, many areas of Pensacola only have 1 provider that meets the FCC definition of broadband. This leads to a lack of competitive pricing which can be allow segments of the population to be unable to purchase broadband service.

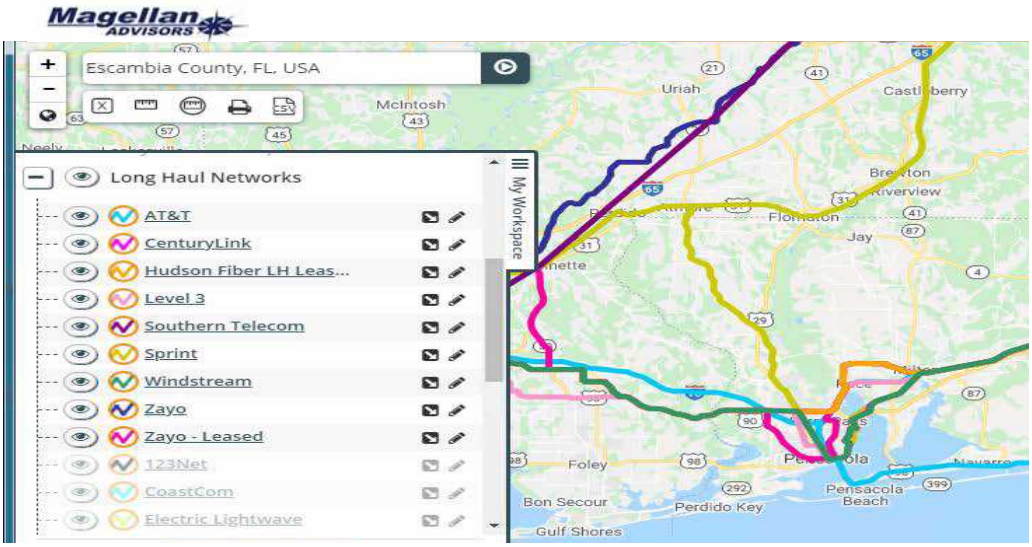
Figure 5: Reported Broadband Speeds in Southern Escambia County



Network Infrastructure

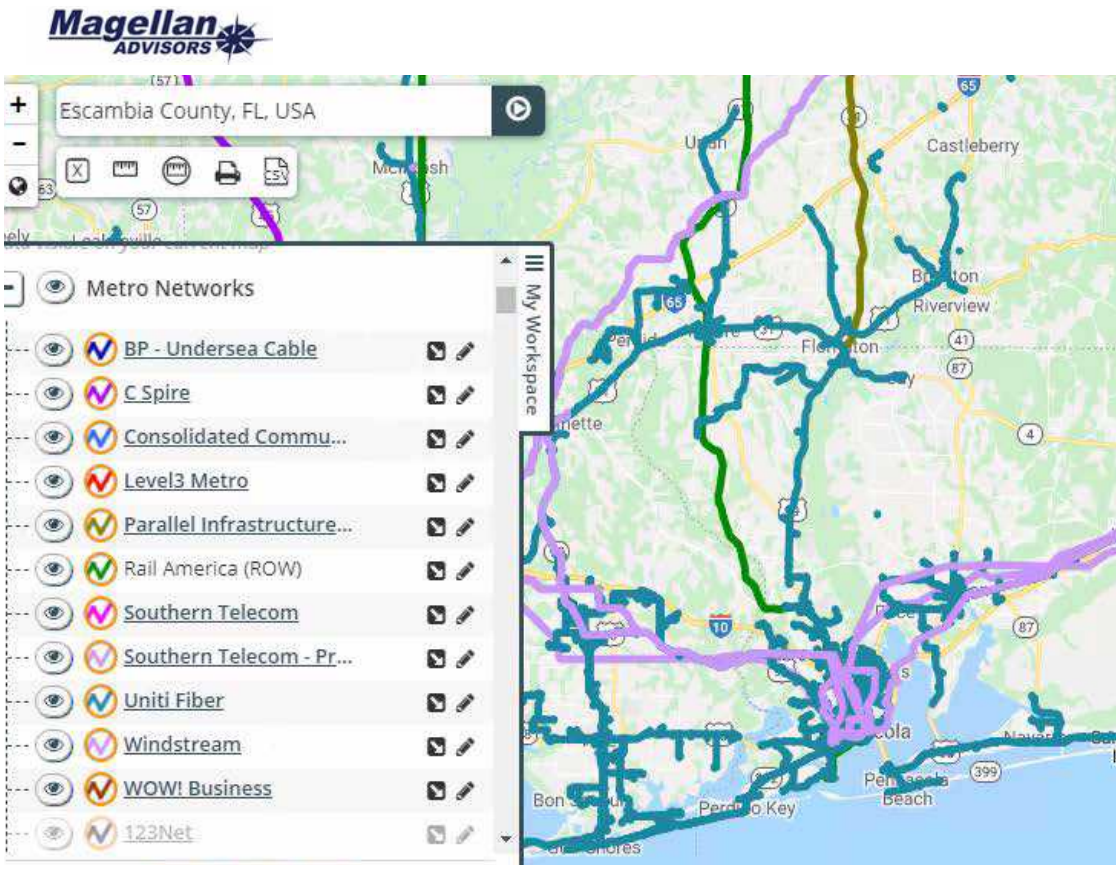
Long-haul fiber providers connect metro areas into the nationwide or worldwide communications networks. Sprint, AT&T and CenturyLink are predominant long-haul carriers for the Escambia region. The county has several long-haul providers, the majority of which are east to west routes that cross through the south of the county. These include AT&T, Level 3, Hudson, Zayo and Windstream. Sprint has a long-haul north/south route that is the solo route in the northern portion of the county.

Figure 6: Long-haul fiber routes in Escambia County



Metro routes provide local city distribution of the long-haul fiber bandwidth. They fill in areas in the city and connect major buildings, schools, hospitals, businesses and other areas of interest to the long-haul networks. Multiple providers have metro routes through the county. Two providers have the majority of metro fiber, Southern Telecom and Uniti both have substantial fiber networks through southern Escambia County. Uniti has some fiber running through communities in the northern part of the county, which is available for larger enterprise customers including large businesses, municipal facilities and large stakeholders.

Figure 7: Metro middle-mile fiber routes in Escambia County

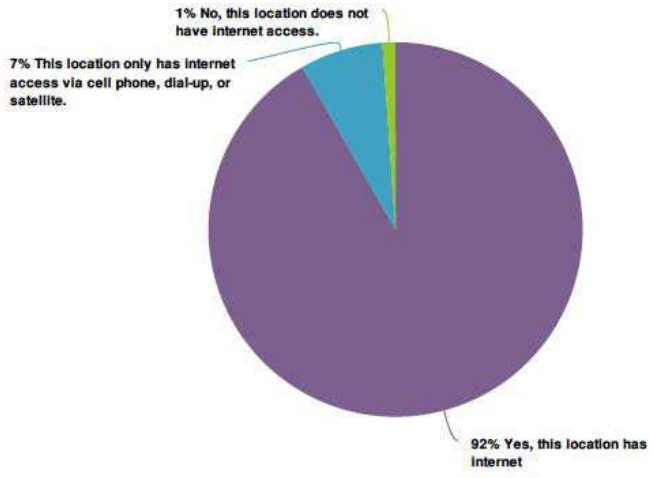


Survey responses

There were a total of 1,266 responses to the broadband survey. The Magellan Advisors broadband survey focuses on locations. Of these responses, 1,215 were from households and 51 were from organizations. Not all respondents answer all questions, so each item on the survey was analyzed separately.

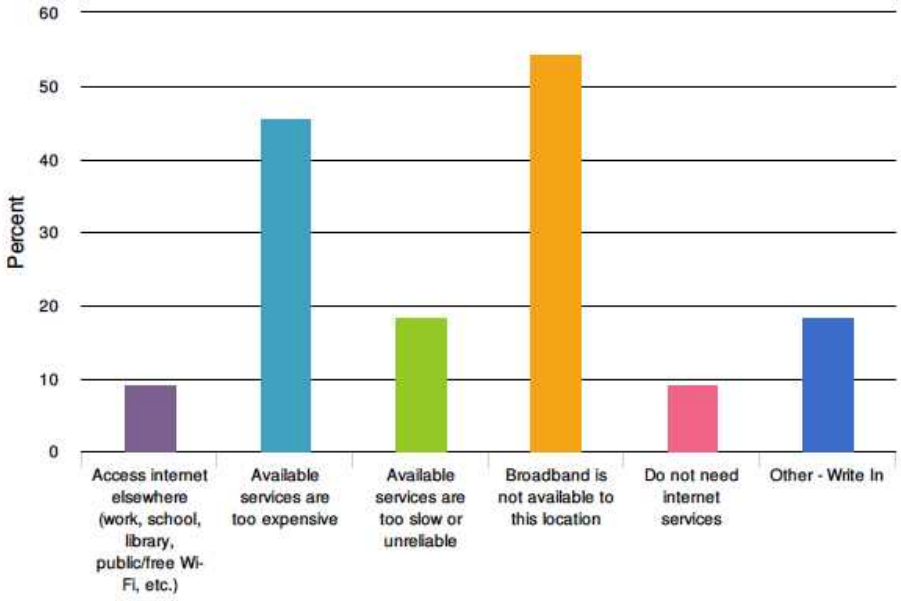
Of the respondents 91.7% had access to internet at the location for which they were completing the survey, while 7.2% had access to internet via only a cell phone, satellite or dial-up, and 1.1% of respondents had no internet access at all at that location.

Figure 8: Survey locations with and without Internet Access



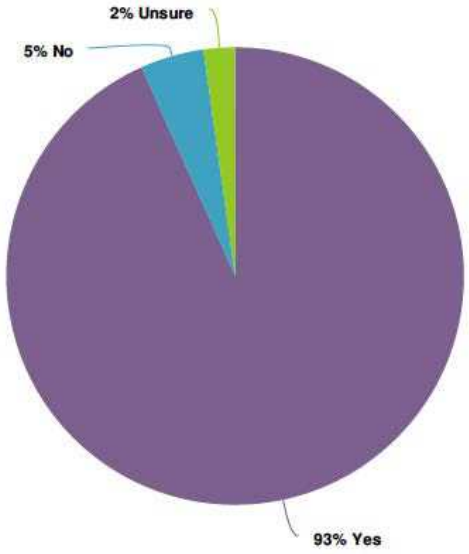
For the respondents that stated they had no access to internet at their location, the primary reason for this was that broadband was not available at that location, followed by services are too expensive and available services are too slow or unreliable as seen in Figure 10 below. In summary, Escambia County residents that lack internet access are struggling with two major issues including lack of broadband infrastructure necessary to households and lack of access due to providers pricing.

Figure 9: Why does your location not have internet



As Internet access becomes more important to our daily lives more households are considering it an essential service. When Escambia County residents were asked if they consider Internet access to be an essential service, like electricity and water, an overwhelming amount said yes – 93%. Verifying that Escambia County's constituents believe that having access to high-speed broadband is no longer a nice to have but a true necessity.

Figure 10: Do you consider internet access to be an essential service, much like water



Current Providers

The survey determined the current market share for providers in Escambia County to understand what Escambia area customers utilize today and the services they offer. Cox is the dominant provider in the market today, with the majority share of the market at 43.6%. AT&T follows as the second leading provider, with 19.2% of Escambia area locations. Additional incumbents have smaller market shares including Frontier (9.6%) and Mediacom (1.4%). The remaining households are served by a variety of wireless, cellular or satellite-based Internet services as shown in Figure 12. Nearly 20% of respondents wrote in that their service provider was "other." Spectrum accounted for nearly 90% of the write-ins making it the third largest provider for the area. Other responses in the other category included mobile hot spots and satellite or other non-wired providers.

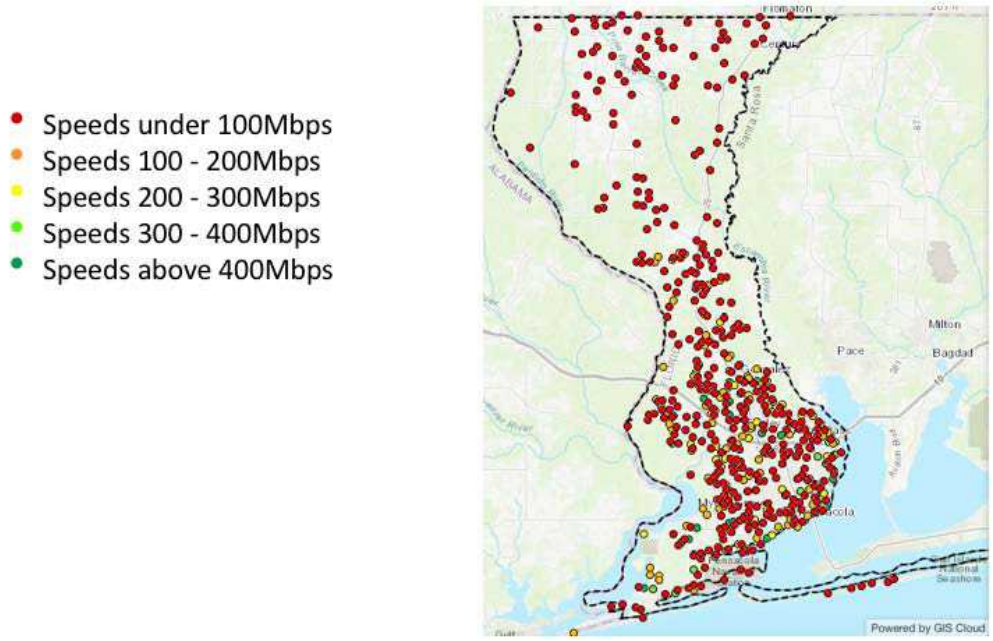
Figure 11: Internet Providers Utilized by Escambia Area Households

Value	Percent	Responses
AT&T	19.2%	168
Cox	43.6%	381
Mediacom	1.4%	12
Frontier	9.6%	84
Excede/Viasat	4%	35
HughesNet	1.3%	11
Charter/Spectrum	18.7%	162
Other	1.1%	10

Speed Test

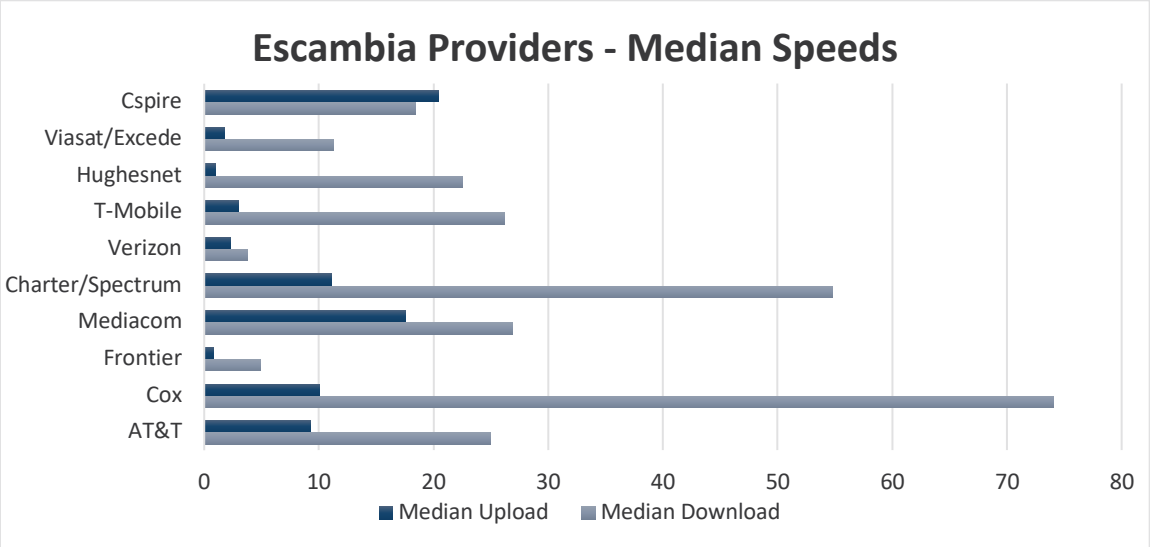
Magellan's survey incorporated a speed test detailing the actual speeds that residents and businesses in Escambia County receive today. No respondents in the North end of the County registered speeds above 100Mbps, with many recording speeds far less. A few respondents in the South portion of the County registered speeds at or above 400Mbps, and only a few registering speeds meeting one gigabit.

Figure 12: Speeds and Locations of Speed Tests



The table below shows the median speeds delivered by each provider as derived from the speed test. Cable providers showed the highest speeds to residents in Escambia with Cox recording the fastest download speeds in the county with a median download speed of 74.015 Mbps. Spectrum had the second fastest speeds (54.73 Mbps) followed by Mediacom (26.84 Mbps) and T-Mobile (26.165 Mbps). The slowest download speeds were recorded by Verizon (3.79 Mbps) who provides LTE based services and Frontier (4.93 Mbps) who provides services over DSL lines.

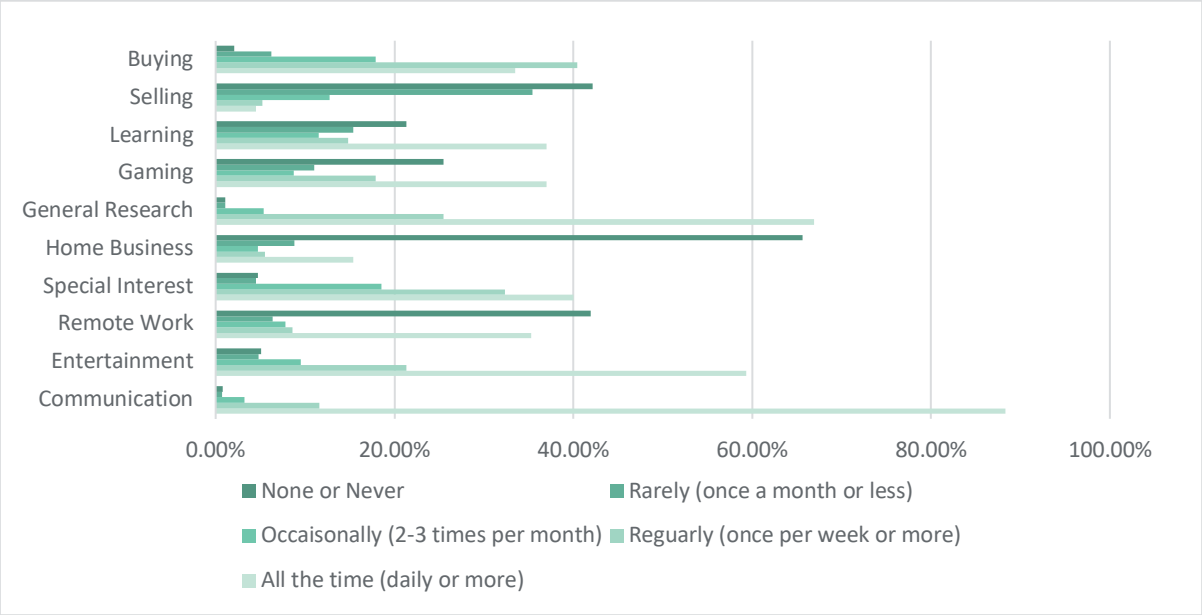
Figure 14: Median Speeds by Provider



Internet Use by Households

The most common uses of the internet among household respondents, as shown in Figure 15 were communication, general interest, and entertainment. Well over 50% of respondents do these activities online every day. Three quarters of respondents used the internet regularly for special interests. Almost 75% of respondents said they buy online at least once a week. Nearly 50% of respondents noted engaging in online learning at least once a week and telecommuting or work from home was reported with similarly frequent uses of the internet.

Figure 15: Frequency of Uses for the Internet by Percentage of 728 Responses



Satisfaction

Escambia residents responded that their internet has consistent slowdowns, with over 34% of respondents experiencing slowdowns every single day and almost 60% experiencing slowdowns multiple times a week. Over a third of respondents experienced brief outages several times a week. Even more concerning nearly 20% of respondents noted that their internet service was out for more than a day multiple times a year and as often as every few weeks.

Escambia's residents weighed the importance of several factors in customer service and satisfaction. Figure 16 below shows that Escambia's residents are

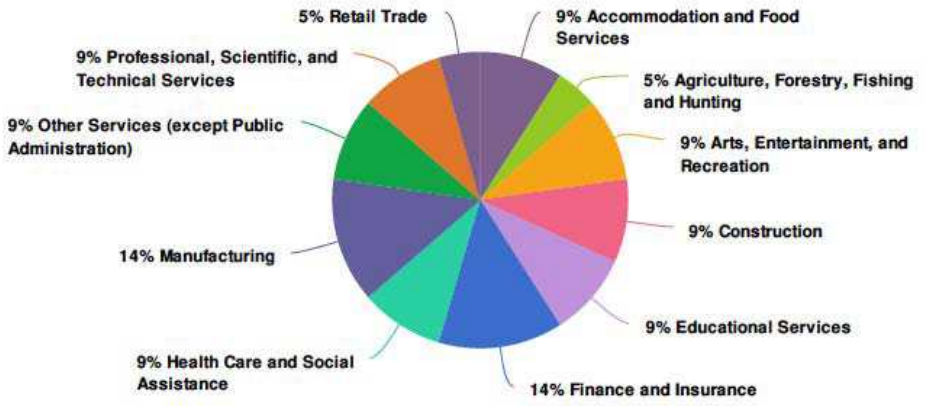
most dissatisfied with broadband pricing, followed closely by performance and speed and reliability. Customers were generally satisfied or neutral about customer service and technical support from current providers.

Figure 16: Customer Satisfaction with Current Service Providers

Businesses Surveys

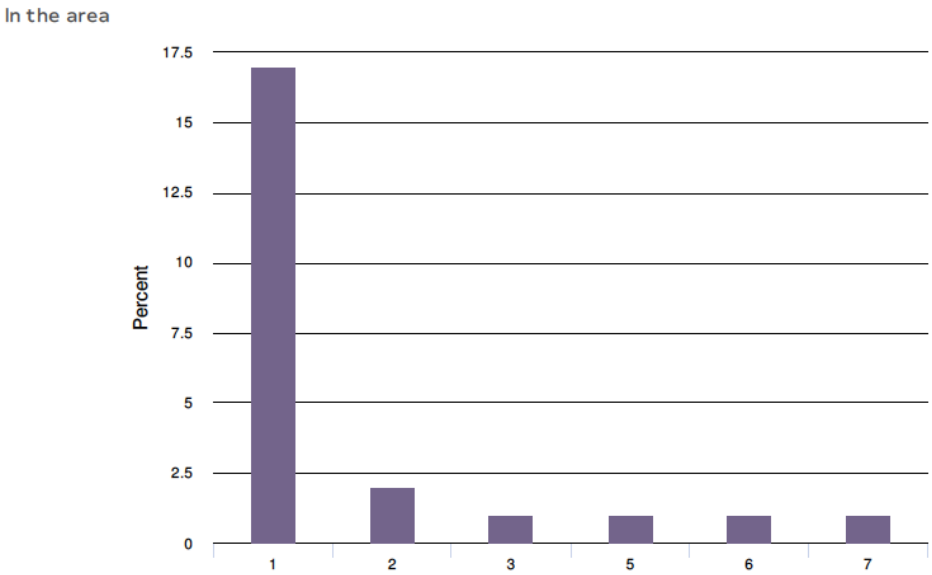
Fifty-one organizations and businesses completed part or all of the Escambia County Broadband Survey. Organizations came from a variety of business sectors. The leading sectors were Finance and Insurance (14%) and Manufacturing (14%), followed by Construction (9%), Accommodation and Food Services (9%) Educational Services (9%), Healthcare and Social Assistance (9%) and Arts Entertainment and Recreation (9%).

Figure 17: Organizations primary line of business



Most organizations had only one location, but several had multiple locations up to 7 different locations across the region. Organizations with multiple locations have interconnectivity needs and tend to fall in the category of financial, education, healthcare and other large stakeholders.

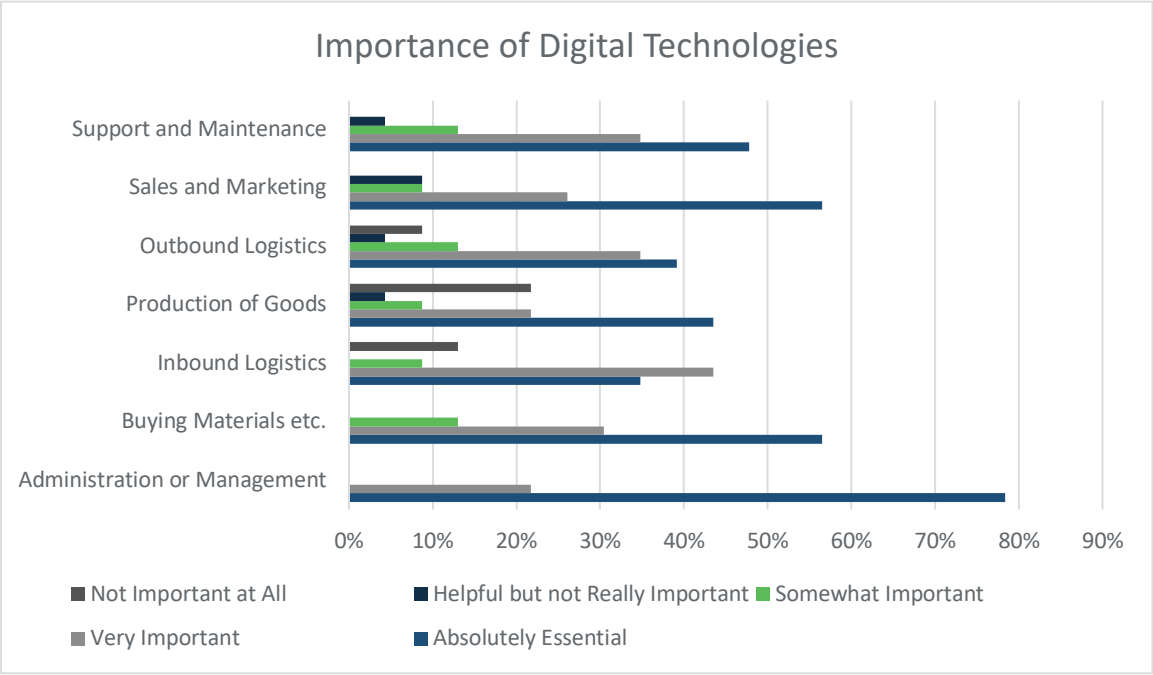
Figure 18: How many locations or sites does your organization have?



Digital technologies have become the lifeblood of sustaining and growing a business. Escambia businesses illustrated this by noting the importance of digital technologies to various functions throughout their businesses. Of the respondents (23) the largest weight was put on administration or management with 78% of respondents saying digital technology was absolutely essential to

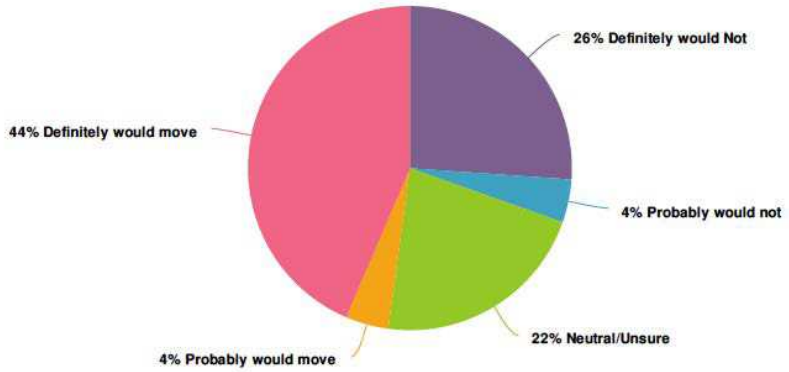
that element of their organization. Sales and Marketing and Buying Materials and Hiring Employees came in a close second with both, 56% of organizations saying that digital technologies are absolutely essential to these elements of their businesses.

Figure 19: Importance of Digital Technologies to Escambia Organizations



To further cement the necessity of quality, high-speed broadband to organizations in Escambia County, the survey asked, "If your organization were able to get much faster and less expensive internet services elsewhere with comparable business characteristics, how likely would it be to move from your current location." Almost half of organizations (44%) said they definitely would move for better service. 28% of respondents said they definitely would not move, meaning their organizations are well settled into the community.

Figure 20: Would your Organization Move for Better Broadband?



REGULATORY ENVIRONMENT FOR ESCAMBIA COUNTY

State policy and regulatory frameworks vary across the country regarding provision of fiber optic-based services by a city or county. Implementing policies related to broadband is a vital role that local governments play in expanding access and creating a competitive market. Magellan Advisors evaluated specific federal policies to ensure any plans and recommendations regarding Escambia County's potential provision of fiber optic-based broadband services is consistent with policy and regulatory requirements. [3] We also considered implications of regulations related to emerging next generation 5G wireless services. As noted earlier, much of the current legislation at the federal, state, and local levels relates to the coming of 5G, which will be accompanied by additional encroachment activities as more fiber is deployed to support additional wireless telecommunications facilities.

Federal Regulation of Broadband

Due to federal preemption,[4] the FCC's approach to regulating broadband often

[3] The following discussion does not constitute a legal opinion and should not be construed as such. Questions about interpretation or applicability of these or other provisions of federal or Florida law should be referred to legal counsel.

[4] When commercial activities primarily occur interstate, as opposed to intrastate, Congress has the ability to regulate these commercial activities and invalidate state or municipal regulations which contradict or oppose the federal regulations. ***See in the Matter of Restoring Internet Freedom (***In Re: Internet Freedom), 33 F.C.C. Rcd. 311, ¶¶ 194-204 (2018).

determines the extent that state and local governments may also regulate broadband. However, the FCC has less ability to use its preemption powers to invalidate state laws which govern municipalities. Because municipalities are considered a creation of state law and agencies of the state, stricter rules apply which limit when federal law can preempt a state's ability to regulate its municipalities.[5] Accordingly, while it is important for a municipal provider to understand the interplay between federal and state law in governing broadband, state laws which apply specifically to municipal broadband are likely valid and not preempted by contradictory federal policy.[6]

Besides contradictory state laws which apply specifically to municipal broadband, FCC orders and regulation do have considerable ability to limit and determine state law in the area of communications, and a federal policy of deregulation generally limits and state and local laws which would limit deployment of broadband infrastructure or have an anticompetitive effect. As discussed above in the introductory paragraph, in 2018, the FCC reclassified "broadband internet access service"—including both fixed and mobile service—as an "information service" instead of "telecommunications service," as each are defined in the Telecommunications Act of 1996 ("TA96").[7] This was a reversal of its 2015 Open Internet Order[8] in which the FCC initially classified broadband internet access service (both fixed and mobile) as a telecommunications service. The FCC described the effect of this reclassification as ending "utility-style regulation of the internet . . . ."[9] As classified as a "telecommunications service," broadband internet service was subject to many of the regulatory obligations of Title II of the Communications Act, and broadband internet service providers were generally subject to common carrier requirements.[10] In ending this utility-style regulation in favor of deregulation, the FCC announced its preemption of any state or local laws which would contradict this approach.[11]

[5] ***Tennessee v. Fed. Commc'ns Comm'n***, 832 F.3d 597, 610 (6th Cir. 2016) (citing ***Nixon v. Missouri Mun. League***, 541 U.S. 125, 140 (2004)).
[6] ***See id***. at 613.
[7] ***See*** in Re: Internet Freedom (interpreting 47 U.S.C. § 153(24), (53)).
[8] ***Protecting and Promoting the Open Internet***, WC Docket No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015) (***Title II Order***).
[9] ***Id.*** at ¶ 2.
[10] ***Id***. at 37 – 57.
[11] We therefore preempt any state or local measures that would effectively impose rules or requirements that we have repealed or decided to refrain from imposing in this order or that

In addition to defining what communication technologies are designated "telecommunications services" and "information services," the FCC otherwise interprets other provisions and definitions of the TA96, including defining different types of broadband services and infrastructure. Providers of broadband should familiarize themselves with the FCC's interpretations and guidance, as its classifications can determine which federal rules apply to specified broadband services, and the applicability of certain federal requirements can influence which state and local rules apply, to the extent such federal rules preempt the state or local law.

As the FCC considers "broadband internet access service" an "***information service***," and thus deregulated (as opposed to "***telecommunications service***" – i.e., basic telephone service – which are regulated as common carriers), it is important to note the FCC's current definition of "broadband internet access service," which it defines as:

> . . . mass-market retail service by wire or radio that provides the capability to transmit data to and receive data from all or substantially all Internet endpoints, including any capabilities that are incidental to and enable the operation of the communications service, but excluding dial-up Internet access service.
>
> The term "broadband Internet access service" includes services provided over any technology platform, including but not limited to wire, terrestrial wireless (including fixed and mobile wireless services using licensed or unlicensed spectrum), and satellite. For purposes of our discussion, we divide the various forms of broadband Internet access service into the two categories of "fixed" and "mobile." With these two categories of services—fixed and mobile—we intend to cover the entire universe of Internet access services at issue in the Commission's prior broadband classification decisions, as well as all other broadband Internet access services offered over other technology platforms that were not addressed by prior classification orders. We also make clear

would impose more stringent requirements for any aspect of broadband service that we address in this order. Among other things, we thereby preempt any so-called ""economic" or "public utility-type" regulations, including common-carriage requirements akin to those found in Title II of the Act and its implementing rules, as well as other rules or requirements that we repeal or refrain from imposing today because they could pose an obstacle to or place an undue burden on the provision of broadband Internet access service and conflict with the deregulatory approach we adopt today. ***Id***. at ¶196.

> that our classification finding applies to all providers of broadband Internet access service, as we delineate them here, regardless of whether they lease or own the facilities used to provide the service. "Fixed" broadband Internet access service refers to a broadband Internet access service that serves end users primarily at fixed endpoints using stationary equipment, such as the modem that connects an end user's home router, computer, or other Internet access device to the Internet. The term encompasses the delivery of fixed broadband over any medium, including various forms of wired broadband services (e.g., cable, DSL, fiber), fixed wireless broadband services (including fixed services using unlicensed spectrum), and fixed satellite broadband services. "Mobile" broadband Internet access service refers to a broadband Internet access service that serves end users primarily using mobile stations. Mobile broadband Internet access includes, among other things, services that use smartphones or mobile-network-enabled tablets as the primary endpoints for connection to the Internet. The term also encompasses mobile satellite broadband services.[12]

The FCC has also listed certain services it does not consider "broadband internet access service," including: (i) data services which provide connectivity to a limited number of internet endpoints in conjunction with the offering of certain products or services such as "e-readers, heart monitors, or energy consumption sensors;" (ii) video or voice services provided by internet service providers, as these services are otherwise regulated; (iii) virtual private network (VPN) services; (iv) content delivery networks (CDNs); (v) hosting or data storage services; (vi) Internet backbone services (if those services are separate from broadband Internet access service, as these services have historically not been considered "mass market," because they usually do not provide the capability to transmit data to and receive data from substantially all Internet endpoints); (vii) premise owners such as coffee shops, bookstores, and airlines and providers of private end-user networks such as libraries and universities, and other businesses which acquire broadband Internet access service from an internet service provider in order to provide their guests and invitees Internet access on location; and (viii) personal Wi-Fi networks created by users of broadband

[12] ***Id***. at ¶¶ 21-22.

internet access service who do not intentionally offer the benefit to others. Each of these are not considered service providers because they do not market and sell the broadband internet access to residential customers, small businesses, or other end-users such as schools and libraries.[13] A municipality which markets internet access to its residents, businesses, and schools and libraries is likely to be considered a broadband internet access service provider by the FCC and subject to FCC regulations; therefore, any municipal provider of telecommunications services should familiarize themselves with the various FCC reporting, filing and other requirements regarding fees, reports and data. While the FCC's current regime supports deregulation and free-market principals in relation to these services, the agency is limited in its authority to preempt state laws related to municipalities, even if those state laws create greater restrictions than the federal regulations.

State Regulation of Broadband

The State of Florida has passed several statutes pertaining to broadband services, of which the two most notable are:

- **The Regulatory Reform Act deregulated telecommunications services**: F.S. 364.011 as amended in 2011 by HB1231, the "Regulatory Reform Act", identifies essentially all telecommunications services as exempt from Florida Public Service Commission jurisdiction, including:
  - "Intrastate interexchange telecommunications services."
  - "Broadband services, regardless of the provider, platform, or protocol."
  - "VoIP."
  - "Wireless telecommunications, including commercial mobile radio service providers."
  - "Basic service."
  - "Non-basic services or comparable services offered by any telecommunications company."
- **Imposition of Business Case Requirements on Municipals**: In 2005 F.S. 350.81 was enacted, which placed onerous procedures and requirements on government entities seeking to offer communications services. These requirements include at least two public hearings, considering a variety of factors such as "a plan to ensure that revenues exceed operating expenses and payment of principal and interest on debt within four years" and many other factors and procedural steps.

[13] ***Id***. at ¶¶23-25.

Since fiber-to-the-home (FTTH) projects, whether public or private, often require longer than four years to become cash-flow positive, this requirement either precludes municipalities from proposing FTTH projects or invites endless disputes over whether or not a municipality's plan is viable, and subject municipal business planning to delays and publication of business information that no other business would be required to accept.

4. Broadband Technologies and Business Models

The general requirements in the southern portion of Escambia County, particularly for business and industry, are for much greater throughput: network access should be symmetrical 1 Gbps services with a path to 10 Gbps services. Private industry and public institutions require multiple providers and redundant network routes in the area for greater reliability. The general requirements in the northern half of the county are more fundamental: Simple access.

Services based on coaxial cables and twisted pair wires simply can't economically meet these requirements. Indeed, these general requirements translate into more specific infrastructure requirements. Escambia County needs fiber-optic backbone and radio access infrastructure, to be overlaid with a variety of services—data, video, voice—that can be provided with various levels of quality-of-service. All of this needs to be lean and secure to minimize need for administrative overhead.

BROADBAND TECHNOLOGY FOR ESCAMBIA COUNTY

The right choice for broadband technology is imperative for Escambia County. As technology continues to upgrade and change, Escambia County should continue to review and analyze their plans and ensure they are delivering the best opportunities for competitive and reliable broadband services that meet the needs of as many stakeholders, enterprises and businesses while maintaining fiscal and operational feasibility. After a thorough review of the Escambia market, needs, gaps and geography the following technology plan was created for Escambia County.

Fiber-optic technology is the gold standard, it maintains life for 20+ years and is the infrastructure that enables all other technologies including advances in wireless, satellite, and 5G. In order to develop a long-term broadband infrastructure plan, the County must invest in fiber optics. A County owned fiber-optic backbone will be the foundation of the County's broadband strategy. Magellan's initial network planning includes the creation of a backbone fiber network to provide the foundation and backhaul required to bring high-speed wireless broadband services to the heavily under and unserved northern portions of the county. In order to further take advantage of this investment

the backbone will be connected to all the county offices and locations. The network is created with a ring architecture to support resiliency and ensure that network interruptions are rare.

Feasibility and access were the keystone's for creating an ultra-high-speed broadband network for Escambia. Layering technologies allows Escambia County to deliver access to a greater population, while reserving capital output and enabling the ability to begin to collect revenues. Building on the backbone, Magellan's team designed a wireless overlay utilizing the fiber ring in the north of the County. This hybrid fiber/wireless network is the most cost-effective method to deliver broadband to the county in a strategic, phased approach.

Conclusions

Major private and public sector sites in Escambia County, including industrial areas and radio towers, must be fiber connected. There must be multiple fiber routes through the county to give it diverse, redundant connections. Major private and public sector sites in Escambia County, including industrial areas and radio towers, should be fiber connected. There must be multiple fiber routes through the county to give it diverse, redundant connections. Diversity and redundancy are necessary attributes for mission critical county services and are a requirement for economic development and attraction of new or expanding businesses. Escambia County's major objectives are to provide connectivity to underserved areas of the county, to encourage digital inclusion, to reduce and stabilize rates for critical connectivity, to retain and expand economic development and job creation and to control its own broadband destiny and improve residents' quality of life. This report and the recommendations and step-by-step phasing that follow provides the opportunity for Escambia County to meets its objective in a prudent and measured way.

BROADBAND BUSINESS MODEL OPTIONS

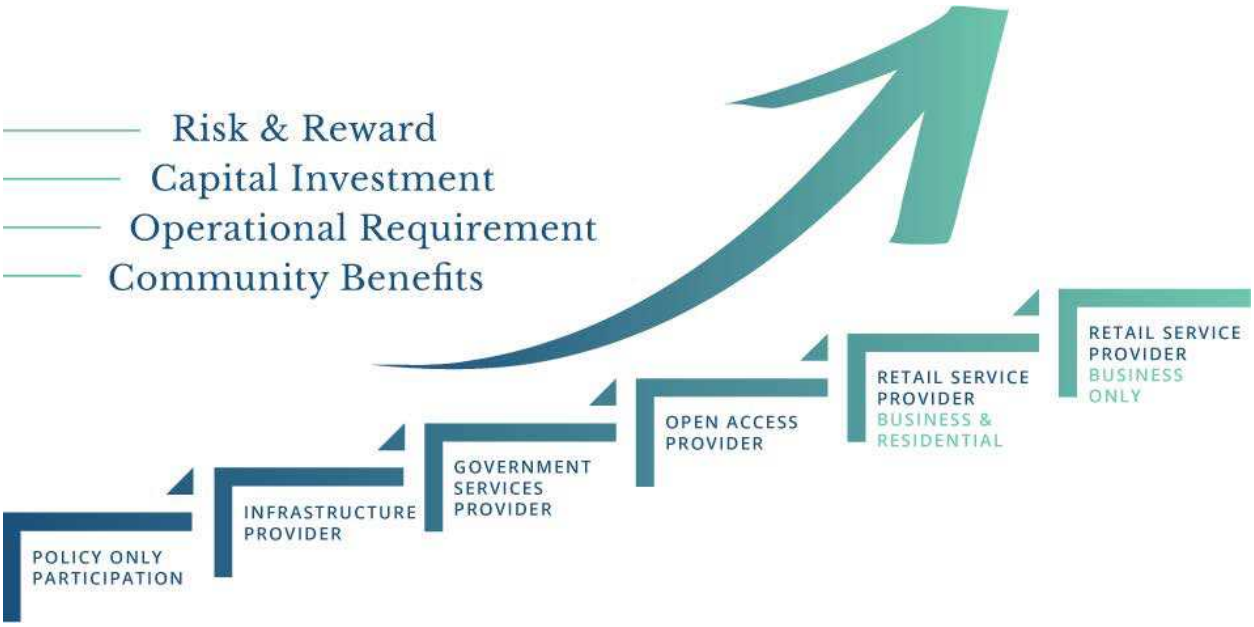
A business model describes how a product or service is developed, operated, and supported. Traditional broadband business models involve enterprises established specifically to provide communications services. The earliest such enterprises were startups that leased telephone lines to provide service. Today, most services are provided by either traditional cable television or telephone companies that added internet access as an optional service via the companies' own infrastructure.

Many local governments and other public enterprises provide broadband or similar services, most only to internal departments and other public agencies. Many also provide free public Wi-Fi access at public facilities. Some provide for-fee services to businesses and residences, competing head-to-head with for-profit providers. Others partner with private companies. There are a range of policies and programs local governments and other institutions can implement to foster broadband development. Which to implement depends on the factors depicted in Figure 21.

Figure 21: Inputs to Selecting the Right Broadband Approach

The greatest return on any investment in network assets comes from using them for broadband services. The best, most feasible, and viable business model is one that aligns with the vision of the community, its leadership, and government operations. Becoming a fully functioning provider comes with significant challenges. Escambia County leaders will need to make decisions about the level of benefits they hope to achieve and level of investment they are willing to make.

Figure 22: Risk and Reward Continuum of Broadband Business Models



The business models fall on a continuum, illustrated in Figure 22, that ranges from low risk, low investment options to higher risk, high investment options. As a local government evaluates the various business model options along the continuum, it will encounter greater degrees of risk and reward; risk, in terms of financial, operational, and regulatory risk; reward, in terms of community benefits, revenue generation, and overall potential for profit. Moving "up" the continuum also implies greater local government participation in the delivery of broadband services. Table 3 provides a high-level comparison of the business model options.

Table 3: Comparison of Public Broadband Options

CONSIDERATIONS	PASSIVE GOVERNMENT MODELS			ACTIVE GOVERNMENT MODELS			
	POLICY-ONLY	INFRASTRUCTURE-ONLY	PARTNERSHIPS (P3)	PUBLIC-ONLY	WHOLESALE OPEN ACCESS	BUSINESS-ONLY	FULL RETAIL
SERVICES	None	Dark Fiber Only	None	All/Any	Transport	Internet	Internet
CUSTOMERS	None	Broadband Providers	None	Public Agencies	Broadband Providers	Businesses	Businesses & Residents
FUNDING	Low	Moderate	Low to High	Moderate	Moderate	Moderate	Moderate
COMPETE WITH PROVIDERS	No	No	No	No	No	Yes	Yes
OPERATIONAL REQUIREMENTS	Low	Low	Low	Low	Moderate	Moderate	Moderate
REGULATORY REQUIREMENTS	Low	Low	Low	Low	Moderate	High	High
REVENUE GENERATION	Low	Low	Low to High	Low	Moderate	High	High
OPERATIONAL COSTS	Low	Low	Low	Low	Moderate	Moderate	Moderate
FINANCIAL RISK	Low	Low	Low	Low	Moderate	Moderate	Moderate
EXECUTION RISK	Low	Low	Moderate	Low	Moderate	Moderate	High

Public Broadband Development Business Models

Policy-only

This is the most passive model and includes permitting, right of way access, construction, fees, and franchises that regulate the cost of constructing and maintaining broadband infrastructure within its jurisdiction. This option is not considered a true business model but does significantly affect the local broadband environment and is therefore included as one option.

Infrastructure-only

Municipalities lease and/or sell physical infrastructure, such as conduit, dark fiber, poles, tower space, and property to broadband service providers that need access within the community. These providers are often challenged with the capital costs required to construct this infrastructure, particularly in high-cost urbanized environments. The utility infrastructure provides a cost-effective alternative to providers constructing the infrastructure themselves.

Partnerships

A broadband public-private or public-public partnership (P3) is a negotiated contract between a public entity (i.e. Escambia) and private or public entity to fulfill certain obligations to expand broadband services in a given area. P3s leverage public broadband assets, such as fiber, conduit, poles, facilities with private broadband provider assets, and expertise to increase the availability and access to broadband services. The table on the following page provides a side-by-side comparison of the various business models.

Public-only

These organizations are generally limited to the community anchors that fall within their jurisdiction, including local governments, school districts, higher educational organizations, public safety organizations, utilities, and occasionally healthcare providers. Many of these anchors require connectivity and often, the municipal network provides higher capacity at lower costs than these organizations are able to obtain commercially.

Open access/wholesale

Municipalities that adopt open-access generally own a substantial fiber-optic network in their communities but do not provide services to consumers. Open access allows these municipalities to “light” the fiber and equip the network with the electronics necessary to establish a “transport service” or “circuit” to service providers interconnecting with the local network. The concept of open

access is designed to enable competition among service providers across an open network that is owned by the municipality. The municipality is essentially a "wholesale" provider that retains neutrality and non-discriminatory practices with the providers who operate on the network.

Business-only

Municipalities that provide end users services to business customers are considered retail service providers. Most commonly, municipalities provide voice and Internet services to local businesses. In many cases, a municipality may have built a fiber network for the purposes of connecting the city's primary sites that has been expanded to connect local businesses, in effort to support local economic development needs for recruitment and retention of businesses in the city.

Full retail

Municipalities that provide end user services to businesses and residential customers are considered retail service providers. Most commonly, municipalities provide services to their businesses and residents through a municipally owned public utility or enterprise fund of the city. As a retail service provider that serves businesses and residents, the municipality is responsible for a significant number of operational functions, including management of its retail offerings, network operations, billing, provisioning, network construction, installation, general operations, and maintenance.

Recommended Model

The County should establish a program to construct publicly owned network infrastructure consisting of a Fiber backbone and distribution in support of a wireless network to provide connectivity for the underserved areas of the county. The county should also place conduit and fiber to take advantage of any ground-disturbing projects, especially road, sewer, and water construction, and any investments in radio towers should accommodate wireless electronic assets to further expand the county's wireless network. The program should also involve outreach to prospective partners and other community stakeholders, with an eye toward establishing a formal entity to lead broadband development. The goals and rationale for this program include:

- Meeting connectivity requirements for the County, its departments, cities, social service agencies, and other partners, and extent broadband services to the underserved,

- Reducing operating costs and providing a platform for service improvements,
- Increasing resilience and supporting disaster planning and response, and
- Attracting new business investments, creating high-pay/high-skill jobs, and generating revenue via asset leasing.
- Establish both dark and lit fiber rate schedules and leasing programs

PARTNERSHIP OPPORTUNITIES

To increase broadband options for better, cheaper, faster broadband, the County and other stakeholders must lower the barriers to entry for network service providers. There are unfortunately few opportunities to do this with incumbent cable and telephone companies. The incumbents generally don't partner with local governments and make investment decisions at the regional and national levels. Even if they did, partnering with the incumbents perpetuates the local duopoly or monopoly, and doesn't really increase the options for consumers.

The general partnership opportunity for Escambia County is to catalyze private investment, primarily by capitalizing on existing assets and making direct public investment in additional assets. Escambia County can also drive investment by aggregating and cultivating demand via partnerships. Broadband-friendly policies are also important for fostering partnership opportunities.

5. Conceptual Network Design

CONCEPTUAL DESIGN: ESCAMBIA COUNTY BACKBONE NETWORK

The conceptual network design presented in this Study meets basic requirements for Escambia County. There are two purposes for this design. The primary, general purpose is to establish a vision for community leaders as they plan public investment and or seek out private investments. The second, specific purpose of the conceptual design is to determine approximate costs and potential benefits to be realized from such investment.

This design is based on assumptions derived from the requirements described above. Possibly the most significant assumption is that the County may own all or most of the network infrastructure and will provide services for a fee to the community at large via the network. The design does not specify anything about the network beyond prospective routes and targeted sites, as this is all the information appropriate and necessary for evaluating feasibility.

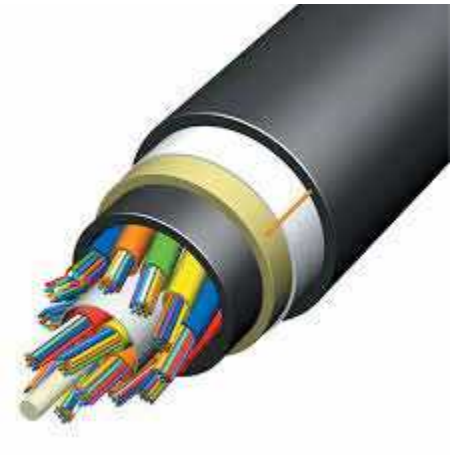
Network Components

The Network is conceptualized as a combination of fiber and radio/wireless infrastructure. The fiber infrastructure is designed as a carrier-class network, which means it would be (a) resilient to most environmental and physical hazards and (b) capable of provisioning various services independently and transparently for multiple customers. The wireless network(s) are designed to use fiber as a backbone/distribution network to connect radio access network cells. Nodes on the network, connected via fiber and wireless links, serve one of three functional roles in the network: access, aggregation, or interconnection.

Fiber Backbone

The fiber backbone is made of two fiber rings, one in the north and one in the south. Both rings maintain a 288-strand fiber count. A route that runs over the Pensacola Bay Bridge will connect the beach areas in the south of the county. The rings connect back to the Emergency Operations Center (EOC) where they

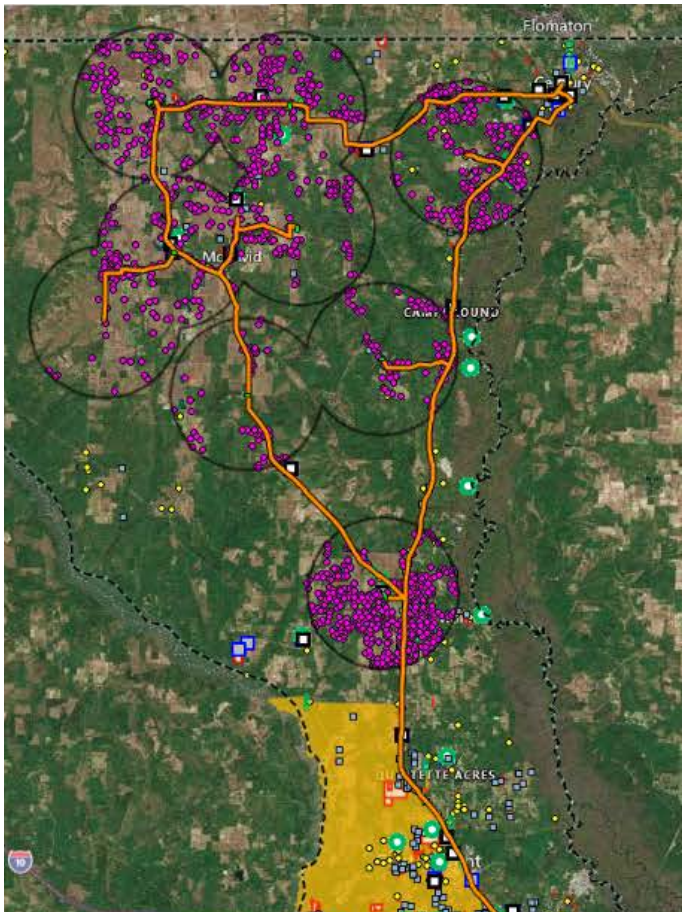
will then interconnect to an Internet Point of Presence (POP). Installing a large count fiber cable does not significantly increase the cost of project and gives great capacity for future projects. Each fiber is ideally capable of carrying terabits of data. Multiple technologies of single mode and multimode operation can be used to get the most bandwidth and efficiency from the backbone. At designated junction's smaller fiber counts will be run as laterals to county offices, telecommunications towers, parks, and other facilities in need of bandwidth. Once in place the fiber can be used by the county, leased to other providers as dark fiber, or eventually lit for a retail network.



Wireless Overlay

In rural areas it is cost effective to build fiber to a central location and use wireless distribution to reach end users. The goal of the proposed network design is to develop a fiber backbone with a ring architecture to multiple facilities and tower locations. Once the fiber connects with towers, the network will deliver bandwidth wirelessly to larger geographic areas. Utilizing this strategy, the County will receive the benefits of high bandwidth fiber with lower distribution costs. Figure 23 shows the northern fiber ring along with connections to towers. The circles display average range of the coverage from each tower. The purple dots are residences in range of that tower.

Figure 23: Escambia Conceptual Network Design - Wireless Overlay



Wireless Technology Used

CBRS technology is the wireless technology chosen for this overlay. There is a full description of this technology in Appendix D. CBRS is a newer frequency band allocated by the FCC in a category defined as ***lightly*** licensed. CBRS has the possibility of 150 MHz, is free to use but base station devices must be connected to a Spectrum Access System (SAS) and installed by a certified professional. The SAS coordinates usage among end users in order to minimize interference. The installers are specifically trained for this network so there is a more consistent installation of network devices which makes the network more reliable. The frequency band used (3.5 GHz) has better propagation distance than common Wi-Fi bands (5.8GHz). In a typical CBRS channel (20 MHz) speeds of 150 Mbps download can be obtained. Upload speeds of 50 and 75 Mbps are possible in good conditions. Lastly, the FCC has allowed over 10 times more power to be transmitted in this band compared to unlicensed Wi-Fi bands. This allows longer range and better penetration through trees and other obstacles.

The equipment is small and economical. Renting space on cellular towers is a large expense so County facilities will be utilized whenever possible. Although a newer technology, it is tested with Google and CommScope endorsements, both of whom have utilized it to provide educational and technical training. The CBRS technology and frequency bands have also been incorporated into the iPhone and Samsung line of cellphones. Multiple vendors support fixed wireless modems that you attach to businesses or homes to provide high-speed internet to that location.

Phasing

Phasing network deployment is practical and financially prudent. Phasing also enables decision makers to understand benefits and costs more clearly. Two general principles apply to phasing network construction: (1) connect key and if possible, under-served sites first and (2) fund later phases in part with revenue from earlier phases. With this in mind, we developed the following phases:

Phase 1A: Design and construct a fiber/wireless network to bring broadband to the unserved and under-served parts of the county mostly in the northern more rural parts of the county. This will consist of tower lease attachment of CBRS radio gear capable of providing up to 150 Mbps download and 75 Mbps upload speeds. These sites are networked together by a fiber ring and backhauled via a fiber backbone to the central data center. This initial

deployment will have the capacity to serve at least 3,000 residents and businesses in these underserved areas.

Phase 1B: This phase is intended to take advantage of the backbone requirements of Phase 1A and to leverage and expand that investment and in doing so provide better service and capacity to the 95 County facilities that are currently leasing commercial circuits from local incumbents. This will not only expand the network, provide better service and capacity, but will also reduce County expenses over time.

Phase 2: As in all of the other phases, this phase will leverage all previous investments to provide connectivity for strategically placed enterprise and businesses located within a well-defined radius of the County's fiber network. This phase will create a considerable return on investment for the County and provide better and less expensive services for the businesses within this footprint. It will also create economic development and job creation opportunities. It is estimated that this approach will make the network assets available to approximately 1,100 businesses with very little additional investment.

6. Financials

The Broadband Financial Plan information provided below depicts a financial outlook for the County's proposed network based on forecasts, projected revenues, capital costs, operational costs, and debt service for the project. This financial plan provides a model that projects the County's financial performance under a particular set of conditions. The financial and network deployment pro-forma is presented in phases with two network deployment distribution methods. The Phases are referred to Phase 1A, Phase 1B and Phase 2. Each phase is costed in two different distribution methods, underground and aerial. In most cases undergrounding is the preferred method of distribution but is substantially more expensive to deploy than aerial. Depending on the County's objectives and priorities either are effective forms of distribution. For the purposes of this Study, we have presented network costing based on all underground or all aerial, however once the decision is made to move forward a deeper analysis of the network requirements might lead to a more effective mix of a hybrid underground/aerial deployment plan.

The financial information provided in this Study is a snapshot at a particular moment in time based on current information available. As costs, markets and business conditions change over time, assumptions are also subject to change. Therefore, it is important that the County periodically update its forecasts and financial model over time to ensure that they reflect the current environment.

Magellan recommends a quarterly review of the forecast and financial plan for the first 24-month period to ensure that the assumptions made throughout this project remain valid. Magellan's modeling software has been designed to allow for input changes to key parameters and then automatically update the underlying financial plan.

PHASE 1A FIBER BACKBONE/WIRELESS NETWORK COVERAGE 3,000 UNDERSERVED RESIDENTS

SUMMARY	PHASE 1A	WIRELESS FIBER
	Underground	Aerial
FIBER MILEAGE	93.20	93.20
PREMISES PASSED	3,068	3,068
RETAIL PRICE	$79.99	$79.99
INTERNET SPEED	150/50	150/50
PREMISES CONNECTED	1,840	1,840
CAP-EX		
CONSTRUCTION (10% CONTINGENCY)	$ 9,765,000.00	$ 3,969,600.00
NETWORK EQUIPMENT	$ 835,000.00	$ 835,000.00
PM/CM/CI	$ 530,400.00	$ 530,400.00
RESIDENTIAL DROP COST	$ 524,685.00	$ 524,685.00
TOTAL CAP-EX	$ 11,655,085.00	$ 5,859,685.00
OP-EX		
PERSONNEL	4	4
STAFFING (AVG 70K/YEAR)	$ 280,000.00	$ 280,000.00
OPERATING COSTS/YEAR	$ 277,220.00	$ 317,220.00
POLES FEE		$ 64,000.00
PRO FORMA		
FIRST YEAR OF POSITIVE CASH	4	3
20 YEAR CASH BALANCE	$ 4, 750,000.00	$ 9, 423,583.00

PHASE 1B COUNTY FACILITIES - 95 SITES

SUMMARY	PHASE 1B	COUNTY FACILITIES
	Underground	Aerial
FIBER MILEAGE	62.00	62.00
INTERNET SPEED	1-10 GIG	1-10 GIG
CAP-EX		
CONSTRUCTION (10% CONTINGENCY)	$ 6,510,000.00	$ 2,641,795.20
NETWORK EQUIPMENT	$ 300,000.00	$ 300,000.00
PM/CM/CI	$ 327,000.00	$ 265,200.00
TOTAL CAP-EX	$ 7,137,000.00	$ 3,206,995.20
OP-EX		
PERSONNEL	1	1
STAFFING (AVG 70K/YEAR)	$ 70,000.00	$ 70,000.00
OPERATING COSTS/YEAR	$ 40,780.00	$ 128,000.00
POLES FEE	$ 0	$ 26,000.00
PRO FORMA		
CIRCUIT COST SAVINGS 20 YEARS		
FIRST YEAR OF POSITIVE CASH	4	3
20 YEAR CASH BALANCE	$ (2,397,402.00)	$ 347,815.00

PHASE 2 ENTERPRISE CUSTOMER CONNECTIONS - 700 BUSINESS SITES WITHIN 500' OF THE FIBER BACKBONE

SUMMARY	PHASE 2	BUSINESSES
	Underground	Aerial
FIBER MILEAGE	30.00	30.00
INTERNET SPEED	500Mbps-1Gig	500Mbps-1Gig
RETAIL RATE AVERAGE	$ 125.00	$ 125.00
BUSINESSES CONNECTED	700	700
CAP-EX		
CONSTRUCTION (10% CONTINGENCY)	$ 3,434,112.00	$ 1,278,288.00
NETWORK EQUIPMENT	$ 100,000.00	$ 100,000.00
PM/CM/CI	$ 265,200.00	$ 265,200.00
DROPS/INSTALLS	$ 299,250.00	$ 299,250.00
TOTAL CAP-EX	$ 4,098,562.00	$ 1,942,738.00
OP-EX		
PERSONNEL	2	2
STAFFING (AVG 70K/YEAR)	$ 140,000.00	$ 140,000.00
OPERATING COSTS/YEAR	$ 172,000.00	$ 148,000.00
POLES FEE	$ 0	$ 28,000.00
PRO FORMA		
CIRCUIT COST SAVINGS 20 YEARS		
FIRST YEAR OF POSITIVE CASH	4	3
20 YEAR CASH BALANCE	$ 9,870,600.00	$ 11,450,620.00

CUMULATIVE FINANCIAL OVERVIEW FOR ALL PHASES - 20 YEAR PROJECTION

SUMMARY	TOTALS	
	Underground	Aerial
FIBER MILEAGE	185.20	185.20
PREMISES CONNECTED	1,840	1,840
BUSINESSES CONNECTED	700	700
CAP-EX		
CONSTRUCTION (10% CONTINGENCY)	$ 19,709,112.00	$ 7,889,683.20
NETWORK EQUIPMENT	$ 1,235,000.00	$ 1,235,000.00
PM/CM/CI	$ 1, 060,800.00	$ 1, 060,800.00
DROPS/INSTALLS	$ 823,935.00	$ 823,935.00
TOTAL CAP-EX	$ 22,828,847.00	$ 11,009,418.20
OP-EX		
PERSONNEL	7	7
STAFFING (AVG 70K/YEAR)	$ 490,000.00	$ 490,000.00
OPERATING COSTS/YEAR	$ 445,220.00	$ 525,220.00
POLES FEE	$ 0	$ 118,000.00
PRO FORMA		
FIRST YEAR OF POSITIVE CASH	3.5	3.5
20 YEAR CASH BALANCE	$ 12,223,198.00	$ 22,539,058.00

7. Recommendations and Next Steps

NEXT STEPS FOR BROADBAND IN ESCAMBIA COUNTY

Escambia County finds itself in the same situation as many other rural counties throughout the country, struggling with a lack of broadband connectivity. The report points out in detail this lack of connectivity affects all aspects of the quality of life for the residents and businesses in many parts of Escambia County. Available, reliable and affordable broadband is just as critical as electricity was a hundred years ago, indeed broadband is the 21st century's essential utility, and will be for the next 100 years.

The reality is for-profit broadband providers are only willing to deploy in areas where the ROI meets their internal metrics, thus leaving large gaps in service for much of rural America. However, this critical utility cannot wait until providers decide if an investment is worth making, the pandemic has brought in to sharp focus just how vital and critical effective broadband is to rural communities.

Florida law, unless grandfathered, prohibits public entities from providing direct retail services without crossing some legal hurdles. They can however easily provide their internal needs and use services, connecting county assets, schools, community centers, public safety and other anchor institutions. The county can also provide wholesale services like dark and lit fiber, conduit, electronics and data storage space as leased or rented assets.

Escambia County's lack of internet broadband is very apparent in several areas but mostly in the more rural parts of the county especially the northern parts of the county. The underlying cause of this lack of broadband is rooted in unsustainable business case to entice private for-profit providers to invest. Given the need the only feasible way to meet way to provide broadband to these areas is for local governments to invest in themselves. These investments should be measured, targeted and flexible to meet future needs. The most cost-effective way to achieve the County's broadband goal is to deploy a wireless/Fiber network, specifically a CBRS wireless network in the northern rural areas with a fiber-optic backhaul backbone that can also be used as the foundation for a county wide ultra-highspeed network expanding through the entire county over time.

The bottom line for Escambia County given the current environment it is highly unlikely that a retail provider will invest in the County especially in the more

rural underserved areas and it is up to the County to invest in itself and to take positive steps to meet short and long terms community and economic development needs.

These steps are recommended to accomplish those goals.

1. Escambia County should invest in itself and take positive steps to meet short- and long-term community and economic development needs by building, owning and operating an ultra-high-speed broadband network.
2. Establish a detailed "bond grade" Business and Financial Plan and commit to fund a 3-5-year program for network infrastructure development based on the approach and phases described in this document.
3. Upon funding commitment begin design engineering and develop a construction work plan.
4. Seek construction funding for network infrastructure development from public and private sources including Bonds, Grants, and Loans.
5. Begin process to gain full regulatory approval and determine the best form of network ownership and governance. Establish a formal entity for these purposes.
6. Deploy a wireless-fiber network to serve mostly rural areas bring true broadband to more than 3,000 under and un-served Escambia County citizens as a basic building block of a phased larger broadband network.
7. Implement broadband-friendly policies and make network infrastructure an integral component of economic development, land use planning, public works, and real estate development.

Appendix A: Grant Funding

FEDERAL AND STATE FUNDING SOURCES FOR BROADBAND PROJECTS DECEMBER 2020.

Below is a list of various federal and state funding sources that are the most relevant and applicable to

U.S. Department of Agriculture Loan and Grant funds

The United States Department of Agriculture's (USDA) Rural Development (RD) mission area administers over $22 billion in loan and grant funds to rural communities and tribal areas. These programs provide funding to finance electric and broadband infrastructure including equipment, inside wiring, tower construction, and land acquisition, as well as investments in critical community facilities such as schools, hospitals, libraries, community centers and public safety/emergency management entities to name a few.

New rules authorizing several USDA Rural Development loan and grant programs to fund broadband infrastructure expansion.

USDA Rural Development issued rules in September, 2020 that permit 10% of grants and loans from a variety of funding programs listed below to be used for the construction, acquisition and deployment of retail or wholesale broadband services in rural areas not served by the minimum level of broadband service, defined as 25 Mbps downlink and 3 Mbps uplink for both mobile and fixed service.

The population eligibility requirement varies from program to program, but generally ranges from 10,000 to 50,000 in population size. Up to 10% of program funds can be used to fund retail broadband services for the following Rural Development funding programs.

- Electric Infrastructure Loans and Loan Guarantees;
- Water and Waste Disposal Loan and Grant Program;
- Revolving Funds for Financing Water and Wastewater Projects;
- Community Facilities Direct Loan and Grant Program;
- Community Facilities Guaranteed Loan Program;

- Multi-Family Housing Direct Loans and Grants;
- Multi-Family Housing Loan Guarantees;
- Intermediary Relending Program;
- Business and Industry Loan Guarantees;
- Rural Economic Development Loan and Grant;
- Rural Energy for American Program; and
- Rural Business Development Grants.

The majority of these programs are administered by the USDA Rural Development state offices, with the exception of the Electric loan program which is managed out of the National Office in Washington, D.C. Applicants must meet the specific program criteria for each program listed above to become eligible.

USDA Rural Utilities Service (RUS) Community Connect Grant Program:

The Community Connect Grant program provides up to $3 million in awards to eligible applicants to deploy either fixed or mobile broadband services throughout rural and underserved communities with a population size of 20,000 or less. Eligible entities include federally recognized tribes, state or local governments, non-profit cooperatives and for-profit entities. Applicants must provide a matching contribution of 15% of the total award amount. Matching funds must be made in cash, which will be used to fund the operations of the project.

Eligible applicants must have the legal capacity to own and operate a broadband network. Eligible areas must be unserved with broadband at a speed of 10 Mbps downlink and 1Mbps uplink. Applicants must agree to provide broadband service at speeds of at least 25 Mbps downlink and 3 Mbps uplink that must also be made available to every residential and business customer in the proposed funded service area (PFSA) in the application. Funds can be used to support the construction, acquisition or leasing of facilities, spectrum, land or buildings used to deploy broadband services throughout the PFSA.

Awardees must provide free broadband service at the minimum broadband grant speed to all essential community facilities for two years. These facilities include public schools, fire stations, public libraries and other publicly held anchor institutions.

The application deadline for application submissions is December 23rd, 2020. This program is administered yearly and will open again next Spring.

USDA RUS Distance Learning and Telemedicine (DLT) Grant program

The DLT program provides 100% grant funding to rural communities and tribal areas with a population of 20,000 or less to provide distance learning and telehealth services. The maximum award is $1 million, and the minimum is $50 thousand dollars.

In early 2020, over $25 million was authorized for the DLT program under the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) which increased the total program funding level to $71 million. Eligible DLT grantees include federally recognized tribal nations, non-profit and cooperative entities, state and local governmental entities or a consortium of eligible entities.

Allowable costs for eligible capital assets under DLT include:

- Broadband facilities
- Audio, video and interactive video equipment
- Terminal and data terminal equipment
- Computer hardware, network components and software
- Inside wiring and similar infrastructure that further DLT services
- Acquisition of instructional programming that is a capital asset
- Acquisition of technical assistance and instruction for using eligible equipment

The application widow for DLT opens in 1st quarter of every year. Awards for FY 2020 are typically announced in the fall. This program is administered yearly.

USDA Rural Utilities Service (RUS) Smart Utility Electric Loan program

The USDA Rural Development rule change announced on September 14th authorizes the RUS Electric Loan program to also fund broadband projects under its existing loan program requirements. Applications are accepted year-round. Eligible areas are communities with a population of 20,000 or less to qualify for funding.

Existing and future electric program borrowers may utilize up to 10% of their total funding commitment towards the construction, acquisition and deployment of retail or wholesale broadband service to customers within the borrowers' service territory, but only if the overall purpose of the project is

smart grid investments. These investments include communications facilities for remote grid management, fiber to the meter for increased energy efficiency initiatives, and other network modernization investments for smart grid purposes. RUS maintains a page dedicated to this program at https://www.rd.usda.gov/smart-utility.

RUS encourages applicants to establish partnerships with other current or former borrowers including those in the Telecommunications loan program to pursue innovative ways to provide smart grid and broadband capabilities in shared service areas. All electric loan borrowers seeking smart utility loan funding for broadband investments must also comply with the RUS Telecommunications and Broadband loan program rules that prohibit the use of agency funding in areas already being served by an existing or previous RUS borrower. Applicants must consult with the RUS field representatives for guidance before submitting an application. This program is open year round.

USDA RD Community Facilities Loan and Grant program

This program is the most expansive of all the RD funding sources and can support a wide variety of funding needs of a rural community including Tribal nations located in rural areas with a population of 20,000 or less. The Community Facilities program (known as "CF") funds any essential community facility for the development of that community.

Awardees are eligible for low interest loans, grants or a combination of both depending on the project and funds available from the applicant. Funds are administered by the State RD office which receives an allocation for projects from the National Office in Washington, D.C.

Eligible entities include local state or federally recognized tribal governments and funds can be used to purchase, construct and or improve any essential community facility including the purchase of equipment. Typical projects include the construction and inside wiring costs of a health clinic, school, community or childcare center. It may also be used to fund public safety services such as fire departments, police stations, prisons, fire trucks, police vehicles, radios, towers, and other devices, fire trucks and public works vehicles. This program is open year round.

USDA RUS ReConnect Loan and Grant program

Originally authorized in 2018 as a pilot program, the RUS Loan and Grant program is the largest USDA funding source for broadband infrastructure in underserved rural and tribal areas lacking broadband service at a minimum

speed of 10 Mbps downlink and 1 Mbps upload. RUS received $600 million to support project requests for broadband construction in rural areas with a population of 20,000 or less outside of an urbanized area.

In 2019, RUS received an additional $550 million to administer a second round of awards, largely due to the demand for project funding among applicants in rural and tribal communities. RUS is reviewing applications submitted in Round 2, and applications are evaluated and awarded on a rolling basis. A third round of funding passed Congress in late December and the appropriation levels are still being determined.

Eligible entities for Reconnect funding include cooperatives, for profit entities, states and local governments or a tribal nation (as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. § 450b)).

Award amounts are as follows:

- **100 Percent Grant**: The maximum amount per application is $25 million.
- **50 Percent Loan / 50 Percent Grant**: The maximum amount per application is $25 million for loans and $25 million in grants.
- **100 Percent Loan**. The maximum amount per application is $50 million.

Loans terms are set at a 2% interest rate with repayment period based on the useful life of the assets used to provide broadband.

Applications are evaluated based on scoring points awarded for a variety of benefits brought to the community. For example, projects that are in a state or tribal area that has a broadband plan that has been updated within the previous five years of the date of publication of the Funding Opportunity Announcement (FOA), 10 points will be awarded.

Universal Service Administrative Company (USAC) Programs

Many of the RUS loan and grant funds for telecommunications and broadband infrastructure investment are utilized in tandem with federal subsidies and monthly support mechanisms administered by the Universal Service Administrative Company (USAC), which is authorized by Congress and guided by the FCC.

Lifeline Program

The Lifeline program provides monthly support to eligible consumers who qualify based on their enrollment or eligibility in several federal social service support programs or based on their income thresholds. The monthly support per customer is provided to participating service providers who then pass the discount to the end user customer.

Eligible consumers may receive a discount of $9.25 off their monthly voice or broadband internet service offerings from their provider.[14] To qualify, applicants must provide documentation that they participate or are eligible for any one of the following programs:

Supplemental Nutrition Assistance Program (SNAP), Supplemental Security Income (SSI), Medicaid, Federal Public Housing Assistance administered by the US Department of Housing and Urban Development (HUD), and the Veterans Pension and Survivors Program administered by the Veterans Affairs Administration. Applicants may also qualify by demonstrating their income which must be at or below 135% of the federal poverty guidelines.

Applicants who live on federally recognized tribal lands in rural areas qualify for up to $34.25 per month off their phone or internet service delivered in the home or via mobile phone.[15] Native applicants may qualify by either providing documentation to their service provider or to USAC, any one of the following programs listed above or any of the programs listed below:

Bureau of Indian Affairs (BIA) General Assistance Program, Food Distribution Program on Indian Reservations (FDPIR), Tribal Head Start or Tribal Temporary Assistance for Needy Families (TTANF).

Congress increased the Lifeline program's budget from $2.5 billion to $2.5 billion to support the needs of low income and tribal consumers impacted by Covid-19.

USAC's Rural Healthcare Program (RHC)

The RHC program provides discounts to eligible rural hospitals, educational institutions, commercial health centers, skilled nursing facilities, rural health clinics or a consortium of clinics in rural and urban to receive broadband connectivity for telehealth use cases. For profit entities are not eligible for RHC funds. The program was authorized to support over $802 million in projects in

[14] https://www.lifelinesupport.org/wp-content/uploads/lifeline/documents/Lifeline-How-to-Apply.pdf

[15] https://www.lifelinesupport.org/wp-content/uploads/lifeline/documents/Tribal-Flyer.pdf

2020 in part due to the demand from Covid-19.

The RHC was also directed by the FCC to administer a Connected Care Pilot program that provides up to $100 million over three years to support connected care services among low income Americans and veterans. Eligible entities include non-profit and public health providers.

The Pilot Program uses Universal Service Funding to help defray up to 85% of the cost of eligible services and network equipment, which include: (1) patient broadband Internet access services; (2) health care provider broadband data connections; (3) other connected care information services; and (4) certain network equipment.

Applicants for the Pilot or for the regular RHC program must complete FCC form 460 and submit to USAC to obtain a Health Care Provider (HCP) number and eligibility determination. Applicants must then file FCC form 461 to submit an RFP that outlines their broadband connectivity needs from vendors. Health care providers must then evaluate bids and select a service provider that is the most cost effective in providing services.

Congress recently authorized an additional $250 million for Covid-19 relief related telehealth projects under the RHC program for 2021.

USAC's E-Rate Program

The E-rate program helps schools and libraries obtain affordable broadband connectivity. Discounts for broadband network services used by the school or library depend on the level of poverty and the urban/rural status of the population served, but typically range from 20 percent to 90 percent of the costs of eligible services. Program participants must engage in a competitive bidding process to select the most cost-effective service provider to win their business.

The application filing window was January 15 – April 29, 2020. However, USAC opened a second application filing window of **September 21 – October 16, 2020.** The program has a funding cap of $4.15 billion for FY 2020 and roughly 89% of the FY 2020 applications have been funded at the time of this report.

Eligible participants include public and most non-profit K-12 schools as well as all public and private libraries. To be eligible for support, schools must meet the statutory definition of elementary and secondary schools found in the ***Elementary and Secondary Education Act.*** Libraries must meet the statutory definition of library or library consortium found in the 1996 ***Library Services and Technology Act*** and must be eligible for assistance from a State

library administrative agency under that Act.

Program participants may request funding in five categories of service: Telecommunications Services, Internet Access, Internal Connections, and Basic Maintenance of Internal Connections. Funding may be requested under two categories: category one services to a school or library (telecommunications services and Internet access), or category two services that deliver Internet access within schools and libraries (internal connections, basic maintenance of internal connections, and managed internal broadband services).

U.S. Department of Commerce, Economic Development Administration (EDA)

EDA provides grant and loan funding to support the revitalization and recovery of economically distressed communities across states, territories and tribal nations through two primary programs: Public Works and Economic Adjustment.

EDA's Public Works program helps distressed communities revitalize, expand, and upgrade their physical infrastructure. The Economic Adjustment Assistance program, EDA provides investments that support a wide range of construction activities, including infrastructure, design and engineering, technical assistance, economic recovery strategies in regions experiencing severe economic dislocations.

EDA received over $200 million in annual FY 2020 appropriations for economic development projects. It also received over $1.5 billion in supplemental CARES Act funding to provide economic assistance to communities impacted by COVID–19.

Appendix B: Broadband Technology Overview

Broadband networks are divided into several general components, each of which has some different technological options. The foundational component is internet exchange or peering. There are a few organizations that operate tier 1 Internet Protocol (IP) networks that peer—or connect—directly to each other for the internet core. Generally, tier 2 networks connect to tier 1, and tier 3 connect to tier 2. Any device or network must be physically connected to and exchange data with one of these networks to access the internet.[16] All of these networks are interconnected at few Internet Exchange Points (IXP), which are basically data centers, almost universally via fiber-optic technology.

Each provider company also has a core network that connects all of its major sites and into one or more IXPs. No customers are connected directly to these core networks, including "long haul," which consist of fiber with some microwave. Providers' core networks are extended to customers via distribution and "metro" or "middle mile" networks. Major customers may be connected to the distribution networks, but most customers get service from access networks that are interconnected via the distribution networks. Distribution networks are almost entirely fiber and can also act as backbones for connecting multiple sites into a network.

Access networks are where there are the most technology options. The traditional options were coaxial cable and twisted pairs of wires. These are "legacy" technologies from analog telephone and television services. Companies transformed them into digital connections but could not overcome inherent limitations of wires. Fiber and wireless are becoming more common because they are more capacious and/or flexible.

Fiber can carry light signals for miles without degradation. The light spectrum within fibers can be subdivided into "colors"—referred to as "lambdas"—each of which can carry separate data streams. The number of lambdas is limited only by the laser technology. Currently, 200 lambdas are common for what is called Dense Wavelength Division Multiplexing (DWDM), but thousands are possible.

[16] It is quite possible to have a private IP network that is ***not*** physically connected. No devices on such networks can reach the internet or vice versa.

The new standard is 100 Gbps over a single lambda, which gives a single fiber an effective throughput of 20 terabits per second.

Wireless uses radio waves, sent and received via antenna and radios that generate the signals. Those signals can be most anywhere in the radio spectrum, from 30 Hz to 300 GHz, although most radio communications use frequency bands from 300 KHz to 30 GHz. Wi-Fi, for example, operates in unlicensed 2.4 and 5.9 GHz bands. Cellular services, in contrast, uses multiple bands to balance distance and speed. Generally, higher frequency radio spectrum carries more information but covers shorter distances.

5G

"5G" is the fifth generation of wireless technology driving evolution of the wireless communications technology platform. First generation, "2G" and "3G" wireless service was provided beginning in the 1980's and 90's using large towers, "4G" was characterized by development of "apps" that needed sustained reliable connectivity which in turn drove antenna densification, while "5G" relies upon even more closely spaced, small antennas.

Wireless carriers are demanding access to city-owned and utility-owned structures and public rights-of-way. Current 4G deployments are aimed at densification and increasing capacity in high-use areas while "5G" small cell facilities are also being deployed in larger numbers to greatly increase speed and data capacity on a "fill-in" basis. 5G uses relatively low power transmitters with cover a radius of approximately 400 feet, thus requires more antennas spaced closer.

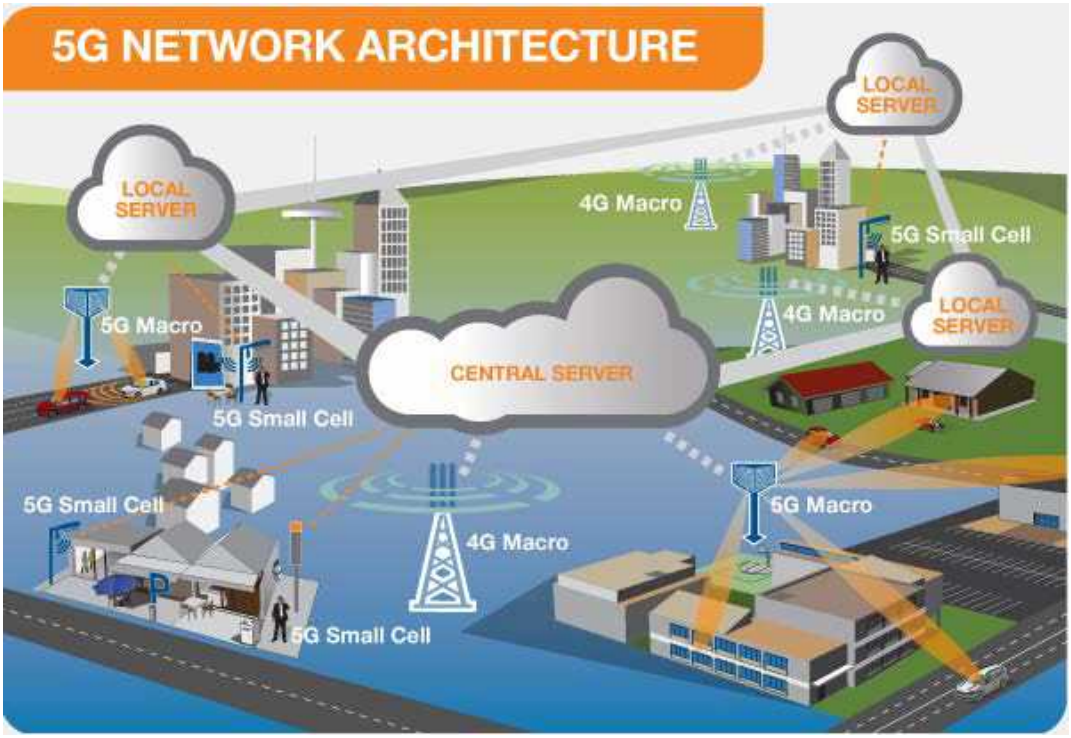
5G networks operate multiple frequencies in three bands using millimeter wavelengths, the highest of which is anticipated to offer download/upload speeds of 1 Gbps. The actual speed and range the consumer gets depends on a variety of factors, including what frequency is being used by the service provider – low-band, mid-band, or high-band. There are tradeoffs among the different bands, between speed and distance/coverage. Low-band and mid-band deployments would likely be most useful and beneficial in Escambia County.

Low-band frequencies work well across long distances and in rural areas; speeds are greater than 4G but slower than other 5G frequencies. Mid-band frequencies are currently sought after since they permit greater speeds while covering relatively large areas. High-band frequencies provide the fastest

speeds but in more limited circumstances such as close to the antenna and in areas without physical obstructions (i.e., windows, buildings, walls). Also, obtaining 5G service requires using a 5G-ready device, of which at present there are only a handful (though the number is growing).

5G networks are designed to provide increased efficiencies while decreasing latency and are designed for improving the performance of connected devices that define the "Internet of Things" or IoT.[17] Examples include autonomous vehicles, healthcare monitoring technologies, ultra-high-definition video, virtual reality, and many more applications that are ripe for development. Indeed, any "tech buzzword" will benefit from 5G's faster speeds and reduced latency. The transition to 5G will not occur overnight, and 4G and 5G will coexist such that when a device drops 5G signal a handoff to 4G LTE should be imperceptible.

Figure 24: 5G Network Architecture18



[17] There is not a universal definition of "Internet of Things" but it generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, and allows these devices to generate, exchange and consume data with minimal human intervention.

[18] http://www.emfexplained.info/?ID=25916

There is plenty of hype regarding the deployment of 5G wireless technology, and the applications, services and business opportunities 5G promises to enable. There are a number of statements that have been made such as "5G networks will be 100 times faster, support 100 times more devices, unlock real-time applications, and will transform industry"; "5G will support innovations in health care, connected vehicles and things we haven't even thought about yet"; "5G will provide centimeter-level accuracy on location"; etc.

Escambia County should be cautious regarding the "hype" but open to 5G's promise as the foundation many new applications and technologies. It will provide faster data speeds and more capacity for mobile broadband applications. 5G provides the basic infrastructure for Smart City applications based on the "Internet of Things", which connects billions of devices without human intervention on a scale never seen before. This trend can be applied to revolutionize industrial processes and applications including agriculture, manufacturing, and business communications.

From a community perspective, interconnection of billions of devices allows evolution of smart cities, smart homes, smart schools, safer and autonomous vehicles, and a safer, healthier, smarter place to live. From a business perspective, interconnection of devices provides data like never before to inform operations and decision-making and automate/innovate in the production process.

The coronavirus pandemic is accelerating shifts and trends for 5G-aided or internet technologies and business trials. Perhaps the obvious example is the boom in Zoom meetings but there are many other trends developing or accelerating as well.

> "The proportion of companies ramping up globally on automation technologies will at least double over the next two years, according to a Bain survey of nearly 800 executives".[19]
>
> "The coronavirus pandemic is deepening a national digital divide, amplifying gains for businesses that cater to customers online, while businesses reliant on more traditional models fight for survival. The

[19] "Pandemic Speeds Up Corporate Investment in Automation"; The Wall Street Journal, April 9, 2020.

process is accelerating shifts already under way in parts of the US economy in ways that could last long after the health crisis has passed…"[20]

CITIZENS BROADBAND RADIO SERVICE (CBRS)

Given the rural nature of Escambia County, with low population in much of the area, and its flat terrain, wireless may be an economic option for access infrastructure. 4G LTE[21] cellular, which is evolving to 5G, is the most common radio access network (RAN) technology, but 4G is limited to providers with licenses for essential spectrum. LTE can also be used in other spectrum, specifically the 4.9 GHz band that is set aside for public safety broadband and the 3.5 GHz Citizens Broadband Radio Service (CBRS) spectrum.

The FCC set aside the 3550-3700 MHz (3.5 GHz) spectrum in 2015 for Citizens' Broadband Radio Service (CBRS). The spectrum can be used for fixed or mobile broadband. This project is for fixed service (mobile applications require additional software infrastructure). Fixed services provide access to the internet from a specific location. It typically requires an external antenna with direct line-of-sight to the central base station antenna. Speeds are generally comparable to DSL and cable modem.

Fixed wireless can be deployed as point-to-point (PtP) or point-to-multipoint (PtMP), this project involves both. PtP involves a one-to-one relationship between antennas at different locations. It is typically used for interconnecting sites, such as a headquarters or main buildings, to a remote facility. Internet service providers typically use this approach for connecting to customer locations where they do not have wired infrastructure. End-users typically use it as a backup or secondary connection or for non-critical sites because the connections have less capacity than fiber and are susceptible to environmental degradation from foliage, weather, and other factors.

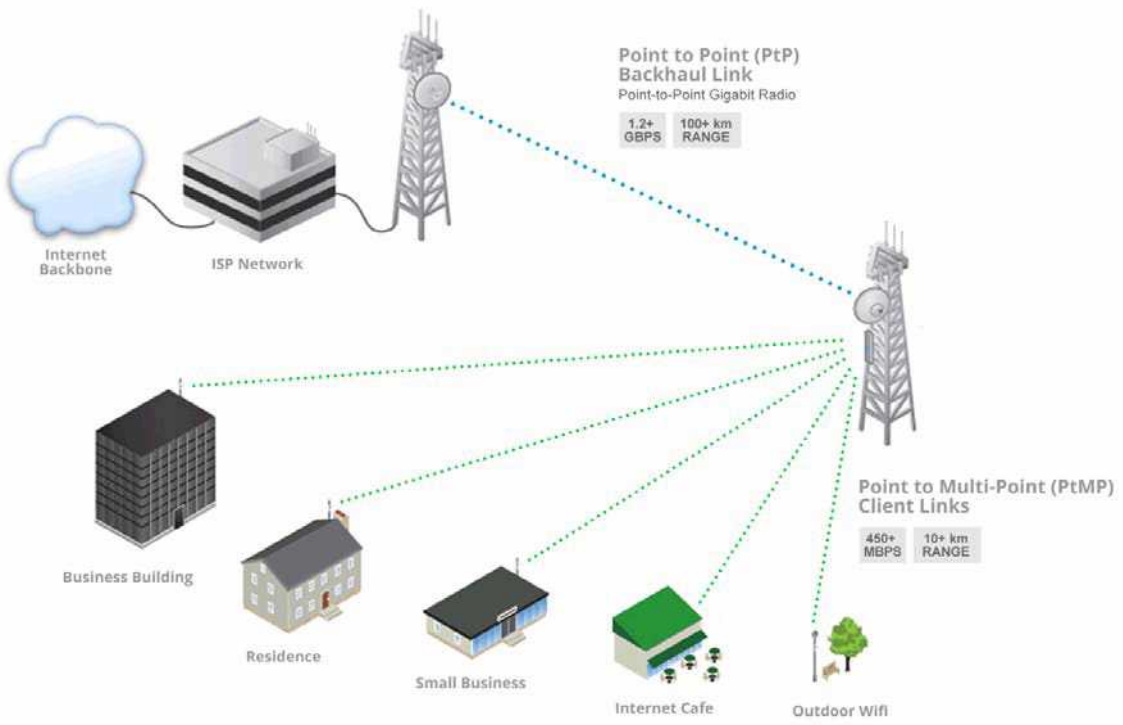
PtMP involves multiple—even hundreds of—users' antennas connecting to a single, central base station. This model and infrastructure are very similar to cellular but with more bandwidth and without the mobility. As illustrated in Figure 25, PtP and PtMP are complementary technologies. PtP can be used to interconnect PtMP base stations as well as for remote sites (although fiber is

[20] "Crisis Speeds Up Economy's Shift"; The Wall Street Journal, April 2, 2020.

[21] LTE stands for "Long Term Evolution."

preferable due to its capacity and reliability). The networks require Line of Sight (LOS) or near Line of Sight (nLOS) to operate. The systems utilize proprietary protocols and specialized devices to achieve the long ranges and high throughputs. Different vendors' products may not interoperate with each other.

Figure 25: Point to Point and Point to Multi-point Technology



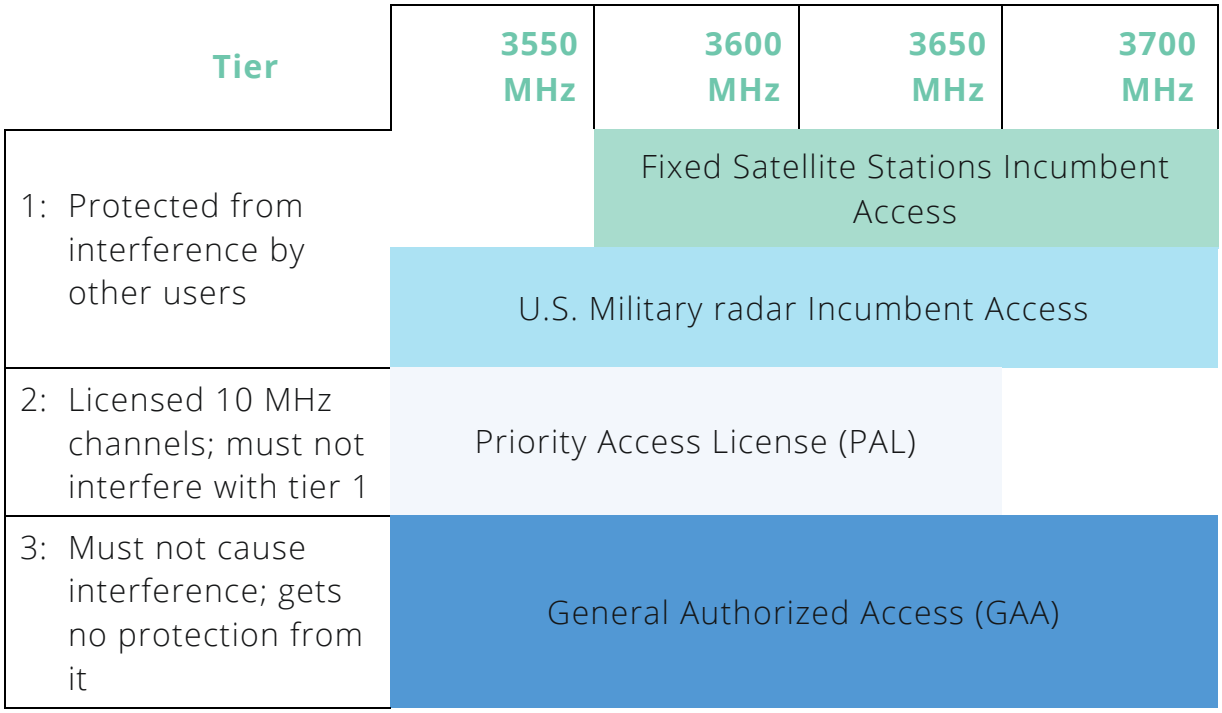
The FCC used a new, shared spectrum approach for CBRS with three tiers of users, diagrammed in Figure 25. Current, incumbent, tier 1 spectrum users, which include US military, fixed satellite stations, and, for a limited time, wireless internet services providers (WISPs) are protected from interference by other users. Ten Priority Access Licenses (PAL) for 10 MHz channels between 3550 and 3650 MHz in a specific county were auctioned off by the FCC in July 2020. These licensees are protected from interference by other users but may not interfere with incumbent users. A licensee may aggregate up to 4 PALs. Any portion of the spectrum may be used without a license for General Authorized Access (GAA), but this may not interfere with incumbent or PAL users.

CBRS uses will be managed by a Spectrum Access System (SAS) with which all Citizen Broadband Service Device (CBSD) base stations must be registered. There are two classes of CBSD. Class A base stations, which can transmit at 1 watt of power, are meant for smaller-scale indoor, enterprise, or campus use.

Class B base stations can transmit at 50 watts, giving them much greater range. Strategically placed radio signal sensors will ensure that uses do not interfere with each other, particularly military radar.

Another important characteristic of CBRS is the LTE protocol commonly used with the spectrum. LTE is also used for 4G cellular data service, so it is widely implemented in user equipment. CBRS involves different spectrum but some smartphones have antenna that operate in the CBRS bands. It is reasonably easy and economical to add CBRS/LTE to devices without changing their operating characteristics or systems. Therefore, there are few barriers to end user adoption.

Figure 26: CBRS User Tiers



The combination of CBRS/LTE in base stations and user equipment is a radio access network (RAN). A RAN has a network core that authenticates and authorizes user equipment and manages connections to multiple base stations. This allows for mobile roaming from base station to base station without loss of connectivity and makes RANs very secure. The downside of a CBRS/LTE RAN is that some entity must operate to the network core and the SAS. These are relatively inexpensive services that can be purchased from vendors or run on private servers. For this project, Magellan Advisors recommends focusing on

fixed services while assessing additional costs and issues related to mobile access.

STARLINK AND OTHER LOW-EARTH ORBIT SATELLITE ACCESS NETWORKS

Starlink (https://www.starlink.com/) is an initiative of Space X to use thousands of very low-earth orbit satellites (LEOS) as infrastructure for wireless internet access. It follows a couple of similar efforts that failed and is competing against several newer efforts, including OneWeb (https://www.oneweb.world/), an Amazon, Inc., effort and another by China's state space agency.

Like any other wireless connection, each and every one of these satellites must have a radio transceiver, with a power source, and spectrum. They must also be placed into orbit and have means to aggregate traffic to IXPs. All of this creates huge barriers to coverage and performance, only some of which can be overcome with financial resources.

Due to these issues and the installed base of terrestrial internet service providers that make huge margins on their services, LEOS internet access is not expected to impact most customers. LEOS will undoubtedly provide more, better options for rural areas and very remote locations. They may even put some price pressure on current options, particularly lower-bandwidth services. But demand for bandwidth and connectivity is likely to grow faster than LEOS capacity, so network fiber and radio network infrastructure will almost inevitably continue to be valuable assets.

HOW FIBER AND WIRELESS FIT TOGETHER

There is a common public misconception that "wireless service" is indeed fully wireless, end-to-end. In fact, typically the only "wireless" component to wireless service is the wireless transmission over radio spectrum between the user's cell phone and the cell tower at either or both ends of the call.[22] Wireless service places significant demands on the wireline network for connection of each cell

[22] In some cases, operators have used radio spectrum to transmit consumer data and voice traffic from the transmitter on the tower to the base, where it is then connected to the landline network. But this engineering practice is going by the wayside as it consumes valuable radio spectrum and is otherwise less desirable from an engineering perspective, in favor of fiber connection of the transmitters on the tower to the base for connection to the landline network.

tower or small cell antenna to wireless providers' network facilities. Even LEOS access networks will require fiber-connected base stations to interconnect with the internet.

In recent years, wireless providers connected their towers to their network with fiber connections under "Fiber-to-the-Tower" programs, procuring fiber connectivity from incumbent local exchange companies and other sources. The 4G LTE evolution of wireless technology and services supported and encouraged much greater consumer demand for bandwidth and data, which in turn required fiber capacity for each cell tower to carry all the traffic to the wireless provider's network. Evolution to 5G network technology greatly increases wireless provider demand for fiber-based network capacity. 5G relies on an even denser network of cells with shorter range at higher frequencies. This denser cell network will require an even denser fiber network to support those cells.

A recent study and report by Deloitte noted that "Deep deployment of fiber optics into our nation's network infrastructure might not be as glamorous as the eagerly anticipated launch of fifth-generation mobile networks (5G); however, it is just as important—if not more so. In fact, 5G relies heavily on fiber and will likely fall far short of its potential unless the United States significantly increases its deep fiber investments." The Deloitte study estimates that the US will need to invest $130 - $150 billion in the next 5-7 years in fiber infrastructure in order to support the roll out of next generation wireless.

Appendix C: Wireless Regulations

FEDERAL REGULATION OF WIRELESS SERVICES

The placement of wireless facilities is governed by an interrelated legal framework characterized by shared jurisdiction between state/local authorities and federal authority (the Federal Communications Commission or FCC). The past two decades have seen increasing federal preemption of state and local authority by the Federal Communications Commission (and Congress), most recently in its "Small Cell Order".[23] The U.S. Code provides the basis for federal preemption where it allows local authorities to regulate the "placement, construction, and modification" of wireless communications facilities but subject to certain limitations.[24] Those limitations include:

- City regulations may not "prohibit or have the effect of prohibiting the provision of personal wireless services"[25];
- City regulations may not "unreasonably discriminate among providers of functionally equivalent services"[26];
- Any denial of an application to place, construct, or modify a personal wireless facility must be based on "substantial evidence contained in a written record"[27]; and,
- City regulations may not "regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions."[28]

[23] Declaratory Ruling and Third Report and Order; In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment; WT Docket No. 17-79; In the Matter of Accelerating Wireline Broadband Deployment by Removing Barriers to infrastructure Investment; WC Docket No. 17-84; Released by the Federal Communications Commission, September 27, 2018. ("Small Cell Order" or "Order".)
[24] 47 U.S.C. § 332(c)(7)(A).
[25] 47 U.S.C. § 332(c)(7)(B)(i)(I).
[26] 47 U.S.C. § 332(c)(7)(B)(i)(II).
[27] 47 U.S.C. § 332(c)(7)(B)(iii).
[28] 47 U.S.C. § 332(c)(7)(B)(iv).

In one specific area – radio frequency (RF) emissions – the Federal Communications Commission (FCC) has been assigned complete regulatory jurisdiction, under the 1996 Telecommunications Act which preempted local regulation of RF safety standards in favor of a uniform national RF safety standard under FCC jurisdiction.[29] "The FCC's limits for maximum permissible exposure (MPE) to RF emissions depend on the frequency or frequencies that a person is exposed to. Different frequencies may have different MPE levels."[30] Local authorities can require compliance with FCC RF standards be demonstrated in evaluating 5G siting applications. Applicants often make this demonstration part of the application package. Local authorities may not however deny wireless communications facilities siting applications based on RF emissions – Congress has preempted local authority on this subject and placed jurisdiction in the hands of the FCC.

The FCC's Small Cell Order

The FCC's Small Cell Order limits local authority in many areas include fees (most notably the annual fee limit of $270 per pole), requirements and criteria that may be used, time frames, and provisions of some state laws. The Order permits fees only to the extent they are non-discriminatory ("no higher than the fees charged to similarly-situated competitors in similar situations"), and are a "reasonable approximation" the government entity's "objectively reasonable costs" specifically related to the deployment.[31]

The Order sets out fee levels which are "presumptively reasonable" are $270 per small wireless facility per year, $500 application fee for up to five facilities, plus $100 for each facility beyond five.[32] Higher fees can be charged if the state or local government entity can show the higher fees are a reasonable approximation of cost and the costs themselves are reasonable and being assessed in an non-discriminatory manner.[33] Beyond fees, the Small Cell Order also addressed state and local requirements in the areas of aesthetic

[29] 47 U.S.C. § 332(c)(7).
[30] A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance; Local and State Government Advisory Committee, Federal Communications Commission, June 2, 2000, at page 3.
[31] Small Cell Order, at paragraph 50.
[32] ***Id***., at paragraphs 78-79.
[33] ***Id***., at paragraph 80.

requirements, undergrounding requirements, and minimum spacing requirements using the "materially inhibits" standard created by the FCC in its Small Cell Order.

The Small Cell Order was appealed to the Ninth Circuit Court of Appeals, which recently issued its Opinion[34] largely upholding the Small Cell Order but with one exception:

> The exception is the Small Cell Order provision dealing with the authority of local governments in the area of aesthetic regulations. We hold that to the extent that provision requires small cell facilities to be treated in the same manner as other types of communications services, the regulation is contrary to the congressional directive that allows different regulatory treatment among types of providers, so long as such treatment does not "unreasonably discriminate among providers of functionally equivalent services." 47 U.S.C § 332(c)(7)(B)(i)(I). We also hold that the FCC's requirement that all aesthetic criteria must be "objective" lacks a reasoned explanation.[35]

And:

> In sum, the requirement that aesthetic regulations be "no more burdensome" than those imposed on other technologies is not consistent with the more lenient statutory standard that regulations not "unreasonably discriminate." The requirement that local aesthetic regulations be "objective" is neither adequately defined nor its purpose adequately explained. On its face, it preempts too broadly. We therefore hold those provisions of Paragraph 86 of the Small Cell Order must be vacated.[36]

[34] Opinion Denying Petitions in Part, City of Portland v. FCC, No. 18-72689 (9th Circuit), at page 31.
[35] ***Id***., page 31.
[36] ***Id***., page 52.

The FCC Rules under the Spectrum Act

Prior to the Small Cell Order, the "Spectrum Act" [37] enacted by Congress in 2012 added new requirements and directives to the Federal Communications Commission (FCC) for processing and approval of wireless deployments. To implement the Spectrum Act, the FCC issued new regulations to interpreting the Section 6409(a) requirements and directives of the Act related to local authorities processing of applications for wireless communications facilities. In brief, the Act tightens the application of "shot clock" timelines, and requires local jurisdictions to approve certain collocations and modifications to existing wireless communications facilities under shortened explicit deadlines, if it is an "eligible facilities request" – which is defined as any request for modification of an existing tower or base station that does not substantially change the physical dimensions of such tower or base station, involving (1) collocation of new transmission equipment; (2) removal of transmission equipment; or (3) replacement of transmission equipment. The new FCC regulations established defined standards for what for "substantial change" and implemented the statutory changes to "shot clock" regulations.

The FCC's "Clarification" Ruling

The FCC recently made another ruling which attempts to preempt local authority regarding placement of wireless facilities by "clarifying" "the meaning of our rules implementing Congress' decisions in section 6409(a) of the Spectrum Act of 2012" [38]. The Declaratory Ruling on June 10, 2020 has been appealed by numerous parties including state and local government organizations and entities.[39] Among other things the Declaratory Ruling purports to "clarify" existing FCC rules originally adopted in 2014 to implement the Spectrum Act. The cities challenge the FCC's ruling on the basis that it

[37] ***See*** Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, § 6409(a) (2012) ("Spectrum Act"), ***codified at*** 47 U.S.C. § 1455(a).

[38] ***In the Matter of Implementation of State and Local Governments' Obligation to Approve Certain Wireless Facility Modification Requests Under Section 6409(a) of the Spectrum Act of 2012***, WT Docket No. 19-250 and RM-11849, FCC 20-75 (released Jun. 10, 2020) ("Declaratory Ruling")

[39] Appeals include The League of California Cities, the League of Oregon Cities, and the cities of Glendora, Rancho Palos Verdes and Torrance in California, Texas Municipal League, Texas Coalition of Cities for Utility Issues, Michigan Municipal League, the US Conference of Mayors and many other cities.

violates federal requirements for rulemakings, and is arbitrary, capricious and an abuse of discretion in seeking to change existing FCC rules regarding applicability of "eligible facilities requests".

State Wireless Policy

The urgency of state and local policy considerations for small wireless facilities stems from the fact that many carriers consider street lights and utility poles to be "ideal" supporting structures for placement of small cell antennas and equipment, which drives the cities' need for standards and guidelines on placement of antennas and other facilities on or near these structures. Cities and counties often prefer installation of small cell wireless facilities on streetlights owned by the local authority based on the positive visual qualities of these facilities when built in conformance with design standards, efficient use of assets and the public rights-of-way, as well as in support of Smart City initiatives. But wireless providers are advocating for their preferred form of legislation in state legislatures as well as at the federal level (especially the FCC), designed to preempt and limit local authority over matters pertaining to small cell deployment. The Florida Legislature passed just such a bill in 2019. Senate Bill 1000 contains sweeping changes and limitations to local authority over regulatory authority over use of public rights-of-way for wireless and other telecommunications infrastructure. SB 1000 also eliminates many provisions from previous legislation which had been agreed to with the industry (the Advanced Wireless Infrastructure Deployment Act of 2017). SB 1000 was effective July 1, 2019, and its provisions (along with remaining provisions of the 2017 Act) include:

- Prohibition of moratoriums on placement of small wireless facilities or utility poles;
- Deletion of non-discrimination language in favor of requiring specific factors for telecommunications facilities;
- Expansion of the definition of "application" to now include placement of new poles for small wireless facilities;
- Prohibition of requirements for provision of information regarding locations of facilities, maps, etc.;
- Limits design standards to those that are "objective" and adopted by ordinance;
- Eliminates previous local authority over installation of new utility poles;
- Applies "shot clock" to permits for location of new utility poles;

- Additional prohibitions include no public notifications, no limits on size or configuration of small wireless facilities, no requirements for undergrounding, no demonstration that collocation is technically possible;
- Prohibits requirements for performance bonds;
- Prohibits certain indemnification requirements; and,
- Prohibits or otherwise limits certain fees (including annual limit on pole rental to $150 per year).

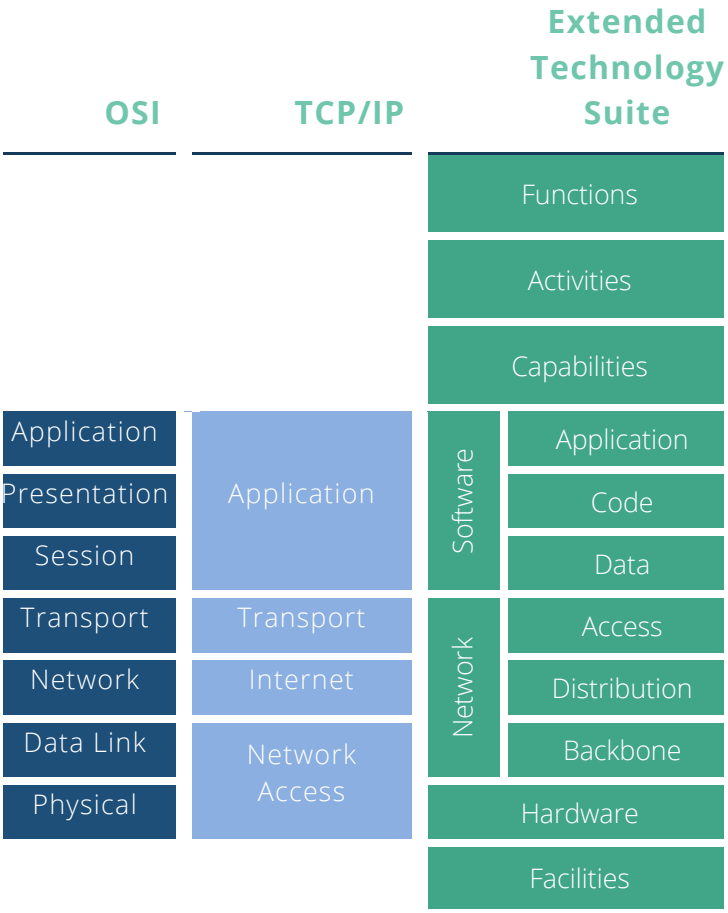
Appendix D: Broadband Systems and Architecture

BROADBAND SYSTEM REQUIREMENTS AND STANDARDS

Broadband is a service—high-speed internet access service—that requires more than infrastructure. The ***extended technology suite*** (ETS) model can be useful for understanding the full scope of requirements and specifying standards and sub-systems for broadband. OSI and TCP/IP[40] are possibly the most widely used reference models for the suite technology standards used in an information system and how they relate to each other. Technology suite models—often referred to as "stacks"—break components into layers. Each layer provides functionality to the layers above and below but is conceptually independent from them. It should be possible to swap out a piece of hardware, for example, without having to replace other components of the system or changing its overall functions.

[40] OSI stands for Open Systems Interconnection, and TCP/IP refers to the Transmission Control Protocol/Internet Protocol suite. The complete description of the OSI model is online at https://www.iso.org/ics/35.100/x/. The TCP/IP suite is described in the Internet Engineering Task Force's "Requirements for Internet Hosts" document, which is online at https://tools.ietf.org/html/rfc1122.

Figure 27: System technology "stack" reference models compared



These models are useful for planning as well as documenting systems based on a simple concept: higher layers determine or drive the functionality necessary of lower layers while lower layer functions constrain or enable functionality of layers above. Generally, when planning a system, start at the top and work your way down. For example, if you want to deploy a new application, start with that, determine what network connectivity requirements, and then choose hardware to fit. Generally, you don't want to start with a piece of hardware and figure out what applications will run on it.

The ETS is different and useful because it includes non-technological components: the system's business function, the activities it supports, human capabilities to carry out those activities, and, at the bottom of the stack, physical facilities in which the system is contained.

Broadband Business Functions, Activities, and Capabilities

Broadband is an integral part of many information systems. The broadband systems that provide network functions to other systems can be analyzed, described and specified as a technology stack. Starting at the top of the ETS stack, broadband systems must provide business functions, including:

- Billing and invoicing
- Customer service

- Network management
- Sales and marketing
- Service provisioning
- Trouble ticketing and support, etc.

Each of these business functions involve different activities and skills. Broadband systems require people to configure equipment, sign up subscribers, splice fiber, send bills, etc. Those people must have general and special skills to carry out the activities, effectively, including ability to use software in the process. Payroll is the largest operating cost for broadband systems, so it is critical to fully consider human resources in any broadband business plan.

Broadband System Software

A variety of applications are needed to operate a broadband system. They must align with the business functions, support the activities, and enable skilled people that comprise that system. For example, every internet service provider (ISP) uses billing software and network management software. For high-functioning systems these different applications must work together so if a subscriber doesn't pay her or his access is cut off.

Beneath the application used by people operating the broadband system, there is a base of computer code that determines its features and functions. The code base, in turn, draws on a data base of customers, equipment configurations, fiber cables, and everything else involved in a broadband system. Systems that lack code and data to support the business functions via intermediate layers do not function as well as those that do have these components.

Broadband Architecture: Access, Distribution, and Backbone

The network layers of the stack describe the infrastructure central to a broadband system. Networks operate in a hierarchy defined by how traffic flows and services are deployed across them. Access infrastructure is at the edges of a network, interfacing directly with users' devices. A backbone is at the core of every broadband system. Distribution infrastructure connects access infrastructure to the backbone.

While user devices can provide services to each other, most services on a network— web sites, streaming audio/video, email, and access to the global internet—are directly on the backbone. This includes services users never really

see: addressing, authentication, error detection and correction, routing, etc. All of these services operate via code and data for the network itself, to keep it running so users can use it.

Each network sub-layer consists of different and often multiple technologies. Access can be cable modems and coaxial cable, cellular phone radio, digital subscriber line service over copper twisted pair, fiber and optical terminators, Wi-Fi[41] radio, and other types of infrastructure. While distribution and backbone infrastructure is mostly fiber, there is a substantial amount of radio, specifically in the microwave spectrum, used in these portions of the network.

Backbone and distribution networks should be structured as rings, so they continue to operate if there is a cable cut or some other failure on a portion of that infrastructure. They are connected by equipment that aggregates traffic by multiplexing, routing, or switching it on to and off of the backbone from the distribution network. Similar equipment connects distribution to access. Each distribution node should connect to multiple access nodes via a single path or route—as a branch, bus, or star—to cost-effectively serve as many subscribers as possible.

[41] Wi-Fi is technically a LAN technology and is usually on the subscriber side of access infrastructure, not part of the broadband system. That said, Wi-Fi is also widely used as access infrastructure by wireless internet service providers (WISP).

Appendix E: Best Practice and Broadband-Friendly Policies

HOLISTIC POLICY APPROACHES

Some local governments have taken a holistic approach to facilitating broadband deployment and enhancing telecommunications access with development of Broadband Master Plans. This involves reviewing and amending existing policies, as well as adopting new policies based on changes in technology and community needs. A holistic approach also has standardized agreements and leases and engineering specifications for implementing those policies. Cities that have pursued the "holistic approach" include:

FOCUSED BROADBAND POLICIES

Implementing specific policies to minimize obstacles can be a very low cost way to promote investment in network infrastructure and services. These should be based existing assets, policies, and the needs of the community. The primary policy focus areas are wireless and wired telecommunication infrastructure with a specific focus on:

- Wireless tower regulations (siting and collocation)
- Small cell/distributed antenna systems (DAS) access to rights-of-way
- Wired access to rights-of-way: dig smart policies to address excavations including open trench, shadow conduit, dig once, and joint trenching
- Permitting and building codes
- Construction, engineering and conduit building specifications
- Broadband Asset Management

Wireless Communication (Tower Siting and Antenna Collocation)

Many local jurisdictions adopted local telecommunication policies commensurate with the 1996 Telecommunications Act to regulate tower location, tower height, and tower design including color, lighting, and screening of base facilities. Antenna collocation is required where possible to reduce costs and time by maximizing the use of existing infrastructure. Collocation is defined by the FCC as "the mounting or installation of an antenna on an existing tower, building, or structure for transmitting and/or receiving radio

frequency signals for communications purposes." Collocation enhances community aesthetics by reducing the number of vertical structures needed for broadband deployment.

The FCC released additional guidelines and regulations in the October 2014 Acceleration of Broadband Deployment Order, which includes final rules implementing Section 6409(a) of the Middle-Class Tax Relief and Job Creation Act of 2012. Section 6409(a) of the Middle-Class Tax Relief and Job Creation Act of 2012 restricts local land use review of modifications and collocations by establishing the "substantial change test" and reduces the processing shot clock from 90 days to 60 days. Distributed antenna systems (DAS) and small cells, may also require compliance with these same processes. Escambia County should consider adopting policies that have uniform rules and limitations regarding tower siting to prevent unnecessary delays in approval, high leasing fees, and other red tape associated with new wireless tower infrastructure, including requirements to collocate if possible, rather than construct a new tower.

Wireless Small Cell/DAS Collocation and Use of Rights-of-Way

The concepts applicable to antenna collocation on towers may also be considered for the latest small cell technology which can be attached to utility poles, street lights and other structures in the public rights-of-way. The FCC's National Broadband Plan concluded that, "the rates, terms, and conditions for access to rights-of-way (including pole attachments) significantly impact broadband deployment." As with collocation on towers, attaching communications facilities to existing poles and other structures lowers costs of infrastructure deployment; ensures efficient use of existing infrastructure, and limits impact of multiple structures in the rights-of-way.

Many states have or are now adopting legislation related to small cell (5G) deployment to regulate the rates, terms, and conditions of use/lease of poles, ducts, and conduits that are owned by "utility providers."

Wired (Conduit & Fiber) Rights-of-Way Excavations

Sixty to eighty percent of wired broadband deployment costs are associated with excavating/opening a trench usually in the rights-of-way and/or in burying conduit. Coordination with all interested parties, including telecommunications, for street cuts and excavations, sidewalk and trail improvements, water and sewer, and street lighting projects not only minimizes disruption and damage

associated with trenching, but reduces associated costs. According to the National Broadband Plan, "the cost of running a strand of fiber through an existing conduit is three to four times cheaper than constructing a new aerial build."[42]

A review of the literature reveals the use of several different terms aimed at managing the rights-of- way more efficiently and effectively, including open trench, shadow conduit, and dig once policies. The overall goals of these policies and procedures is to reduce the number of street excavations and associated costs and ensure equal access to all providers who use the rights-of-way to provide services which meet the needs of the public.

The Fiber to the Home (FTTH) Council refers to all of these policies as "Dig Smart" Policies and lists the following conditions that Dig Smart Policies should include to maximize the deployment of Broadband.[43] The goals of Dig Smart Policies are to:

- Reduce disruptive repeated excavation;
- Minimize traffic disruption and road deterioration;
- Enhance public safety and service outages;
- Eliminate waste of government resources;
- Incentivize underground installation of fiber; and
- Improve broadband service reliability and aesthetics.

Dig Smart policies require coordination and asset mapping/tracking and should be mandatory to be effective. Open Trench refers to the digging or excavation of a 'ditch' in the right-of-way for any purpose, including but not limited to deploying fiber. These policies focus on the dimensions, location, safety, signage, etc., for open trenches. "Dig Once" policies minimize excavation and damage to rights-of-way through coordination efforts involving ALL users of the rights-of-way including telecommunications when construction is planned which will create an "open trench." Joint Building or Joint Trenching requires right-of-way users (e.g. telecommunications providers) to utilize a common or joint trench with other utilities (i.e. sewer, water, gas, electric) where a (re)developer or utility company provides a trench for undergrounding of utilities. Shadow Conduit is used to refer to the installation of empty and/or spare conduit by a public agency when excavations occur in the public right-of-

[42] https://transition.fcc.gov/national-broadband- plan/national-broadband-plan.pdf

[43] https://www.fiberbroadband.org/d/do/2300

way, with agency costs limited to incremental costs. Some cities also require the installation of fiber when a trench is open for any reason.

Escambia County should consider policies and implement practices that encourage coordinating construction activities in the rights-of-way to minimize disruption thus maximizing public safety and reducing overall costs associated with multiple repeated excavation projects. The County should adopt clear engineering and construction specifications, and place conduit and/or fiber-optic cable when a trench is open for whatever reason in the rights-of-way.

Permitting and Building Codes

Expedited permitting codes that streamline approvals and eliminate red tape for approval of cable and antenna installation in rights-of-ways or public structure will speed up the process of expanding telecommunications access in a community. Many localities have simplified the permitting efforts by placing broadband infrastructure projects solely in the public works department via encroachment permit processes. Additionally, local governments have reviewed permitting fees to cover costs and reduced overall expenses associated with permitting fees. Finally, local governments have added connectivity requirements to building codes, ensuring that new constructions are equipped with broadband access.

Conduit and Fiber Standards for New Home Construction

Building codes that set standards and require conduit and/or fiber during development have been essential parts of expanding broadband, particularly in underserved and rural areas. The following cities exemplify best practices for this approach. Because of the uniqueness of these policies to each community, no Master Template is provided.

Engineering/Construction Specifications

Engineering standards and specifications identify and define requirements and policies for designing and installing telecommunications infrastructure and substructure at all facilities including conduit placement, type and installation. Conduit-specification documents address capacity, separation of facilities, proper sizing and placement, access to the conduit with detailed provisions for vaults and all access points. Cost sharing or cost recovery stipulations can be put in place for materials and labor assignment. Engineering specifications outline drawings that address conduit sweeps, bend radius and physical

placement requirements can be provided with the standard conduit specification.

Broadband Asset Management

The availability of Geographic Information System (GIS)-mapping databases allows local government to collect and map all infrastructure including assets which may be used for wired and wireless broadband services. A GIS-mapping database allows cities to track availability of current resources, coordinate excavation and other work in the rights-of-way for permitting, lease publicly owned assets, and readily share available resources for the purpose of expanding broadband. Leveraging existing infrastructure and implementing innovative fee structures can help to reduce the costs of broadband build-out.

Require utilities, developers, contractors and others to submit detailed plans to allow for real time updates of broadband asset data into the (GIS). Map and track both horizontal and "vertical" assets, that is: all utilities, cable, fiber and shadow conduit and all poles, towers, and other structures onto which network equipment can be mounted. Vertical assets can include communications towers, water tanks, grain silos, multi-story buildings, and other structures potentially useful in deploying wireless broadband.

Appendix F: Glossary of Terms

3G – Third Generation	The third generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.
4G – Fourth Generation	The fourth generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.
5G – Fifth Generation	The fifth generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web. It is believed that this technology will significantly increase bandwidth to users, up to 1 Gig.
ADSL – Asymmetric Digital Subscriber Line	DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service.
ADSS – All-Dielectric Self-Supporting	A type of optical fiber cable that contains no conductive metal elements.
AMR/AMI – Automatic Meter Reading/Advanced Metering Infrastructure	Electrical meters that measure more than simple consumption and an associated communication network to report the measurements.
ATM – Asynchronous Transfer Mode	A data service offering that can be used for interconnection of customer's LAN. ATM provides service from 1 Mbps to 145 Mbps utilizing Cell Relay Packets.
Bandwidth	The amount of data transmitted in a given amount of time; usually measured in bits per second, kilobits per second (kbps), and Megabits per second (Mbps).
Bit	A single unit of data, either a one or a zero. In the world of broadband, bits are used to refer to the amount of transmitted data. A kilobit (Kb) is approximately 1,000 bits. A Megabit (Mb) is approximately 1,000,000 bits. There are 8 bits in a byte (which is the unit used to measure storage space), therefore a 1 Mbps connection takes about 8 seconds to transfer 1 megabyte of data (about the size of a typical digital camera photo).
BPL – Broadband over Powerline	A technology that provides broadband service over existing electrical power lines.

BPON – Broadband Passive Optical Network	BPON is a point-to-multipoint fiber-lean architecture network system which uses passive splitters to deliver signals to multiple users. Instead of running a separate strand of fiber from the CO to every customer, BPON uses a single strand of fiber to serve up to 32 subscribers.
Broadband	A descriptive term for evolving digital technologies that provide consumers with integrated access to voice, high-speed data service, video-demand services, and interactive delivery services (e.g. DSL, Cable Internet).
CAD – Computer Aided Design	The use of computer systems to assist in the creation, modification, analysis, or optimization of a design.
CAI – Community Anchor Institutions	The National Telecommunications and Information Administration defined CAIs in its SBDD program as "Schools, libraries, medical and healthcare providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities." Universities, colleges, community colleges, K-12 schools, libraries, health care facilities, social service providers, public safety entities, government and municipal offices are all community anchor institutions.
CAP – Competitive Access Provider	(or "Bypass Carrier") A Company that provides network links between the customer and the Inter-Exchange Carrier or even directly to the Internet Service Provider. CAPs operate private networks independent of Local Exchange Carriers.
Cellular	A mobile communications system that uses a combination of radio transmission and conventional telephone switching to permit telephone communications to and from mobile users within a specified area.
CLEC – Competitive Local Exchange Carrier	Wireline service provider that is authorized under state and Federal rules to compete with ILECs to provide local telephone service. CLECs provide telephone services in one of three ways or a combination thereof: 1) by building or rebuilding telecommunications facilities of their own, 2) by leasing capacity from another local telephone company (typically an ILEC) and reselling it, and 3) by leasing discrete parts of the ILEC network referred to as UNEs.
CO – Central Office	A circuit switch where the phone lines in a geographical area come together, usually housed in a small building.

Coaxial Cable	A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this technology.
CPE – Customer Premise Equipment	Any terminal and associated equipment located at a subscriber's premises and connected with a carrier's telecommunication channel at the demarcation point ("demarc").
CWDM – Coarse Wavelength Division Multiplexing	A technology similar to DWDM only utilizing less wavelengths in a more customer-facing application whereby less bandwidth is required per fiber.
Demarcation Point ("demarc")	The point at which the public switched telephone network ends and connects with the customer's on-premises wiring.
Dial-Up	A technology that provides customers with access to the Internet over an existing telephone line.
DLEC – Data Local Exchange Carrier	DLECs deliver high-speed access to the Internet, not voice. Examples of DLECs include Covad, Northpoint and Rhythms.
Downstream	Data flowing from the Internet to a computer (Surfing the net, getting E-mail, downloading a file).
DSL – Digital Subscriber Line	The use of a copper telephone line to deliver "always on" broadband Internet service.
DSLAM – Digital Subscriber Line Access Multiplier	A piece of technology installed at a telephone company's Central Office (CO) and connects the carrier to the subscriber loop (and ultimately the customer's PC).
DWDM – Dense Wavelength Division Multiplexing	An optical technology used to increase bandwidth over existing fiber-optic networks. DWDM works by combining and transmitting multiple signals simultaneously at different wavelengths on the same fiber. In effect, one fiber is transformed into multiple virtual fibers.
E-Rate	A Federal program that provides subsidy for voice and data circuits as well as internal network connections to qualified schools and libraries. The subsidy is based on a percentage designated by the FCC.
EON – Ethernet Optical Network	The use of Ethernet LAN packets running over a fiber network.
EvDO – Evolution Data Only	EvDO is a wireless technology that provides data connections that are 10 times as fast as a traditional modem. This has been overtaken by 4G LTE.

FCC – Federal Communications Commission	A Federal regulatory agency that is responsible for regulating interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Rock Falls, and U.S. territories.
FDH – Fiber Distribution Hub	A connection and distribution point for optical fiber cables.
FTTN – Fiber to the Neighborhood	A hybrid network architecture involving optical fiber from the carrier network, terminating in a neighborhood cabinet which converts the signal from optical to electrical.
FTTP – Fiber to the premise (or FTTB – Fiber to the building)	A fiber-optic system that connects directly from the carrier network to the user premises.
FTTx – Fiber to the X	All fiber optic topologies from a provider to its customers, based on the location of the fiber's termination point
GIS – Geographic Information Systems	A system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.
GPON- Gigabit-Capable Passive Optical Network	Similar to BPON, GPON allows for greater bandwidth through the use of a faster approach (up to 2.5 Gbps in current products) than BPON.
GPS – Global Positioning System	a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.
GSM – Global System for Mobile Communications	This is the current radio/telephone standard developed in Europe and implemented globally except in Japan and South Korea.
HD – High Definition (Video)	Video of substantially higher resolution than standard definition.
HFC – Hybrid Fiber Coaxial	An outside plant distribution cabling concept employing both fiber-optic and coaxial cable.
ICT – Information and Communications Technology	Often used as an extended synonym for information technology (IT), but it is more specific term that stresses the role of unified communications and the integration of telecommunications, computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.
IEEE – Institute of Electrical Engineers	A professional association headquartered in New York City that is dedicated to advancing technological innovation and excellence.

ILEC – Incumbent Local Exchange Carrier	The traditional wireline telephone service providers within defined geographic areas. Prior to 1996, ILECs operated as monopolies having exclusive right and responsibility for providing local and local toll telephone service within LATAs.
IP-VPN – Internet Protocol-Virtual Private Network	A software-defined network offering the appearance, functionality, and usefulness of a dedicated private network.
ISDN – Integrated Services Digital Network	An alternative method to simultaneously carry voice, data, and other traffic, using the switched telephone network.
ISP – Internet Service Provider	A company providing Internet access to consumers and businesses, acting as a bridge between customer (end-user) and infrastructure owners for dial-up, cable modem and DSL services.
ITS – Intelligent Traffic System	Advanced applications which, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.
Kbps – Kilobits per second	1,000 bits per second. A measure of how fast data can be transmitted.
LAN – Local Area Network	A geographically localized network consisting of both hardware and software. The network can link workstations within a building or multiple computers with a single wireless Internet connection.
LATA – Local Access and Transport Areas	A geographic area within a divested Regional Bell Operating Company is permitted to offer exchange telecommunications and exchange access service. Calls between LATAs are often thought of as long distance service. Calls within a LATA (IntraLATA) typically include local and local toll services.
Local Loop	A generic term for the connection between the customer's premises (home, office, etc.) and the provider's serving central office. Historically, this has been a copper wire connection; but in many areas it has transitioned to fiber optic. Also, wireless options are increasingly available for local loop capacity.
MAN – Metropolitan Area Network	A high-speed intra-city network that links multiple locations with a campus, city or LATA. A MAN typically extends as far as 30 miles.
Mbps – Megabits per second	1,000,000 bits per second. A measure of how fast data can be transmitted.

Middle Mile Network	Middle mile is a term most often referring to the network connection between the last mile and greater Internet. For instance, in a rural area, the middle mile would likely connect the town's network to a larger metropolitan area where it interconnects with major carriers.
MPLS – Multiprotocol Label Switching	A mechanism in high-performance telecommunications networks that directs data from one network node to the next based on short path labels rather than long network addresses, avoiding complex lookups in a routing table.
ONT – Optical Network Terminal	Used to terminate the fiber-optic line, demultiplex the signal into its component parts (voice telephone, television, and Internet), and provide power to customer telephones.
Overbuilding	The practice of building excess capacity. In this context, it involves investment in additional infrastructure projects to provide competition.
OVS – Open Video Systems	OVS is a new option for those looking to offer cable television service outside the current framework of traditional regulation. It would allow more flexibility in providing service by reducing the build out requirements of new carriers.
PON – Passive Optical Network	A Passive Optical Network consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer's premise. Between them lies the optical distribution network comprised of fibers and passive splitters or couplers. In a PON network, a single piece of fiber can be run from the serving exchange out to a subdivision or office park, and then individual fiber strands to each building or serving equipment can be split from the main fiber using passive splitters / couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared among many customers, thereby dramatically lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications.
PPP – Public-Private Partnership	A Public–Private Partnership (PPP) is a government service or private business venture that is funded and operated through a collaborative partnership between a government and one or more private sector organizations. In addition to being referred to as a PPP, they are sometimes called a P3, or P^3.

QOS – Quality of Service	QoS (Quality of Service) refers to a broad collection of networking technologies and techniques. The goal of QoS is to provide guarantees on the ability of a network to deliver predictable results, which are reflected in Service Level Agreements or SLAs. Elements of network performance within the scope of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate. QoS involves prioritization of network traffic.
RF – Radio Frequency	a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.
Right-of-Way	A legal right of passage over land owned by another. Carriers and service providers must obtain right-of-way to dig trenches or plant poles for cable systems, and to place wireless antennas.
RMS – Resource Management System	A system used to track telecommunications assets.
RPR – Resilient Packet Ring	Also known as IEEE 802.17, is a protocol standard designed for the optimized transport of data traffic over optical fiber ring networks.
RUS – Rural Utility Service	A division of the United States Department of Agriculture, it promotes universal service in unserved and underserved areas of the country with grants, loans, and financing. Formerly known as "REA" or the Rural Electrification Administration.
SCADA – Supervisory Control and Data Acquisition	A type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes that exist in the physical world.
SNMP – Simple Network Management Protocol	An Internet-standard protocol for managing devices on IP networks.
SONET – Synchronous Optical Network	A family of fiber-optic transmission rates.
Streaming	Streamed data is any information/data delivered from a server to a host where the data represents information that must be delivered in real time. This could be video, audio, graphics, slide shows, web tours, combinations of these, or any other real time application.
Subscribership	Subscribership is how many customers have subscribed for a particular telecommunications service.

Submarine Network	Submarine networking is the process by which data is carried on subsea cables to connect continents. Submarine networks carry 95 percent of the world's intercontinental electronic communications traffic.
Switched Network	A domestic telecommunications network usually accessed by telephone, key telephone systems, private branch exchange trunks, and data arrangements.
T-1 – Trunk Level 1	A digital transmission link with a total signaling speed of 1.544 Mbps. It is a standard for digital transmission in North America.
T-3 – Trunk Level 3	28 T1 lines or 44.736 Mbps.
UNE – Unbundled Network Element	Leased portions of a carrier's (typically an ILEC's) network used by another carrier to provide service to customers. Over time, the obligation to provide UNEs has been greatly narrowed, such that the most common UNE now is the UNE-Loop.
Universal Service	The idea of providing every home in the United States with basic telephone service.
Upstream	Data flowing from your computer to the Internet (sending E-mail, uploading a file).
UPS – Uninterruptable Power Supply	An electrical apparatus that provides emergency power to a load when the input power source, typically main power, fails.
USAC – Universal Service Administrative Company	An independent American nonprofit corporation designated as the administrator of the Federal Universal Service Fund (USF) by the Federal Communications Commission.
VDSL – Very High Data Rate Digital Subscriber Line	A developing digital subscriber line (DSL) technology providing data transmission faster than ADSL over a single flat untwisted or twisted pair of copper wires (up to 52 Mbit/s downstream and 16 Mbit/s upstream), and on coaxial cable (up to 85 Mbit/s down and upstream); using the frequency band from 25 kHz to 12 MHz.
Video on Demand	A service that allows users to remotely choose a movie from a digital library whenever they like and be able to pause, fast-forward, and rewind their selection.

VLAN – Virtual Local Area Network	In computer networking, a single layer-2 network may be partitioned to create multiple distinct broadcast domains, which are mutually isolated so that packets can only pass between them via one or more routers; such a domain is referred to as a Virtual Local Area Network, Virtual LAN or VLAN.
VoIP – Voice over Internet Protocol	An application that employs a data network (using a broadband connection) to transmit voice conversations using Internet Protocol.
VPN – Virtual Private Network	A virtual private network (VPN) extends a private network across a public network, such as the Internet. It enables a computer to send and receive data across shared or public networks as if it were directly connected to the private network, while benefitting from the functionality, security and management policies of the private network. This is done by establishing a virtual point-to-point connection through the use of dedicated connections, encryption, or a combination of the two.
WAN – Wide Area Network	A network that covers a broad area (i.e., any telecommunications network that links across metropolitan, regional, or national boundaries) using private or public network transports.
WiFi	WiFi is a popular technology that allows an electronic device to exchange data or connect to the Internet wirelessly using radio waves. The WiFi Alliance defines WiFi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards".
WiMAX	WiMAX is a wireless technology that provides high-throughput broadband connections over long distances. WiMAX can be used for a number of applications, including “last mile” broadband connections, hotspot and cellular backhaul, and high speed enterprise connectivity for businesses.
Wireless	Telephone service transmitted via cellular, PCS, satellite, or other technologies that do not require the telephone to be connected to a land-based line.
Wireless Internet	1) Internet applications and access using mobile devices such as cell phones and palm devices. 2) Broadband Internet service provided via wireless connection, such as satellite or tower transmitters.

Wireline	Service based on infrastructure on or near the ground, such as copper telephone wires or coaxial cable underground or on telephone poles.