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Executive Summary

Broadband access is one of the more important aspects of any thriving community today. Our educational system, our healthcare, the competitiveness of our businesses, and the quality of our lives are all enhanced with broadband. Community leaders of Hamblen and Jefferson Counties in east Tennessee believe that such adequate and affordable broadband service is lacking in their communities and initiated this study to understand those needs and identify feasible solutions.

This study examines the current availability, adoption and use of broadband by households, businesses and community organizations in Hamblen and Jefferson Counties served by the Appalachian Electric Cooperative (AEC). The feasibility study then focuses on the deployment of a fiber-optic infrastructure to deliver gigabit Internet connectivity to homes and businesses in the AEC service areas of these two counties, as defined by the yellow boundary in Figure 1.

Figure 1: The AEC broadband feasibility study coverage area

The study identifies geographic areas of the AEC service area that are underserved by retail Internet service providers, and ascertains the degree to which lack of infrastructure, adequate service levels, and high cost limits the use of the Internet by households and businesses. The
feasibility study includes a needs assessment portion that presents an analysis of the local retail broadband market and identifies indicators of current and future demand and use of broadband by households, businesses, and civic organizations in the AEC service area.

Through the benefit of in-person meetings and a survey of almost 2,000 Jefferson and Hamblen County residents and businesses, a broadband needs assessment explores how the Internet currently benefits local households and facilitates the operations of local businesses and organizations. The assessment will determine local indicators of broadband importance and identify barriers that discourage or prevent local broadband service adoption and identifies opportunities for future increased broadband adoption and socioeconomic benefit.

The feasibility study then presents a high-level network design and financial analysis to estimate the cost of deploying and operating a fiber-optic network in the AEC service areas in Jefferson and Hamblen Counties. The study will present financial models and operating plans that could prove viable options for AEC to play an integral part in the delivery of broadband services to its customers while operating within the bounds of the State of Tennessee regulatory environment.

**Turning Obstacles into Opportunities**

Utilities and public organizations are charged with making wise investments in infrastructure that will universally benefit their communities. In areas around the country where broadband infrastructure has been slow to develop, local governments and utilities have taken it upon themselves to strengthen their communities by investing in broadband. In doing so, they have leveled the playing field for their residents and businesses, allowing their communities to compete in the connected world.

As one of the leading national examples of this community-led empowerment, Morristown Utility System (MUS) in Hamblen County, is a municipally-owned electric utility that provides high-speed broadband, television and telephone services within the City of Morristown. MUS has operated FiberNet since 1996, and has become the leading provider in Morristown with about 48% market share. FiberNet is profitable, and is widely considered a model municipal network operation. If MUS FiberNet were a commercial entity, it would be wildly successful and would have grown its geographic market well beyond Morristown and Hamblen County and into neighboring counties where broadband access and competition are severely lacking.

Today, MUS desires to share its gigabit networking technology with surrounding communities to improve regional educational opportunities and support regional workforce development to retain and create jobs for east Tennessee. However, State of Tennessee law restricts public utilities from expanding telecommunications services beyond their electric service area. In the case of MUS, this service area is mostly the city limits of Morristown.

Yet with a tremendously successful fiber-optic network, a technology asset capable of serving upwards of 500,000 broadband customers, state law dictates that MUS FiberNet can only serve customers in its electric footprint, which is approximately 11,000 households and 2,500 businesses. With no way to expand or generate revenue by offering services to customers
outside its electric coverage area, MUS is concerned about sustaining operations amid future programming and operations cost increases.

On the other hand, AEC is an electric utility cooperative that serves parts of four counties in east Tennessee. Just as MUS recognizes for Morristown, AEC also recognizes the importance of broadband to its customers who live and work in the communities it serves. However, even if AEC wanted to replicate the broadband services of MUS FiberNet by deploying and operating its own fiber-optic network, state regulations prohibit electric cooperatives from even offering retail broadband services to the communities it serves. Electric utility cooperatives are, however, within the bounds of state law to provide data transport across infrastructure they own, which presents a unique opportunity for broadband growth in the AEC service area.

**Working Together for a Solution**

The last several decades have changed the nature of east Tennessee remoteness and isolation, and the prosperity of our communities is determined increasingly on the connectedness to the digital world. While physical isolation has vastly improved through improved transportation systems, today’s residents and businesses now confront an era of digital isolation. Broadband highways have now become a critical factor in measuring capabilities to succeed in the new economy. Infrastructure that enables these digital highways is essential, especially in rural communities that are often disregarded by profit-centered telecommunications corporations.

In smaller and often poorer communities, broadband services have generally lagged behind that found in larger and wealthier areas of the country, a concept often referred to as the “digital divide,” which to a degree is what we have in Jefferson and Hamblen Counties. This digital isolation is especially true for the region’s youth, who often find themselves unable to access media or educational materials, and interact with peers or game online. Isolated from mass culture and opportunities, it is little wonder that so many seek a future outside of the region, while many of the best and brightest who do strike out into the world seldom return home.

Clearly, the relatively lower population densities found in rural communities make broadband infrastructure investments costlier for service providers and lengthens the time required for the return on investment that commercial service providers seek. For the residents and businesses of Jefferson and Hamblen County, this means choice in available broadband services is often limited to one provider, if wireline services are available at all. Where services are available, the prices reflect the lack of competition through higher cost and limited service levels.

All local stakeholders involved agree that affordable broadband would have a tremendous benefit for local economic growth in ways we can only begin to imagine. Fiber-optic based broadband rarely makes it to rural areas, so having abundant fiber-optic broadband throughout the county will ripen the soil for homegrown entrepreneurs and allow small businesses to grow where they started.

Likewise, knowing that home-based workers can live where they please, the natural beauty and recreational opportunities of east Tennessee can become a magnet for new community
development opportunities around the retention and the attraction of young professionals and a digital workforce. Better broadband also creates a more responsive local government that makes the community stronger through improved efficiencies and smarter through better applications of technology.

With a fiber-optic broadband network to every AEC home, schools can interact directly with students. With state mandated digital textbooks and online testing on the horizon, the same interactivity can be beneficial on snow days as when a student is sick at home. Churches can broadcast their services to traveling or home-bound members, just as high school football games and civic events can be broadcast throughout the community. Likewise, volunteer and social support organizations can organize and deliver services more efficiently to sustain the limited resources with which they often operate.

Several of the above activities are already happening in the City of Morristown, made possible through the fiber-optic network technology. Improvements in these quality of life indicators can all be key differentiators as the Lakeway Region strives to meet its economic development goals of becoming an attractive home for recent retirees, to be an appealing location for a millennial workforce engaged in the knowledge economy, as well as become a magnet for larger employers looking to relocate or expand.

There are limitless examples of what delivery of services are possible with fiber-optic broadband connections to every home, business, and mobile device in the AEC service area. Thankfully for Jefferson and Hamblen County, forward-thinking leaders from local government, public utilities, and the public and private sector have stepped in with a strong desire to improve broadband services for their residents and businesses.

This feasibility study strives to capture that vision to provide a roadmap of options for broadband opportunities that can support the delivery of fiber-optic broadband services to the AEC communities of Jefferson and Hamblen Counties.
1. The State of Broadband in the AEC Service Area

Magellan Advisors has studied and evaluated the state of broadband networks in the Appalachian Electric Cooperative (AEC) service area within Hamblen and Jefferson Counties and the prominent cities of White Pine, Jefferson City, and Dandridge. Through the assessment process, we have identified the existence of necessary local networks and facilities to enable the expansion of fiber-optic infrastructure in Hamblen and Jefferson County communities that are served by AEC.

In addition to nearby broadband provider Morristown Utility System (MUS) FiberNet, regional and national telecommunications carriers maintain routes through Jefferson and Hamblen Counties. These backhaul networks generally follow the physical routes of railroads and highways to connect with other communities throughout east Tennessee, then on to data centers in Knoxville and across the eastern U.S. where interconnections are then made with national and international backbone networks.

In general, we found that service providers have the capabilities and service platforms to operate and manage limited broadband services in the populated areas of the country they choose to serve. However, as observed in Hamblen and Jefferson Counties, rarely do commercial Internet service providers overlap their coverage areas. So, while there appears to be competition in the county and its communities, seldom do service providers compete in the same neighborhoods for the same households and businesses. This leaves customers with limited choices of service providers at typically a higher cost than in areas with healthier competition.

Another observation is that the quality of similar services varies in different parts of the AEC service area. In places where there is Internet access, almost all customers are connected either across telephone wire or coaxial cable. Both delivery systems have limitations inherent with copper wiring, and quality suffers considerably from the practice of over-subscription by service providers. As such, anything more than basic service levels are not consistently available as advertised throughout the county, and where advanced services are available the high cost is a stated deterrent for businesses to obtain the adequate service levels they need to be competitive.

Likewise, for the surprising number of home-based businesses and teleworkers in the AEC service area, limited access to quality broadband services and high cost are a constraint for small businesses and a loss of opportunity for homegrown entrepreneurs to emerge and mature.

This same lack of consistent and affordable residential service in AEC communities legitimizes concerns of Internet adoption and subscribership barriers being a limiting factor in enabling educational opportunities. The State of Tennessee mandate for schools to move to digital textbooks and online testing becomes a reality with the 2017 school year, and school leaders in Jefferson County and parts of Hamblen County outside of Morristown in particular are concerned with home connectivity and the ability to deliver the changing curriculum.
In an attempt to stay a step ahead of the state mandates, beginning with the 2016 school year, the Hamblen County Board of Education began Project 2020 with the goal of providing laptops to every high school student by 2020. This is considered a cutting edge move throughout the region as education requirements move online. Improved broadband in both counties is imperative to support both this initiative and the state mandates.

In areas of both counties where Internet providers have grown their service offerings, adoption and use of the Internet has also grown. Residents use the Internet more every day and survey responses show that the Internet has risen in importance to the point that people can’t live without it. With this growth in Internet use, and the rising popularity of multiple applications and devices that connect to the Internet, overall bandwidth requirements have grown along as well.

Looking forward, it is important to understand that almost all the county’s Internet customers – residents and businesses alike, subscribe to services from providers that use a copper-based infrastructure. As we heard from business and residents alike, the quality of service varies by time of day, and delivery of Internet content is limited in areas where copper infrastructure exists and is shared by multiple subscribers. AEC businesses and households commented about the drop in Internet speeds at different times of day, as an almost predictable pattern.

As individual demand drives the aggregate bandwidth consumption throughout the community, the copper wiring that makes up local and regional networks gets overloaded. This affects every business and organization that relies on either large amounts of data or time-sensitive information, just as it does every house that tries to stream real-time events across the Internet, whether it’s breaking news, stock exchange tickers, or Tennessee football games.

All broadband customers demand more bandwidth from their telecommunications provider in order to support more applications and more devices. In areas where broadband exists, both as new users come online and as all user groups consume increasingly more bandwidth, the quality of local networks will be impacted. Local copper-based networks are showing signs of reaching an unsustainable level with no indication of commercial service providers increasing their local infrastructure capacity or their retail service offerings.

Uncertainties in the Local Broadband Market

Through analysis of the available broadband infrastructure in the AEC service area and through discussions with broadband service providers, there is no fiber distribution technology utilized to deliver fiber service to the customer premises. In many cases, businesses and homes have little
choice other than to purchase services from local service providers that offer legacy network offerings of DSL and cable.

Should an AEC resident or business owner want broadband greater than a 60 Mbps or a fiber-optic connection, the customer must negotiate a contract for dedicated services, which typically requires a costly custom-built connection from the provider’s network to the premises. The cost of infrastructure is borne by the business or developer that requests the connection. These fees typically start in the tens of thousands of dollars, based on distance between the customer and the service provider, and often requires a long-term contract agreement for services.

In comparison, MUS FiberNet passes every single home and business in Morristown with a minimum synchronous speed of 50 Mbps with no up-front installation costs or service contracts. All homes and businesses in Morristown have service options for Gigabit speeds, costing far less than and providing far more than any incumbent services.

In discussions with the local incumbent service providers, there are no plans to build out fiber infrastructure other than continuing the dedicated service offerings to individual requesting customers. These types of dedicated arrangements are far more expensive than traditional services and typically only benefit larger enterprise customers and community anchors that can afford these negotiated services.

Compounding this problem with its insufficient infrastructure, the current incumbent providers are in a period of instability and uncertainty, as Verizon, Charter and AT&T are each in the middle of corporate mergers and potential divestiture of existing local infrastructure.

- While Verizon Wireless serves Jefferson and Hamblen Counties, Verizon is in the process of divesting its wireline business in the states of California, Florida and Texas, and the future is uncertain for its FiOS product in many markets.

- Charter is merging with Time Warner Cable and Bright House Networks to create a new cable provider known as New Charter. Once the merger transition is complete, New Charter would service more than 23 million customers, rivaling Comcast as the number two cable operator in the U.S.

- AT&T has made announcements recently to suspend its U-Verse service in many areas, which could impact the many DSL subscribers in Jefferson and Hamblen Counties. There is a trend from AT&T toward increased attention on DSL, mobile wireless and satellite and seemingly less on fiber networks, especially in rural areas.

Until these corporate transitions play out and decisions about how these new entities intend to serve their existing markets, there is a degree of uncertainty in the retail broadband markets of Jefferson and Hamblen Counties.
The State of Broadband in Hamblen and Jefferson Counties

Hamblen and Jefferson County residents, business owners, community leadership and leadership of AEC are beginning to recognize the limitations of legacy copper-based networks and understand the capabilities of fiber-optic networks. Likewise, broadband providers understand that fiber-optic infrastructure delivers the only long-term solution to the ever-growing bandwidth needs of homes, businesses, and community anchors.

However, outside telecommunications corporations aren’t vested in Jefferson City, Dandridge, White Pine or elsewhere in the AEC service area enough to prioritize the investment in their network upgrades. Retail broadband service providers around the country are slowly transitioning to fiber to the customer, but as seen in the communities of the AEC service area, the pace of this transition is uneven and slow. AEC and community leaders believe it is now time to provide this improved infrastructure for the community.

This chapter provides a market analysis of the supply side of broadband by presenting information about the providers that serve the cities, towns, and homes and businesses of Jefferson and Hamblen Counties. The chapter begins with a section that overviews current community networking infrastructure so that readers unfamiliar with networking terminology can gain a basic understanding of the concepts and types of technology being discussed in this feasibility study. Then the chapter will present the retail services that local providers offer in various locations around the AEC service area, the physical infrastructure maintained by each provider, and the service levels and pricing for business and residential customers.
1.1 Overview of Broadband Networking Technology

Broadband is deployed throughout communities as wired and wireless infrastructure that carries digital signals between end users and the content they want to access. The content accessed across the network in the local community comes in several forms and likely from many locations across the world via regional and national networks that connect the local community to the Internet and to other communities across the world. Websites, television, streaming video, videoconferencing, cloud services, and telephone service are just a few types of content that we use, consume, and add to every day that gets delivered across broadband networks.

The way people and our digital devices access content is made available through five main types of infrastructure and connections available. Most Internet providers — including Charter, Verizon, and AT&T — started out as or bought telephone companies, giving them control of one of the physical wires that serve each household, in this case twisted pair copper telephone line. The second wire typically comes from Cable TV providers that control coaxial cables that enter almost every home. Wireless and satellite companies try to compete but those technologies can’t reliably provide high speeds, and often limit the amount of data consumers can use.

Infrastructure that is aging and built on the older technologies described above result in slower, less reliable access to content. Fiber-optic cables provide the robust infrastructure that connect telephone and cable infrastructure between communities and around the world. Today, fiber-optic technology is beginning to appear in homes and businesses throughout the world as telephone and cable has done in the past.

*Figure 2: How fiber-optic networks connect our communities*
1.1.1 Dial-Up Access

Though not defined as a broadband technology due to speed and bandwidth limitations, dial-up access still exists. Dial-up Internet access is a form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a connection to an Internet service provider (ISP) by dialing a telephone number on a conventional telephone line.

1.1.2 Digital Subscriber Line (DSL)

DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines installed in homes and businesses. DSL-based broadband provides transmission speeds ranging from several thousand bits per second (Kbps) to millions of bits per second (Mbps). The availability and speed of DSL service depends on the distance from the customer to the closest telephone company facility otherwise known as a central office.

The following are types of DSL transmission technologies:

- Asymmetrical Digital Subscriber Line (ADSL/ADSL2/ADSL2+/VDSL) – Used primarily by customers who receive a lot of data but do not send much. ADSL typically provides faster speed in the downstream direction than the upstream direction. ADSL allows faster downstream data transmission over the same line used to provide voice service, without disrupting regular telephone calls on that line.
- Symmetrical Digital Subscriber Line (SDSL) – Used typically by businesses for services such as video conferencing, which need significant bandwidth both upstream and downstream.

1.1.3 Cable Modem

As the Internet came of age, the same copper coaxial cable that created the connectivity for cable television networks have also provided bandwidth to a majority of residential and small business users. Cable operators provide broadband service to subscribers using the same coaxial cable that has historically delivered pictures and sound to televisions through a cable modem.

Most cable modems are external devices that have two connections: one to the cable wall outlet via coaxial cable that goes out to the Internet, the other to a computer via Ethernet cable. Cable provides transmission speeds of 1.5 Mbps or more. Subscribers can access their cable modem service by simply turning on their computers, without dialing-up an ISP, and can still watch cable TV while using it. Transmission speeds vary depending on the type of cable modem, cable network, and traffic load.

In response to growing consumer demand for bandwidth, DSL and cable network operators upgrade outdated or underperforming equipment following their revenue models and capital budget limitations to attempt to make the infrastructure faster and more reliable. However,
several fundamental issues exist that pose long-term challenges to meeting the growing bandwidth demand through copper infrastructure:

- Broadband signals degrade significantly as distances increase.
- Broadband signals are susceptible to electrical interference and signal degradation, particularly as they age.
- Service providers generally share bandwidth among pools of users that result in an uneven distribution of speed to users, and speed degrades to all as these facilities become congested.

### 1.1.4 Fiber-Optic Networks

Fiber-optic network technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of megabits per second. With fiber-optic broadband networks, speeds in the billions of bits per second range are possible.

The actual speed the customer experiences will vary depending on a variety of factors, such as how close to the computer the service provider brings the fiber and how the service provider configures the service. The same fiber that provides broadband Internet can also simultaneously deliver voice (VoIP) and video services, including video on demand, and provides these services synchronously, meaning the service is consistently robust in both download and upload directions, which is important for households and businesses.

Variations run the fiber all the way to the customer’s home or business, to the curb outside, or to a location (node) somewhere between the provider’s facilities and the customer.

- **Fiber to the Node (FTTN)** - Brings high-capacity fiber-optic cables to local service areas and then connects to existing DSL and coaxial equipment. Rather than bringing fiber-optic cables to every home or business, the fiber is connected to the existing copper network to increase its capacity. These networks carry more traffic, but the copper-based “last mile” network that connects homes and businesses to the local nodes is still a bottleneck and results in subscribers not accessing the true speeds of fiber-optic connections.

- **Fiber to the Premise (FTTP)** – Provides Internet access by running fiber-optic cable directly from an Internet Service Provider (ISP) to a customer’s home or business. Fiber facilitates much faster speeds than dial-up and coaxial cable connections, and generally needs to be serviced less. Considered one of the most “future proof” types of Internet technology, since there are no foreseeable devices that could use more bandwidth than can be sent via fiber-optic cables.
To illustrate the relative difference between common Internet connection methods, Figure 3 compares traditional access technologies, beginning with basic dial-up service, through DSL, cable, and fiber. Whereas traditional broadband technologies have an upper limit of 300 Mbps, next-generation broadband that utilizes fiber-optic connections surpasses these limitations and can provide data throughputs of 1 Gbps and greater.

**Figure 3: Physical bandwidth capacity comparisons**

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1.1.5 Wireless

Wireless broadband connects a home or business to the Internet using a radio link between the customer’s location and the service provider’s facility. Wireless broadband can be mobile or fixed. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide. Speeds are generally comparable to DSL and cable modem. An external antenna is usually required. Wireless broadband Internet access services offered over fixed networks allow consumers to access the Internet from a fixed point while stationary, and often require a direct line-of-sight between the wireless transmitter and receiver. These services have been offered using both licensed spectrum and unlicensed devices. For example, thousands of small Wireless Internet Services Providers (WISPs) provide such wireless broadband at speeds of around 1 Mbps using unlicensed devices, often in rural areas not served by cable or wireline broadband networks. Mobile wireless broadband services are also becoming available from mobile telephone service providers and others. These services are generally appropriate for highly mobile customers and require a special PC card with a built-in antenna that plugs into a user’s laptop computer.
1.2 Service Providers and Offerings in the AEC Service Area

Networks in the AEC coverage area are composed primarily of networks built by private companies such as telephone and cable TV providers, and networks built by a number of telecommunications providers including the incumbent local exchange carriers (ILEC), competitive local exchange carriers (CLEC), cable providers, and Tier 1/Tier 2 providers.

To support these companies and their services, fiber routes are maintained near the AEC service area along Interstate 40 and 81 corridors. Gaining access to service provider data that shows specific current and future fiber routes, available capacity, and proprietary information can be a challenging endeavor. While several providers serving east Tennessee have made high-level fiber maps available, it is difficult to obtain this same data from the ILEC and cable providers.

Figure 4: AEC broadband feasibility study area
Where information is available, service provider offerings and network assets have been documented and inventoried to define a baseline from which to evaluate local network capabilities, network gaps, and potential for future expansion and applications.

The Internet service providers that offer retail broadband service to the retail and wholesale markets of the AEC service areas include:

- **Charter Communications** is the competitive local exchange carrier (CLEC) in Jefferson and Hamblen Counties that provides both retail services to consumers and wholesale services to other telecommunications providers. Charter provides voice, Internet and video services through the brand, Spectrum. *Maps depicting Charter’s broadband infrastructure were requested but not provided for proprietary reasons.*

- **Comcast** is the incumbent (ILEC) cable provider serving east Tennessee, including Jefferson and Hamblen Counties. Comcast maintains offerings of voice, Internet, and video that are delivered to subscribers via coaxial cable through the Xfinity brand. *Maps depicting Comcast’s broadband infrastructure were requested but not provided for proprietary reasons.*

- **AT&T** is the incumbent local exchange carrier (ILEC) for Jefferson and Hamblen Counties due to the area being served by a Regional Bell Operation Company, first as South Central Bell then later BellSouth before RBOC consolidation. AT&T is a global communications provider, headquartered in Dallas, Texas, and provides communications services to enterprise, government, and carrier customers. In Jefferson and Hamblen Counties, AT&T offers DSL, video, and voice through its U-Verse and DirecTV brands, noting that service offerings could change as a result of recent corporate decisions. *Maps depicting AT&T’s broadband infrastructure were requested but not provided due to proprietary reasons.*

- **EarthLink** is a nationwide network operator with more than 29,000 fiber route miles, and provides retail residential DSL and business telecommunications services. Wholesale voice and data transport services are available through the EarthLink Carrier brand. *Maps of EarthLink’s network infrastructure and service offerings can be viewed at: https://www.earthlink.com/why-earthlink/our-network*

- **iRis Networks** is a regional wholesale carrier delivering fiber transport for voice, video and data in and around Tennessee with over 5,000 miles of fiber. iRis provides data transport to over 100 rural communities in Tennessee, Kentucky, and Alabama with scalable customer speeds from 10 Mbps to 1 Gbps. iRis also provides fully redundant high-capacity transport between the larger regional markets of Nashville, Knoxville, Chattanooga, Memphis, and Atlanta. *Maps of iRis Networks’ infrastructure and service offerings can be viewed at: http://www.iristransport.com/our-network.php*
• **Planet Connect** is an Internet service provider headquartered in Dandridge, but started in Newport as one of the region’s first dialup ISPs, and years later its first fixed wireless Internet provider. Planet Connect has a significant coverage area throughout east Tennessee and into southwest Virginia offering dialup and point-to-point fixed wireless services, with download speeds of just under 1 Mbps and uploads of 256 kbps. Services packages include 30 Gbps of monthly data for $45 per month. Customer premise equipment needed is determined after a site survey to insure customer is within line-of-sight of tower locations. *Maps depicting Planet Connect’s broadband infrastructure and service coverage area are available on its website at: http://planetc.com/wireless/locations/locations*

• **Ultranet** is a wireless Internet service from LogOn Computer Services headquartered in Morristown. Ultranet has a coverage area throughout much the Lakeway region of Jefferson and Hamblen Counties. LogOn offers VoIP services, is a satellite television reseller, and offers point-to-point fixed wireless Internet services, with download speeds of just under 1 Mbps and uploads of 256 kbps. Packages range from $40 per month for 1 Mbps to $80 for 8 Mbps. *Maps depicting Ultranet’s wireless service coverage area are available on its website at: http://www.lcs.net/coverage-area*

*Figure 5: Sample portfolio of typical services from broadband service providers*
1.3 Residential Broadband Market Analysis

To provide an analysis of the residential broadband market, Magellan identified a number of residential sites by address, selected randomly across the AEC service area in Hamblen and Jefferson Counties. Magellan’s team contacted each residential retail telecommunications provider identified as operating wireline services in the market to determine service availability, service levels and pricing. The results show that although there are two provider options for most household addresses, the speed and pricing varies.

The following residential site locations were utilized:

- Residential Site #1 - 382 Terry Point Road, Dandridge, TN 37725
- Residential Site #2 - 1050 Chestnut Grove Road, Dandridge, TN 37725
- Residential Site #3 - 3579 Mountain View Lane, White Pine, TN 37890
- Residential Site #4 - 2264 Walnut Street, White Pine TN, 37890
- Residential Site #5 - 1412 Clintwood Court, Jefferson City, TN 37760
- Residential Site #6 - 252 Andrea Lane, Jefferson City, TN 37760
- Residential Site #7 - 2944 Bluegrass Lane, Strawberry Plains, TN 37871
- Residential Site #8 - 7308 Sweetbriar Drive, Talbott, TN 37877
- Residential Site #9 - 1175 McIntosh Lane, Russellville, TN 37860
- Residential Site #10 - 3560 Holts Church Road, Morristown, TN 37814
- Residential Site #11 - 2945 Inman Bend Road, Morristown, TN 37814

*Figure 6: Spatial distribution of residential market analysis sites*
Figure 7: Residential sites for broadband market analysis

<table>
<thead>
<tr>
<th>Residential Site #1 - 382 Terry Point Road, Dandridge, TN 37725</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 18Mbps/3Mbps</td>
<td>$42/month</td>
<td></td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Comcast</td>
<td>Cable up to 150Mbps/20Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #2 - 1050 Chestnut Grove Road, Dandridge, TN 37725</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 18Mbps/3Mbps</td>
<td>$42/month</td>
<td></td>
</tr>
<tr>
<td>Charter, Comcast</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #3 - 3579 Mountain View Lane, White Pine, TN 37890</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
<tr>
<td>Comcast, AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #4 - 2264 Walnut Street, White Pine TN, 37890</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 12/1.5Mbps</td>
<td>$40/month</td>
<td></td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #5 - 1412 Clintwood Court, Jefferson City, TN 37760</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
<tr>
<td>Comcast, AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #6 - 252 Andrea Lane, Jefferson City, TN 37760</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T, Charter, Comcast</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #7 - 2944 Bluegrass Lane, Strawberry Plains, TN 37871</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 45Mbps/3Mbps</td>
<td>$72/month</td>
<td></td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Comcast</td>
<td>Cable up to 75Mbps/10Mbps</td>
<td>$59.95/month</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #8 - 7308 Sweetbriar Drive, Talbott, TN 37877</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse DSL up to 18Mbps/1Mbps</td>
<td>$45/month</td>
<td></td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #9 - 1175 McIntosh Lane, Russellville, TN 37860</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comcast</td>
<td>Cable up to 150Mbps/20Mbps</td>
<td>$99.99/month</td>
<td></td>
</tr>
<tr>
<td>Charter, AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #10 - 3560 Holts Church Road, Morristown, TN 37814</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.95/month</td>
<td></td>
</tr>
<tr>
<td>Comcast, AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential Site #11 - 2945 Inman Bend Road, Morristown, TN 37814</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse DSL up to 6Mbps/1Mbps</td>
<td>$35/month</td>
<td></td>
</tr>
<tr>
<td>Charter, Comcast</td>
<td>Not Available</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
1.4 Commercial Broadband Market Analysis

To provide an analysis of the broadband market for businesses, Magellan identified a number of commercial sites by address, selected randomly across the AEC service areas in Hamblen and Jefferson County. Magellan’s team contacted each telecommunications provider identified as operating wireline services to the business market to determine service availability, service levels and pricing. The results show that although there are two provider options for most addresses, the speeds and pricing varies.

The following commercial site locations were utilized:

- Commercial Site #1 - 831 Epco Drive, Dandridge, TN 37725
- Commercial Site #2 - 955 Pine Drive, Dandridge, TN 37725
- Commercial Site #3 - 918 R.H. Ellis Road, White Pine, TN 37890
- Commercial Site #4 - 1564 Hollow Springs Way, White Pine, 37890
- Commercial Site #5 - 221 East Broadway, Jefferson City, TN 37760
- Commercial Site #6 - 402 Victor Villa Way, Jefferson City, TN 37760
- Commercial Site #7 - 1171 West Highway 11E, New Market, TN 37820
- Commercial Site #8 - 178 West Park Court, Talbott, TN 37877
- Commercial Site #9 - 5675 Commerce Boulevard, Morristown, TN 37814
- Commercial Site #10 - 2039 Valley Home Road, Morristown, TN 37813
- Commercial Site #11 - 7464 W Andrew Johnson Highway, Talbott, TN 37877

Figure 8: Spatial distribution of commercial market analysis sites
Figure 9: Commercial sites for broadband market analysis

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial Site #1 - 831 Epco Drive, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 1.5Mbps/786Kbps</td>
<td>$30/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #2 - 956 Pine Drive, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 786Kbps</td>
<td>$30/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #3 - 918 R.H. Ellis Road, White Pine, TN 37890</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 75Mbps/8Mbps</td>
<td>$160/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #4 - 1564 Hollow Springs Way, White Pine, 37890</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T, Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #5 - 221 East Broadway, Jefferson City, TN 37760</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 18Mbps/1.5Mbps</td>
<td>$95/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #6 - 402 Victor Villa Way, Jefferson City, TN 37760</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 75Mbps/3Mbps</td>
<td>$160/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #7 - 1171 West Highway 11E, New Market, TN 37820</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 24Mbps/3Mbps</td>
<td>$90/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>T-11.5Mbps/1.5Mbps</td>
<td>$310/month</td>
</tr>
<tr>
<td><strong>Commercial Site #8 - 178 West Park Court, Talbott, TN 37877</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>T-11.5Mbps/1.5Mbps</td>
<td>$210/month</td>
</tr>
<tr>
<td><strong>Commercial Site #9 - 5675 Commerce Boulevard, Morristown, TN 37814</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T, Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>T-11.5Mbps/1.5Mbps</td>
<td>$210/month</td>
</tr>
<tr>
<td><strong>Commercial Site #10 - 2039 Valley Home Road, Morristown, TN 37813</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse up to 75Mbps/8Mbps</td>
<td>$130/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>T-11.5Mbps/1.5Mbps</td>
<td>$210/month</td>
</tr>
<tr>
<td><strong>Commercial Site #11 - 7464 West Andrew Johnson Highway, Talbott, TN 37877</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse DSL up to 18Mbps/1.5Mbps</td>
<td>$80/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>T-11.5Mbps/1.5Mbps</td>
<td>$210/month</td>
</tr>
</tbody>
</table>
2. **AEC Broadband Needs Assessment**

Use of the Internet in recent years has increased the integration of technology and access to instant information into everyday life for both individuals and businesses. As residents and businesses discover more beneficial online applications on their computers and smartphones, with each of those applications requiring an increasing amount of data, many local business and homes are finding that their broadband service needs are not being met. In response, community leaders in the AEC service area are wielding a variety of tools to stimulate broadband development, with the goals of increasing access, adoption, and utilization of broadband.

The Magellan Advisors approach to developing a solid needs assessment in communities of every size is to engage representatives of the community in the process. It is important to identify community assets and understand the specific broadband requirements and future plans of a community’s heavy data consumers, along with the local employing industries and organizations that are critically dependent on broadband.

In this chapter, we will look at the demand side of broadband by exploring Hamblen and Jefferson Counties’ broadband access and availability from the perspective of residents and businesses in the AEC coverage area. We will also look at how businesses and households use broadband today to determine the existing broadband capacity. Where possible, we will include their experiences with service providers, and will assess the current ability of the broadband infrastructure in the area to support the future needs of all community stakeholders.

**Community Engagement**

As part of the needs assessment research process, Magellan and AEC staff visited with community and business leaders in Hamblen County, Jefferson County, and the communities of White Pine, Dandridge, and Jefferson City during the fall and winter of 2015. The goal of each meeting was to better understand each community’s broadband market conditions and learn about the challenges from the people who live and work in the community, and understand how businesses function with the levels of broadband connectivity available to them today.

These community stakeholder meetings provided the opportunity for candid and open discussions with key employers, government and community organizations, business and community leaders, and technology service providers. The meetings allowed each to share how they use the Internet today and how they envision using the Internet and technology in the future. Participation exceeded expectations, and as provided in this report, it is clear that residents and businesses in the AEC service area have needs for better broadband services.

Knowing that it is impossible to speak with every resident and business owner, an online survey of AEC households and businesses within Hamblen and Jefferson County was conducted. In sum, almost 1,800 households and 150 businesses responded to the survey, with a fair geographic distribution of survey responses through the counties and the towns of Dandridge, White Pine,
and Jefferson City. The survey provided a broader understanding of broadband uses and needs of the region, and aggregate results of the survey will be distributed throughout the report.

In fact, the high household response rate lends to a high statistical relevancy of data. For the household survey, the number of survey responses yield a 95% confidence level with a 3% margin of error. This rate exceeds industry research standards of 95% confidence level with a 5% margin of error. While the number of business responses were somewhat lower, the responses yield a statistically relevant 95% confidence level with an 8% margin of error.

The engagement process also allows opportunities to identify local broadband champions and early adopters to keep projects moving ahead with momentum, that over time develops stronger partnerships to insure deeper benefits are realized, such as educational or workforce goals leading to economic impacts. Equally important, the stakeholder engagement process allows the identification of other efforts underway that can be leveraged for greater benefit.

For example, discussions across several county or city departments could share news of a road project or a newly planned subdivision that could provide the opportunity for the installation of conduit or fiber-optic cables at a fraction of the cost while the ground is open for other utilities. Such efforts might connect fiber to homes in the new subdivision sooner or be prepared for industry expansion. The significant benefit is that over time such "dig once" policies could result in the utility or local government having miles of conduit and fiber placed at relatively little cost.
2.1 AEC Households

To understand broadband related issues faced by AEC households, a survey of Jefferson and Hamblen County residents was conducted that included questions about current broadband access and use in the home. Details of the survey results follow in this section, but overall survey data shows that where broadband access is available in the Jefferson and Hamblen Counties, the adoption of the Internet and use of Internet-enabled devices is very strong. This suggests a strong demand for residential broadband services into the future.

Through most of this AEC household section we will gain a better understanding of how AEC households access and use the Internet. Of the 1,778 AEC households that completed the survey, 81.7% report subscribing to Internet services at their home. This means that almost 20% of AEC households do not subscribe to Internet services. So before moving into the characteristics of households that subscribe to broadband, it is interesting and beneficial to understand the important reasons why households do not subscribe to Internet services.

Barriers to AEC household Internet subscribership

A remarkable 97.1% of all AEC households subscribed to or expressed a desire to subscribe to broadband services, while across all surveyed AEC households, 2.9% of households reported they chose to not subscribe to Internet services because they don’t want it or need it.

Figure 10: Responses to the question, "Do you subscribe to Internet service at home?"

Of the 18.3% of surveyed AEC households that do not subscribe to Internet services, we asked them the single-most reason they do not have service at home. The goal of asking the question is to understand whether non-subscribership is the choice of the household, or if it is a reflection of
local broadband market conditions, such as lack of service availability near the home, or if the high cost of service discourages service subscription.

What the survey results show in Figure 11 is that of the non-subscribing AEC households, 15.9% choose not to subscribe because they don’t want or need the Internet at home. Of the remaining 84.1% of non-subscribing households that do want broadband, 40% report they do not subscribe to services because broadband is “not available” at their home, with another 25.3% saying “services are too expensive.”

*Figure 11: Responses to the question, “If you do not have Internet at home, why not?”*

![Bar chart showing reasons for non-subscription](chart11)

While these percentages are very telling of local broadband market conditions, the AEC findings are actually on par, if not slightly better than national averages. In fact, AEC households actually mirror recent U.S. Department of Commerce research that identifies non-subscribing households with “no Internet availability” at 48%, with “too expensive” the reason of 28% of U.S. households.

When AEC households that want broadband are able to list more than one reason why Internet services aren’t subscribed to, cost emerges as a legitimate barrier alongside lack of availability. As seen in Figure 12, almost half (49.1%) of non-subscribing AEC households that want broadband say they can’t subscribe to broadband because “services aren’t available,” while almost as many (41.8%) say “services are too expensive.”

*Figure 12: Reasons for non-subscribership from AEC households that want broadband*

![Bar chart showing reasons for non-subscription](chart12)

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1 *Exploring the Digital Nation: America’s Emerging Online Experience: www.ntia.doc.gov/files/ntia/publications*
Also emerging as a necessary substitute for home Internet access, 8.1% of all AEC households report regularly accessing the Internet outside the home, possibly at work, school, or a public place such as a library or a restaurant. Alternatively, as we’ll see in later sections, smartphones and other mobile devices are also increasing their role in connecting homes without access, and could also be represented in that response as accessing the Internet elsewhere.

As a final look at non-subscribing households, to get an idea of how many non-subscribing households would potentially subscribe to services if given the opportunity, we asked households to rank the importance of the Internet to members of their household on a scale from 1 to 10. We wanted to understand if non-subscribing households actively made the decision to not subscribe to services, or if households actually wanted to subscribe to Internet services but couldn’t realistically purchase services.

As visualized in Figure 13, the responses were essentially a tale of extremes, with 27.2% of AEC household that ranked the importance as a 1 (the lowest ranking) as “not important,” while 35.5% ranked the importance as a 10 (the highest ranking) as “extremely important.” Between those two extremes, 4.2% of households ranked the importance of broadband as 2, 3, or 4, while 13.1% ranked importance as 5, 6, or 7. A total of 55.6% ranked the importance between 8 and 10.

![Figure 13: Non-subscribing AEC households rank the importance of the Internet](image)

Taken together, the survey data from non-subscribing households clearly indicates that while less than 3% of AEC households have no interest or need for broadband services, a majority of AEC households certainly recognize the importance of broadband to their household and would likely adopt services if available at an affordable price.

**AEC Internet households**

Moving on to AEC households that subscribe to Internet services, we’ll first look at the connection method chosen by AEC households, then move into some of the details around cost and service satisfaction. Actually, the notion of Internet provider “choice” is a misnomer. As shown in the residential market analysis table in Figure 7, and as detailed later in this needs assessment, AEC households don’t really have a true choice in their Internet connection method, but instead must subscribe to the connection method that is available in their neighborhood and to their home. As illustrated in Figure 14, an overwhelming number of AEC households (48.1%) subscribe to cable, with DSL the second most method at 17.3%. However, the popularity of the next third- and fourth-ranked connection methods should be particularly disturbing for local officials in the AEC service area.
An alarmingly high percentage of households use satellite (11.8%) and their mobile phone (15.1%) as their primary method of Internet connectivity. Not only is mobile wireless and satellite the most expensive form of consumer data available today, these platforms are severely limited in the types of benefits and online experiences that can be delivered. Each are decent platforms for consuming content, but do little to support productivity, creativity, or interactivity, especially from the mobile wireless platform. For example, a work or school file or job application can’t easily be created or navigated on a phone, nor can any type of video interactivity be performed across a satellite connection.

Also important to understand that today’s mobile wireless and satellite Internet platforms are shared data systems. To discourage subscribers from using more bandwidth and overall data that they absolutely need, these wireless providers typically place limits on the amount of data that can be transmitted each month. These data caps also come with overage penalties that include bandwidth restrictions and inflated per-byte fees. These connection methods must be considered a last resort for any household.

To perfectly illustrate the above point about mobile wireless and satellite not being suitable as a residential desktop or household connection, we asked AEC households if their current Internet service provider fulfills the needs of their household.

26.9% of AEC households rely on satellite (11.8%) or mobile phones (15.1%) as their primary Internet connection – both are the most expensive forms of data available.
Figure 15: Responses to, "Are Internet services meeting your household needs?"

As seen in Figure 15, over half of AEC households (55.9%) report that current Internet services do not meet their households needs. Performing best was cable, but not surprisingly, mobile and satellite Internet providers prove to be the lowest performers in the AEC service area, significantly behind more traditional wireline technologies. Mobile wireless fulfills the Internet needs of only 17.9% of their households, while satellite is only 4% better at 22.3%.

From the group of the 55.9% of AEC households that responded “no” to the question in Figure 15, when asked the different ways that their household Internet service is insufficient, 71.8% claimed the “price is too high for received services,” while 65% said their service is “not fast enough,” with 38.8% saying their Internet service is “unreliable.” When broken out by types of Internet connection in Figure 16, we once again see poor ratings for satellite and mobile wireless, with high cost of cable and slow speeds of DSL standing out.

Figure 16: How AEC households say their Internet access is insufficient, by connection type

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Regarding price, survey data shows that a majority of AEC households (45.5%) pay between $50 and $74 each month for their home Internet services, with 31.9% paying $30 to $49 each month. The percentages across the AEC service area shown in Figure 17 are for any type of stand-alone or “unbundled” Internet service. On the costlier side of the spectrum, 7.9% of AEC households pay over $100 each month, while on the opposite side, 5% of AEC households pay less than $30 each month for Internet service.

Digging deeper into the numbers we compare the residential cost across the four most popular services in the AEC coverage area. Cable is the most common Internet connection in the AEC area (see Figure 14), with the majority of cable subscribers (56.2%) paying between $50 and $74 a month, with 31.9% paying in the $30-49 range. A majority of DSL subscribers (53.1%) fall in the $30-$49 range, while a majority of satellite subscribers (56.1%) pay in the $50-74 range.

Additionally, we once again see data that supports the position that mobile wireless is the most expensive form of Internet service. Of the 7.9% of all AEC households that pay over $100 each month for Internet service, 63.9% of that group is mobile wireless subscribers, yet that group represents only 4.7% of all Internet households in the AEC region (Figure 14).

Figure 17: AEC household monthly cost by Internet connection type

Especially for rural, cash-strapped families and often poor households of east Tennessee, it is important for a community to have affordable broadband options. Not only can fiber broadband improve quality of life and help extend household budgets, it offers more opportunities for productivity, creativity, and interactivity.
Residents appear to be generally satisfied with their Internet provider in terms of customer service and reliability. However, as seen in Figure 18, the single outlier of dissatisfaction shows tremendous need for pricing improvement as residents overwhelmingly feel they are paying more than they should for the services they receive. Dissatisfaction with speed appears to be the next concern, though this rating could be an indicator of the high use of mobile wireless and satellite connections.

Figure 18: Levels of satisfaction with current Internet services among AEC households

<table>
<thead>
<tr>
<th>Not Satisfied</th>
<th>Completely Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Price</td>
<td>38.1% 22.6% 22.8%</td>
</tr>
<tr>
<td>Reliability</td>
<td>11.2% 14.1% 26.5%</td>
</tr>
<tr>
<td>Speed</td>
<td>19.1% 16.5% 23.4%</td>
</tr>
<tr>
<td>Customer Service</td>
<td>15.3% 14.7% 24.8%</td>
</tr>
</tbody>
</table>

While the desire for faster and cheaper is a reflection of human nature, the sentiment was echoed during stakeholder interviews and survey comments around the notion that if someone in the AEC communities wants faster service, they can get the needed speeds, albeit at a steep price. Again, affordable access appears to be a legitimate dividing issue for AEC households.

Demand indicators

In attempt to understand how AEC households utilize the Internet today and identify indicators of Internet demand growth, we asked about the number Internet-enabled devices that members of their household connect to the Internet. Somewhat surprisingly, of the AEC households that subscribe to Internet services, 80.1% connect three or more devices to the Internet. Comparing AEC households with national averages, it turns out that 90% of U.S. households have three or more Internet-connected devices. So while a high percentage of AEC homes have 3 or more connected devices, they are slightly behind the nation average.

However, while just under half (47%) of U.S. households have five or more devices connected, almost 60% of AEC households (59.2%) report connecting five or more devices. As we see in Figure 19, it is equally remarkable that over 11% of AEC households report connecting 10 or more devices – over 3% more than U.S. households (8.7%). These findings suggest that once AEC households get a taste of online devices – once they get the first couple of connected devices and realize the benefits, the desire for more devices increases. All that stands between these households increasing their productivity is affordable, higher speeds of broadband. These findings certainly bode well for future broadband service demand in the counties.

In looking at the average number of Internet-connected devices per household, AEC residents have a healthy appetite for technology and devices that connect to the Internet. In fact, survey respondents claim an average of 5.2 Internet-connected devices per household. Comparing AEC with national averages we see the number of connected devices per U.S. household is also 5.2. So while on par with national averages, demand appears to be strong in the AEC service area, with such numbers understandably expected to climb as more devices and services come to market.

Over 80% of AEC homes connect 3 or more devices to the Internet. Almost 60% of AEC homes connect 5 or more devices, well above the national average of 47%.

The number of connected devices per AEC home is 5.2, on par with the national average of 5.2 connected devices per household.
A recent study\(^3\) demonstrated the amount of time the average user spends with their devices across each type of device. As illustrated in Figure 20, across a 24-hour period users spend significantly more time with their devices, on devices that all require broadband connections. So as the numbers of the devices increase, the need for more bandwidth to support more applications on growing numbers of devices also grows along with it.

*Figure 20: The proliferation of Internet-connected devices*

While the survey did not ask for specific devices inside the home that connect to the Internet, the most current U.S. research\(^4\) finds that devices related to security and safety lead the way, with devices that help manage utilities and energy consumption next, followed by smart appliances, health and wellness monitoring, and entertainment and gaming systems. The research discovered the most popular devices to be connected smoke detectors and thermostats.

These demands extend to many devices inside the home that are connected to the Internet and often are automated and require little or no human interaction. As an example, for the first time ever a majority of U.S. households have TVs that are connected to the Internet, which crossed the 50% threshold in 2015 to land at 53% of U.S. homes with Smart TVs.\(^5\) Many multimedia entertainment systems, thermostats, irrigation systems, food storage and preparation areas, and security and monitoring systems are now connected to the Internet, consuming even more home broadband bandwidth. The explosion of Internet-connected devices in and around the “smart home” will lead to increased use of always-on residential broadband connections.

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\(^3\) The New Multi-Screen World. Understanding Cross-Platform Consumer Behavior”

\(^4\) Delivering on the Promise of Connected Homes: [www.mckinsey.com/spContent/connected_homes](http://www.mckinsey.com/spContent/connected_homes)

Gartner Research says there are 174 million smart homes in 2015, with the number expected to almost double in 2016 to 339 million. Consumer applications fueling the growth of smart homes are smart TVs, smart lighting and various automation tools, such as smart thermostats, home security systems and kitchen appliances. Overall, the total number of connected devices is expected to hit 1.6 billion, up from 1.2 billion in 2016.6

Today, broadband subscribers across every user class are utilizing more online applications, and particularly those that consume larger amounts of high-quality bandwidth. Broadband subscribers make heavy use of the core Internet functions of Internet browsing, web hosting, e-commerce, virtual private network connectivity, and voice services.

Figure 21: Broadband application speed requirements

Enabling smart homes is the ability to wirelessly connect all the various devices around the house quickly and conveniently. Today, this wireless connection is made through Wi-Fi technology, which is often done through the use of a router with wireless functionality. In the AEC service area, 82.8% of surveyed households have a Wi-Fi router installed in the home.

However, subscribers are consuming proportionately more real time video and streaming applications, which require significant bandwidth, reliability, and performance from their broadband connections. We are still early in the evolution of Internet video applications and these are expected to grow significantly over the next 10 years, replacing much of the text-based Internet we are familiar with today. Looking ahead, the limiting factor for consumers to utilize and gain benefit for these and imaginable other advanced applications is unlimited and affordable high-speed, high-capacity broadband. Clearly, the only networking technology suited to deliver this unlimited bandwidth to the household is through fiber-optic connectivity.

6 http://www.gartner.com/newsroom/id/3175418
AEC residential word cloud

The word cloud in Figure 22 is a visual representation of the open-ended comments of the residential survey. Word clouds work in a simple way: the more times a specific word is used, the bigger and bolder it appears in the word cloud. Color here has no meaning, other than to help separate different words.

Word cloud visualizations can be a powerful tool when analyzing large amounts of contextual and qualitative data. In addition to normal research techniques, using a word cloud may help identify potential issues that would otherwise go unnoticed.

Figure 22: Word cloud of AEC residential survey comments
Of the almost 1,800 completed surveys, there were over 270 comment entries containing a total of over 7,650 words. For comparison purposes, the most used word was “internet,” which appeared 171 times.

Looking at the larger words we can tell that Charter is likely the leading residential provider, and we can identify likely pain points and topics that are important to residents in the AEC service area. For example, we see the appearance of words like “terrible,” “expensive,” “access” and “limited” and know that people are likely using those words to describe their experiences with their Internet service. The recurrence of words like “choices,” “stream,” “affordable,” “reliable,” “fiber” and “alternative” we can better understand the likely desires of AEC households and their willingness to accept service offerings from new local providers.

While word clouds like this help us understand and substantiate assumptions of how residents feel about Internet access in AEC, it also helps to paint a fuller picture of the state of broadband in the AEC coverage area when used in conjunction with the more quantitative data the surveying process provides.

**The changing face of work**

As the household section comes to a close and we transition to the businesses section, this is a good opportunity to look at the workforce space between homes and office and examine home-based businesses and teleworking in the AEC service area.

An impressive 17.4% of AEC households that completed the survey reported having a home-based business, and another 26% reported having someone who telecommutes, or occasionally works from home for an outside employer. In total, considering some surveyed households reported both a home-based business and a telecommuter, 28.3% of AEC households use the Internet at home for business needs.

For comparison, the most recent findings from the U.S. Small Business Association says there were 14.56 million home-based businesses in 2013, representing 12.4% of U.S. households, so AEC households are above national average by 5%. Additionally, a 2015 survey from Gallup Analytics found that 37% of U.S. workers have telecommuted within the previous year, which is roughly 10% above the AEC household average.

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Teleworkers in the U.S. work an average of 6.4 days from home each month, with 9% working over 10 days each month from home.

In both groups that work from home, AEC percentages are on par with national averages, and leads one to speculate that if residential broadband was better and more affordable, AEC communities could realize an increase in entrepreneurial and telework percentages.

Telework requirements are quite basic at home; typically, not much more than a desktop computer is needed with coordination from the employer to provision remote access to office resources. The goal being to seamlessly connect the teleworker with office colleagues and clients to provide an experience as close as possible to being in the workplace. Of course, a reliable home broadband connection makes it all possible.

To further that point, 12.3% of AEC households that report having a home-based business also do not subscribe to broadband, so broader availability of broadband could certainly enhance the prospects of entrepreneurship and growth of existing small businesses.
2.2 AEC Service Area Businesses

Businesses in the communities of the AEC service area compete in a state and region heavily entrenched in the tourism, retail, and manufacturing. The towns in Jefferson and Hamblen Counties compete not with beaches, theme parks and outlet malls, but rather successfully promote themselves as a mountains and lakes destination close enough to visit the tourism destinations around the Smoky Mountains, but far enough away from the crowds to also appeal to the outdoor recreation and retirement sector.

The City of Morristown and Hamblen County provides a major industrial base across several sectors that employs many citizens of the Jefferson and Hamblen Counties, as well as counties in the greater region. Likewise, community and business leaders admit that building an economic foundation around manufacturing and distribution is “boring,” but with a capable workforce and a geographic location central to the eastern U.S. along major east-west and north-south Interstate corridors, community leaders believe that steady growth is possible around tourism, manufacturing, and transportation industries.

Just as these communities rely on the Interstate highways and public infrastructure to bring in tourists and ship out manufactured goods, broadband that is accessible, affordable, and reliable is a key economic development tool to attract and retain technology and data-driven businesses in AEC communities. However, in many cases the bandwidth demanded by local businesses today outpaces the service levels that local Internet service providers are able to deliver. Even then, upgrading service levels is often not an option due to the limited budgets that small businesses are able to afford.

To gather a better understanding of broadband related issues faced by businesses in Jefferson and Hamblen County, a business survey was conducted that included questions related to broadband access and its use in the operation of AEC service area businesses. Details of the survey results follow in this section, but in summary, the overall survey data shows that where broadband access is available, the adoption of the Internet and use of Internet-enabled applications and devices is very strong. In fact, of the 146 businesses that completed either the printed or online version of the survey, 87.7% subscribe to Internet services at their business.

*Figure 23: Responses to the question, “Does your business have Internet service?”*
From a business recruitment standpoint, broadband can be a true competitive differentiator for AEC communities. Through promotion of the community’s leading-edge broadband services, prospective businesses can be assured that they can locate in the AEC region and have robust access to the rest of the digital world. Community leaders recognize the fact that available and affordable high-speed broadband has also gone beyond being a differentiator to being a key part of the “minimum ante” for attracting and retaining desirable businesses and facilities.

When broadband services cannot keep up with business needs, businesses lose productivity and efficiency, which together affects their bottom line and makes them less competitive as compared with regions that have more widely deployed and affordable broadband services. This eventually results in a less competitive business market, leading to industry retention issues as businesses that are not able to gain efficiencies with their existing broadband services will, in many cases, move to communities that have availability of these services.

**Supporting Small Businesses**

There is privately owned fiber infrastructure throughout east Tennessee; however, the direct retail use of this infrastructure by businesses and community organizations is limited. Most networks are operated by Tier 1 service providers and limit their connections and services to either lower tiered service providers or to very large businesses that need and can afford direct physical connections through these providers.

While there are a number of Tier 1 providers in and around the AEC service area, there is a gap in the number of retail providers that can either serve the area’s retail market or has the resources and desire to improve the local infrastructure from copper to fiber. Fiber infrastructure is not typically installed by any retail provider in advance of revenue opportunities, and therefore puts the AEC cities and counties at risk when executing their economic development efforts, specifically in downtown areas, business centers and industrial parks, as well as residential areas.

Without this necessary infrastructure, AEC communities will continue to experience issues when recruiting and retaining people and bandwidth intensive industries to the area. In many cases, businesses looking to potentially locate in the AEC communities would be required to spend significant amounts of money, often in the tens of thousands of dollars to build out the provider’s network infrastructure to then receive costly service.

Placing the Lakeway Region’s economic future in the hands of Internet service providers that are headquartered far away from east Tennessee and no real involvement in the community can have a detrimental effect on local economic development efforts. The primary corporate goal of these telecommunications giants is to increase shareholder value by focusing on high margin areas of the country. With the size and demographic makeup of AEC communities, one can guarantee that small communities in rural east Tennessee are not a priority for telecom corporations headquartered in places like Philadelphia and Dallas.
Jefferson and Hamblen County Business Profile

As part of the research performed for this broadband assessment, a survey of AEC area businesses was conducted to understand the business community’s broadband uses and needs. The responses were a representative sample of businesses in the AEC service area with 146 businesses responding to the online survey. The data provides a snapshot of how broadband is shaping the way small businesses operate in the multi-county AEC service area.

The business market in the AEC service area is predominately made up of small- and medium-sized businesses. A majority of survey respondents were small businesses (66.4%) with 10 or fewer employees, while just under 10% (8.9%) were businesses with over 100 employees. These businesses, regardless of size, report the need for an advanced broadband infrastructure, yet are hampered by the legacy connections currently offered by providers that serve AEC communities.

As seen in Figure 24, the overwhelming majority of Hamblen and Jefferson County businesses in the AEC service area (52.9%) subscribe to Internet services via cable, with DSL accounting for less than half of cable at 21.5%. Approximately 10% of AEC businesses connect to the Internet via fiber, which mostly serves larger employers or business that are part of larger corporations that have a local facility requiring connectivity between a number of sites around the country. Making up the remaining 15% of AEC businesses include wireless types of connectivity, including mobile and fixed wireless and satellite, along with dial-up. These types of connectivity are perhaps a reflection of the geographic terrain and rural nature of the AEC service area where more traditional broadband providers have limited physical infrastructure.

Figure 24: How AEC service area businesses connect to the Internet

What is interesting is the comparison of broadband services subscribed to by small businesses and large businesses in AEC communities. In Figure 25, survey responses from businesses that employ less than 20 people are represented by the chart on the left, while the chart on the right represents business with over 50 employees. Note that only 2.3% of surveyed small businesses subscribe to fiber, while fiber is the choice of 38.9% of larger employers in the AEC service area.
Bandwidth requirements are obviously driven by the fact that larger employers have more computers and equipment, and thus have an advanced need for information and communications connectivity that fiber providers. Whether out of necessity or lack of choice or both, cable and DSL remain the practical options for most small- and mid-sized businesses. However, this speaks to the issue of the general lack of availability of fiber connectivity from commercial service providers in east Tennessee, and if fiber is able to be provided to a business customer, the price is often unrealistic for a small business. This speaks directly to the fact that fiber-based broadband connections simply aren’t universally available or affordable for smaller businesses in the AEC region.

Additionally, an observation from Figure 25 that speaks to the reliability and quality of wired broadband is that no business in the AEC service region with over 50 employees relies on wireless forms of network connectivity. The data clearly shows us that larger businesses in the AEC region depend exclusively on wired network technology. Fiber Internet access is now recognized as a fundamental infrastructure that all businesses require. In fact, the data from this survey shows that to support large employers, fiber is the best possible solution. The lack of fiber infrastructure can be a major competitive obstacle to attracting businesses and winning site selection deals. Therefore, it is critical that community leaders are able to promote the access, availability and

38.9% of AEC businesses with over 50 employees have fiber connections, while only 2.3% of AEC businesses under 20 employees have fiber connections.
affordability of broadband in business and industry recruitment efforts just as it promotes the access to transportation corridors and the availability and affordability of traditional water and electric utilities.

Many of the small businesses surveyed that are settling with the connectivity they have available to them could be stifling their business efficiency, growth and innovation opportunities. With fiber, a community can incubate home-grown businesses, grow small businesses into large employers, and be a magnet for relocating both expanding employers and entrepreneurs.

To gauge the perception of the importance of broadband connectivity from AEC businesses, the question was asked if broadband is considered a utility. As seen in Figure 26, businesses overwhelmingly (85%) consider broadband to be the “fourth utility,” on par with electricity, water and sewer, as something that should be universally available and affordable.

*Figure 26: Responses to the survey question, “Do you consider broadband to be a utility?”*

As seen with the above findings, broadband is considered a fundamental infrastructure that businesses require to maintain connectedness to the world, their customers and employees. Having access to reliable broadband and subscribing to services is one thing, but to realize benefits from broadband, meaningful utilization must first occur. As such, accessible, affordable and reliable broadband is a key economic development tool to attract, sustain and grow businesses in the AEC communities.

Through this needs assessment process, we’ve learned that the majority of the area’s businesses rely on online services to maintain their daily operations and it is critical that the AEC and their partner communities expand and promote the availability of affordable and reliable broadband services, especially to support business and industry recruitment efforts.

In thinking of Internet services that are capable of supporting local business, Figure 27 shows that only 50% of all responding businesses reported that current Internet services are fulfilling their business needs. On the other hand, 50% of businesses that believe their current provider is
either insufficient (36.9%) or they are not sure (13.1%) that their current Internet service is meeting their business needs.

Because of the wide array of connection types subscribed to by AEC businesses and the popularity of wireless forms of Internet connectivity by businesses, it is useful to understand how the different types of Internet connections have a role in meeting the needs of AEC businesses.

Figure 27: Responses to, “Is your Internet provider meeting your business needs?”

As we’ve seen elsewhere in the AEC service area, Figure 27 shows that wireless forms of connectivity represent the lowest ratings, with mobile wireless and satellite scoring almost identically low ratings. Cable rated above average, while almost as many DSL customers are unsure that their business needs are being met as those who are sure. Fiber clearly represents the gold standard in business connectivity with the highest rating of meeting business needs.

When we asked the 36.9% of businesses that said their Internet provider is not fulfilling all their business needs, the overwhelming top response at 78.7% was that their “service is not fast enough,” with 54.1% saying the “price is too high for the level of service received,” while 50.8% said the service was “unreliable.”

While on the topic of Internet reliability, 55.8% of AEC businesses reported moderate, severe, or total disruption of their business Internet service each month, meaning their Internet service is completely out of service at least a day or more every month. Survey comments painted a picture of what the unreliable connectivity means to their business in terms of lost revenue or lost opportunity. While over half of businesses report longer periods of service disruption, almost 40% of businesses report minimal disruptions of less than an hour per month, and only 5.7% report no disruptions at all.

“Every storm and rainy day takes our Internet out and prevents us from offering our programs to schools and other customers.”

– Jefferson City business comment
Businesses were asked their levels of satisfaction with their current Internet service provider. Figure 28 shows that most businesses are generally satisfied with their services, but important patterns emerge. First, echoing earlier findings, price and speed stand out as areas of concern as businesses report higher levels of dissatisfaction, with very few responses in the “completely satisfied” side of each category. In fact, no businesses reported being completely satisfied with the price of their Internet service.

**Figure 28: Satisfaction with current Internet services among AEC community businesses**

<table>
<thead>
<tr>
<th>Service</th>
<th>Not Satisfied</th>
<th>Partially Satisfied</th>
<th>Somewhat Satisfied</th>
<th>Neutral</th>
<th>Partially Dissatisfied</th>
<th>Completely Dissatisfied</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>27.0%</td>
<td>9.8%</td>
<td>37.7%</td>
<td>18.0%</td>
<td>7.4%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Reliability</td>
<td>12.3%</td>
<td>14.8%</td>
<td>27.0%</td>
<td>27.9%</td>
<td>15.6%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>23.8%</td>
<td>10.7%</td>
<td>26.2%</td>
<td>23.8%</td>
<td>14.8%</td>
<td>0.8%</td>
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<tr>
<td>Customer Service</td>
<td>21.3%</td>
<td>14.8%</td>
<td>27.0%</td>
<td>21.3%</td>
<td>12.3%</td>
<td>3.3%</td>
<td></td>
</tr>
</tbody>
</table>

Service reliability shows the healthiest trend among the four categories. What one looks for in a healthy trend line is a bell-shaped curve, and ideally a bell shape with a higher right side than left side, which would indicate relatively higher levels of satisfaction. Of the four categories measured, reliability has the most ideal trend line, yet far fewer responses on the satisfied side of the spectrum mirror the pattern in all other categories, which gives cause for concern, particularly with price and speed.

Most alarming is the fact that of the 148 responses to this question, and out of the 592 individual opportunities to respond “completely satisfied” to one of the categories in this question, only 8 times was “completely satisfied” selected across any of the four aspects of Internet satisfaction. In fact, 7 of the 8 responses of “completely satisfied” came from fiber and cable reliability and speed, with the one outlier being a vote for mobile wireless customer service.

When asked why their business hasn’t upgraded Internet services to greater speeds and service levels, 72.1% said that “better services are not available in my area.” The second and third most responses were that “the price is too high” (18%), and that “no other providers are in my area” (14.8%) for faster service. The three responses speak directly to the heart of the broadband issue for businesses in the AEC service area – lack of availability, affordability, and choice.

**Only 8 times in 592 opportunities did AEC businesses respond with "completely satisfied" to any survey question about Internet access.**
In considering the cost of Internet services for businesses in the AEC coverage area, in Figure 29 we see that 42.9% of businesses pay between $50 and $99, with the second most common price range at $100 to $149 per month, which is paid by just over 20% of AEC businesses. Of course, these cost percentages mean little on the surface because some businesses subscribe to relatively inexpensive DSL, while others subscribe to relatively expensive fiber.

Figure 29: AEC business monthly Internet cost, by connection type

Digging deeper into the numbers we see a breakdown of average cost to businesses across the various service offerings in the AEC coverage area. Cable is the most common Internet connection for businesses in the AEC area (see Figure 23), with the majority of cable subscribers (45.3%) paying between $50 and $99 a month, with 20.3% paying in the $100-149 range. A majority of DSL subscribers (50%) fall in the $50-$99 range, while a majority of satellite Internet subscribers (80%) pay in the $50-99 range.

Fiber is the most expensive form of Internet service, with 75% of fiber subscribers paying over $300 per month. Obviously, more devices and more applications, such as multiple phones and video streams can be support by fiber, so the cost per device is lower. All told, 48.7% of AEC businesses pay under $100 per month, while 18.5% of business pay over $300 per month.

Striving to learn more about the needs of AEC businesses, during interviews with several businesses we began to understand that bandwidth consumption is outpacing the available bandwidth services that businesses are able to purchase from Internet service providers. As we learned in meeting with Jefferson County businesses, when broadband services cannot keep up with business needs, businesses lose productivity and efficiency, which together affects their bottom line and makes them less competitive as compared with regions that have more widely deployed and affordable broadband services.
Regardless of business size, it is becoming more evident that businesses need a fiber-based broadband infrastructure, yet are hampered by the legacy wireless and copper connections currently offered by commercial service providers in the AEC service area.

In many cases, Jefferson and Hamblen County businesses assert they are currently subscribing to services from the only provider that can serve their location. In AEC communities, that provider is often either Charter, Comcast, or AT&T, though rarely do businesses actually have a choice in providers – typically it is either Comcast or Charter that serves select areas with cable access, or AT&T that provides select areas with DSL.

The lack of service provider competition limits the improvement of services throughout the AEC service area. Due to the physical limitations of copper-based network infrastructure, better services simply are not possible without infrastructure upgrades. From the corporate service provider perspective, it continues to profit by selling costly services across an infrastructure that was installed and paid for decades ago. Where there is no competition, there is no incentive to improve that infrastructure.

Service providers are willing to build a dedicated upgraded network directly to an individual business that requests the advanced services, but the cost is clearly prohibitive to all but the largest businesses and employers.

“Our survival and expansion depends on getting a more reliable provider with faster connectivity.”
– Hamblen County business comment

Jefferson County promote the availability and affordability of broadband services in industrial recruitment efforts as it executes its economic and workforce development strategies.

In terms of attracting new business, a key focus of Jefferson and Hamblen County economic development organizations is to target businesses in recreational tourism, manufacturing, and

For AEC businesses, there is very little competition in Internet providers. In fact, nowhere in the AEC service area did research identify an address where Comcast, Charter and AT&T compete for the same customers.
transportation sectors. Logistics and warehousing are time-sensitive and data-driven while dependent on automated technology.

As discussed in the household section, the same holds true for businesses in that broadband has evolved to carry more and more data because of the advancements in networked applications and the rapid growth in the number of online devices. Every application requires a certain amount of bandwidth on a broadband connection to function properly. As time has progressed, we have witnessed significantly more devices, each with hundreds of possible applications, and significantly more bandwidth being used by those applications. Figure 30 illustrates the bandwidth requirements of common applications and the impact of multiple applications running across a broadband connection.

*Figure 30: Growth in application bandwidth demand*

In addition to current business needs, an innumerable offering of cloud services and online-only applications further drive the need for more broadband as real-time and cloud-based applications require additional bandwidth, both in download speed and upload speed. These applications often synchronize in real time, meaning that they are always consuming bandwidth at a constant rate rather than only when the user is actively engaging the application. As more of these applications are deployed and gain popularity, broadband connections will need to accommodate the increased bandwidth load.

Having access to broadband and subscribing to services is one thing, but to realize benefits from broadband, meaningful utilization must occur. The AEC business numbers are similar with national trends that are topped by buying and selling online, followed by communication (email, voice), marketing (social media), and online research. In fact, AEC businesses clearly recognize the importance of the Internet for their business, with 77.3% of businesses reporting that the Internet is “critically important” (the highest option) for their business operations and success.
### 2.3 AEC Service Area Community Institutions

#### 2.3.1 Jefferson and Hamblen County Education

The Jefferson County School District has 13 schools and a total of 16 facilities. The high school is by far the largest facility, which is also among the largest high schools in Tennessee by student population. Clearly the pressing concern on the minds of school leaders is related to the State of Tennessee Department of Education mandates for online curriculum and testing that are due to begin during calendar year 2017-2018.

Beyond curriculum and testing, the entire educational field appears to be ever-changing and is trending to be more technology-based. Textbooks will soon be online and only online, along with homework and study guides and an increasing array of student learning resources that utilize more online content to support lesson plans. Lesson plans and teaching materials are coming from streaming sources across the web, such as YouTube, Vimeo, or TeacherTube.

In a rural county like Jefferson County, the lack of availability and affordability of residential broadband is a legitimate and critical concern in meeting those mandates, and school leaders recognize the fact that some areas of the county will not be able to support those mandates, especially once the child is outside the classroom.

*Figure 31: Jefferson County School District facilities and connectivity*

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Street Address</th>
<th>City</th>
<th>Staff</th>
<th>Rooms</th>
<th>Bldgs</th>
<th>Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dandridge Elementary</td>
<td>780 South Hwy 92</td>
<td>Dandridge</td>
<td>70</td>
<td>48</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson County High</td>
<td>115 West Dumplin Valley Rd</td>
<td>Dandridge</td>
<td>158</td>
<td>114</td>
<td>7</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson Elementary</td>
<td>321 West Broadway Blvd</td>
<td>Jefferson City</td>
<td>80</td>
<td>53</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson Middle</td>
<td>361 West Broadway Blvd</td>
<td>Jefferson City</td>
<td>70</td>
<td>35</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Maury Middle</td>
<td>965 Maury Circle</td>
<td>Dandridge</td>
<td>65</td>
<td>29</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Mount Horeb Elementary</td>
<td>500 East Dumplin Valley Rd</td>
<td>Jefferson City</td>
<td>80</td>
<td>33</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Patriot Academy</td>
<td>419 West Dumplin Valley Rd</td>
<td>Jefferson City</td>
<td>60</td>
<td>37</td>
<td>1</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>New Market Elementary</td>
<td>1559 West Old AJ Highway</td>
<td>New Market</td>
<td>50</td>
<td>25</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Piedmont Elementary</td>
<td>1100 West Dumplin Valley Rd</td>
<td>Jefferson City</td>
<td>61</td>
<td>25</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Rush Strong Elementary</td>
<td>3081 West Old AJ Highway</td>
<td>Strawberry Plains</td>
<td>78</td>
<td>38</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Talbott Elementary</td>
<td>484 Talbott Kansas Rd</td>
<td>Talbott</td>
<td>41</td>
<td>20</td>
<td>1</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>White Pine School</td>
<td>3060 Roy Messer Highway</td>
<td>White Pine</td>
<td>96</td>
<td>50</td>
<td>4</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson Ace Academy</td>
<td>341 West Broadway Blvd</td>
<td>Jefferson City</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Technology Center</td>
<td>205 West Dumplin Valley Rd</td>
<td>Jefferson City</td>
<td>41</td>
<td>--</td>
<td>5</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Central Office</td>
<td>1030 TN Hwy 92</td>
<td>Dandridge</td>
<td>13</td>
<td>--</td>
<td>1</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>1107 County Lane</td>
<td>Dandridge</td>
<td>4</td>
<td>--</td>
<td>1</td>
<td>100 Mbps</td>
</tr>
</tbody>
</table>

Jefferson County High School is egress for district - 300 Mbps burstable to 500 Mbps

The high school is currently taking the first round of testing online, which requires students to be utilizing technology more all the time. Speaking to that fact, a school administrator who attended a meeting lives in Morristown and said “people living in Morristown have the ability to do things in Morristown in the MUS FiberNet service area that just isn’t possible in Jefferson County.”
In talking with school leaders, "the sky is the limit" for envisioning of future needs, as leaders say, the school district can use as much help as it can get regarding technology and student resources. College and career training is the goal of getting students through school, but educators are saddened that personalized training is outside of reach, with limited resources at the school district and school level, as well as in most county households.

To provide an idea of what bandwidth is needed in the typical classroom, Figure 32 illustrates the bandwidth requirements per student for common educational applications and the quality and performance requirements of these applications.

Basic educational tools, such as web browsing and video streaming consume up to about 1 Mbps per student. However, moving up to more advanced educational technologies such as streamed classroom lectures and 2-way video teleconferences, significantly more bandwidth is used per student, between 4 Mbps and 7 Mbps when combined with the basic educational tools. In addition, these advanced tools require not only more bandwidth but also strict broadband quality metrics that allow them to function properly, such as low latency and higher upload speeds.

**Figure 32: Bandwidth download demands for concurrent applications**

The FCC E-Rate Program

E-Rate is the commonly used name for the Schools and Libraries Program of the Universal Service Fund, which is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission (FCC). The program provides federally-subsidized discounts to help schools and libraries obtain affordable telecommunications and Internet access.
The E-Rate program is one of four federal programs funded through the Universal Service Fund fees that are charged to telecommunications companies that provide interstate and/or international services. This fee is passed on to consumers on their telecommunications bills. Since all households that subscribe to video and/or telephone services are required to pay into the Universal Service Fund, it is important that communities maximize their participation in the E-Rate program to help recoup the investment made by their residents that pay into the fund.

Both Hamblen and Jefferson County school districts utilize the E-Rate program to procure telecommunications services to connect its schools and facilities, as well for Internet services. The E-Rate subsidy for both school districts is system-wide at 80%. This means that 80% of each school district’s total telecommunications and Internet access costs are funded by the federal government. The school district must pay the remaining 20% through its own internal cost allocation. The Education Networks of America (ENA) maintains the E-Rate contract for the both Hamblen and Jefferson County school districts.9

These contracts provide telecommunications and network connectivity to all Jefferson County schools and administrative facilities, as well as the Jefferson City Library. The current contract for these services is for the existing school year and has the ability to extend the contract for two additional one-year terms, at which time they can decide to terminate the contract after 2016-2017 school year.

Figure 33: E-Rate discount for Hamblen County School District, 2013-15

<table>
<thead>
<tr>
<th>Year</th>
<th>Form 471</th>
<th>Service Provider</th>
<th>Service</th>
<th>Funded</th>
<th>Discount</th>
<th>Contract Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1022579</td>
<td>ENA Services</td>
<td>IA</td>
<td>$539,040</td>
<td>80%</td>
<td>30Jun16</td>
</tr>
<tr>
<td>2014</td>
<td>941078</td>
<td>BellSouth Telecommunications</td>
<td>T</td>
<td>$74,957</td>
<td>82%</td>
<td>30Jun15</td>
</tr>
<tr>
<td>2014</td>
<td>948825</td>
<td>SCHOOLinSITES</td>
<td>IA</td>
<td>$17,589</td>
<td>82%</td>
<td>30Jun19</td>
</tr>
<tr>
<td>2014</td>
<td>949495</td>
<td>CenturyLink Qwest Communications</td>
<td>T</td>
<td>$3,178</td>
<td>82%</td>
<td>30Jun16</td>
</tr>
<tr>
<td>2014</td>
<td>949600</td>
<td>ENA Services</td>
<td>T</td>
<td>$25,584</td>
<td>82%</td>
<td>30Jun16</td>
</tr>
<tr>
<td>2014</td>
<td>949617</td>
<td>Education Networks of America</td>
<td>IA</td>
<td>$0.00</td>
<td>82%</td>
<td>30Jun16</td>
</tr>
<tr>
<td>2014</td>
<td>953366</td>
<td>Verizon Wireless (Cellco Partnership)</td>
<td>T</td>
<td>$42,148</td>
<td>82%</td>
<td>30Jun17</td>
</tr>
<tr>
<td>2014</td>
<td>971783</td>
<td>ENA Services</td>
<td>IA</td>
<td>$472,949</td>
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<tr>
<td>2013</td>
<td>889691</td>
<td>ENA Services</td>
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<td>$502,349</td>
<td>81%</td>
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<tr>
<td>2013</td>
<td>895486</td>
<td>ENA Services</td>
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<td>$25,272</td>
<td>81%</td>
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<tr>
<td>2013</td>
<td>895923</td>
<td>CenturyLink Qwest Communications</td>
<td>T</td>
<td>$3,084</td>
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<tr>
<td>2013</td>
<td>895930</td>
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<td>IA</td>
<td>$17,374</td>
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<tr>
<td>2013</td>
<td>898447</td>
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<td>T</td>
<td>$54,669</td>
<td>81%</td>
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<tr>
<td>2013</td>
<td>898720</td>
<td>BellSouth Telecommunications</td>
<td>T</td>
<td>$74,043</td>
<td>81%</td>
<td>30Jun14</td>
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</table>

The school district has one device for two students and maintains device connectivity at all schools. Clearly, the E-Rate program offers a significant amount of money, and it would benefit

the success of any broadband initiative in Jefferson County to serve the USAC Schools and Libraries Program. This funding could help support the infrastructure to the schools and libraries in the county, to both keep money in the local economy and grow the network to benefit the larger community.

In Morristown, FiberNet connects the Hamblen County schools inside the FiberNet network without any data required to be routed across the Internet, so all data and network traffic remains local. FiberNet uses VPLS (Virtual Private Local Area Networking) technology with a virtually unlimited synchronous speed. Such technology has enabled remote teaching by highly skilled teachers, which previously required busing of students, just as it allows for countless connections and applications between Hamblen County schools. These same benefits would extend to Jefferson County and Hamblen County schools located in the AEC service area.

Figure 34: E-Rate discount for Jefferson County School District, 2013-15

<table>
<thead>
<tr>
<th>Year</th>
<th>Form 471</th>
<th>Service Provider</th>
<th>Service</th>
<th>Funded</th>
<th>Discount</th>
<th>Contract Ends</th>
</tr>
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<td>CenturyLink Qwest Communications</td>
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</tr>
<tr>
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<td>ENA Services</td>
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</tr>
<tr>
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<td>30Jun16</td>
</tr>
<tr>
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<td>IA</td>
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<td>79%</td>
<td>30Jun15</td>
</tr>
<tr>
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</tr>
<tr>
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<td>IA</td>
<td>$18,703</td>
<td>80%</td>
<td>30Jun14</td>
</tr>
</tbody>
</table>

**Carson-Newman University**

Located in downtown Jefferson City, Carson-Newman is a Baptist liberal arts institution with a growing enrollment and increasing academic programs. The enrollment, at 2,528 this academic year, is the largest in the school’s 164-year history. In making the transition from Carson-Newman College to Carson-Newman University in 2012, 90 different academic majors are now offered in conferring bachelor, master and doctorate degrees. The most popular majors among the 1,750 undergraduates are Nursing, Education, Business, Pre-Medicine, and Psychology.

From a network perspective, the campus maintains excellent connectivity with fiber connecting all buildings, boasting 99% buried fiber between buildings. Internet connectivity is provided with a MetroE 500/500 Mbps circuit from Charter, with PRIs for voice over fiber. The network
supports 600 employees and 750 computers with Wi-Fi available all over campus with 1,400 mesh access points, with NAC supporting campus BYOD policies. Security and network access concerns were mostly related to the possibility of city Wi-Fi crossing over into the campus Wi-Fi, which opens the door for deviant activity as student online behavior can't be authenticated and monitored by the campus.

From the student perspective, Advance 360 is the Blackboard alternative that is used by the university, which is accessible through any network device. Internet, phone and cable television are available in all student housing, and students are allowed to connect any device to the network.

A previous survey indicated that students averaged about 3 Internet-enabled devices, but a survey in 2015 shows that for the 75% of undergraduate students who live on campus, that average is now over 7 devices per student. With increased gaming and different connected entertainment devices in use, outbound data peaks around 30 Mbps. Paired with the fact that cloud-based Office 365 is on the horizon for campus use, campus administrators are concerned with a diverse network route and obtaining a backup circuit.

**Walters State Community College**

While the main campus of Walters State Community College (WSCC) is in Morristown and outside the AEC service area, WSCC is a regional community college that draws over 6,000 commuter students from all the AEC communities and neighboring counties. WSCC operates satellite campuses throughout east Tennessee, with 10 counties directly involved with WSCC. The college also maintains a conference and exposition center in White Pine just off Interstate 81, which is served by AEC.

The college appears to have excellent connectivity between its flagship and satellite campuses with 100 Mbps connections across the WAN. The expo center in White Pine is served by MUS FiberNet with campuses in Greene and Claiborne Counties served by CenturyLink. Backhaul from Morristown is across two 200 Mbps connections from AT&T through ENA with MUS FiberNet providing a redundant path, with MPLS from various vendors. On-campus messaging and alerts via text, with on-campus Wi-Fi separated by guest and staff SSID.
2.3.2 AEC Service Area Healthcare

Broadband is expected to transform healthcare, simultaneously enabling better outcomes and lowering costs, both on the internal operations of the healthcare practice, and on the patient care side through telehealth. The National Broadband Plan says that Electronic Health Records and Remote Monitoring technology could alone save over $700B over 15-25 years.\(^\text{10}\) Beyond the cost aspects, using telehealth is a viable way to revolutionize patient care. The American Medical Association (AMA) believes that the appropriate use of telehealth applications to deliver care to patients could greatly improve access and quality of care while maintaining patient safety. In 2014, the American Medical Association created guiding principles for ensuring the appropriate coverage of telehealth services that state:\(^\text{11}\)

- Telehealth provided over robust broadband networks can facilitate immediate diagnoses and care to prevent lasting damage to stroke victims, prevent premature births, and deliver psychiatric treatment for patients in underserved rural areas.
- Telehealth is viewed as a cost-effective alternative to the more traditional face-to-face consultations or examinations between provider and patient.
- Similar to regular small businesses, rural clinics and small physician offices have the same price sensitivity to broadband, which is often priced beyond their means or altogether insufficient to support their health IT needs.

For patients, remote access to healthcare providers offers major advantages over traditional methods of delivery. Obviously, broadband connectivity to the patient's home is the fundamental enabler of all telehealth benefits. At the top of this list is making certain types of care more accessible for those who struggle to get to distant medical facilities, which are precisely the demographic that commercial service providers neglect – the elderly and the poor.

For example, Tennova Healthcare in Jefferson City reports how it is beginning to incorporate devices like breathing machines and other health monitoring equipment into the network, with video used to connect patients with medical staff over the Internet, but poor broadband access in the areas served by Jefferson Memorial Hospital limits full deployment of possible telehealth services.

Both Lakeway Regional Medical Center in Morristown and Jefferson Memorial anticipates area benefits of telehealth as residential Internet delivery improves, and is now moving in that direction through patient-centered healthcare service options such as:

- Patient-provider communications
- Patient self-management
- Health provider feedback
- Improve health literacy
- Lifestyle behavior modification
- Medication management
- Patient travel reduction
- Provider-provider consultations

\(^{10}\) http://www.broadband.gov/issues/healthcare.html
While not a substitute for in-person visits, telehealth can provide face-to-face care and improve a patient’s understanding of his or her own health. Broadband is crucial for healthcare providers as they begin to leverage electronic medical records and other important capabilities of telehealth and the electronic exchange of health care information.

Jefferson Memorial Hospital and Lakeway Regional Medical Center

The effort to streamline hospital operations is accelerating throughout the statewide Tennova Healthcare. Local hospital administrators acknowledge the rationale as marketplace pressures under value-driven business models challenge healthcare organizations to a much greater extent than in the past. New competencies are required, including close integration with physicians, balanced service distribution, and higher levels of information technology sophistication. Central to driving efficiencies is the integration of broadband and technology into internal operations, as well as offer the delivery of new services across local broadband platforms.

Both Lakeway Regional Medical Center in Morristown and Jefferson Memorial Hospital are part of the statewide Tennova Healthcare system, which includes 16 other hospitals for a total of 2,600 beds, 2,400 doctors and over 9,600 employees. For its part, Jefferson Memorial is a full-service hospital with 50 patient beds, with 25-30 usually filled. As part of a statewide system, Internet connectivity is a corporate arrangement, and often AT&T gets the call for statewide connectivity contracts.

As such, Jefferson Memorial has fiber connectivity via a 150 Mbps dedicated circuit to the data center in Knoxville. A SONET ring connects Lakeway Regional and other regional Tennova locations back to the data center via diverse routes on a 1 Gbps local backbone, with services provisioned by Cisco ASR4000 integrated service routers. Wi-Fi is provided for visitors and visiting physicians, which runs across the same fiber network but is provisioned for separation.

When asked of future broadband needs, local Tennova administrators admit that “our 150 Mbps seems sufficient, but the way applications are growing, we never know.” Thinking about current data consumption, the computerized physician order entry (CPOE) alone consumes an average of 90-110MB per day. Added to that the picture archiving and communication (PAC) system of another average 40-50MB per day, and the bulk of bandwidth is accounted for. In addition to having enough bandwidth to support operations, network route diversity and redundancy is an issue. Some of the phones are VoIP, so if fiber is down, voice is down too. Equipment is in place in Jefferson City that would be capable of handling a diverse route should the opportunity arise.
Looking ahead to broadband drivers, administrators believe Telehealth will ramp up in 2016, with Jefferson Memorial and other Tennova medical centers connected to a hospital in Atlanta to develop applications. The Healthcare Information and Management Systems Society (HIMSS) recently published a study of the telemedicine industry and the use of the technology by healthcare organizations. The research found that 57.7% of healthcare organizations in the U.S. have adopted some form of Telehealth, and that most of those organizations use more than one type of technology. The market for Telehealth services has doubled since 2011, with the number of Telehealth vendors having grown from 45 that year to 85 in 2015.

The most popular Telehealth programs follow a “hub and spoke” model, such as video chats between healthcare providers and patients at originating sites. Nearly 60% of organizations use that model, with patient portals the second-most popular technology used at 49.7% of facilities.

Tennova maintains access to broadband services but the healthcare providers that have access to services is relatively unknown. Doctor offices, outpatient clinics, and imaging centers all have growing broadband needs as their organizations transition to the digital healthcare environment. For each of these smaller healthcare organizations, high-speed broadband becomes a critical infrastructure need to efficiently fulfill their mission and sustain operations. Bandwidth needs of healthcare providers in Jefferson and Hamblen Counties are guaranteed to continue growing, and additional connected devices are being incorporated all the time.

The FCC’s Connect2Health program considers ways to accelerate the adoption of healthcare technologies and the FCC envisions that future healthcare systems will use broadband-based tools to allow clinicians, pharmacies, and health and social service providers to collaboratively optimize health outcomes – all in an interconnected healthcare ecosystem. As a guide, the FCC has released recommended broadband speeds for healthcare organizations. These speeds identified by Healthcare Connect should be considered minimum requirements and any healthcare organization should have access to more bandwidth if needed.

**Single Physician Practice – 4 megabits per second (Mbps)**

- Supports practice management functions, email, and web browsing
- Allows simultaneous use of electronic health records (EHR) and video consultations
- Enables non real-time image downloads
- Enables remote monitoring

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12 [http://www.bna.com/telemedicine-market-nearly-n57982063688](http://www.bna.com/telemedicine-market-nearly-n57982063688)
Small Physician Practice (2-4 physicians) - 10 Mbps
- Supports practice management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring, and use of HD video consultations

Nursing home - 10 Mbps
- Supports facility management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring, and use of HD video consultations

Rural Health Clinic (approximately 5 physicians) - 10 Mbps
- Supports clinic management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring, and use of HD video consultations

Clinic/Large Physician Practice (5-25 physicians) - 25 Mbps
- Supports clinic management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables remote monitoring, and use of HD video consultations

Hospital - 100 Mbps
- Supports hospital management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables remote monitoring, and use of HD video consultations

Academic/Large Medical Center - 1,000 Mbps
- Supports hospital management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables remote monitoring, and use of HD video consultations
2.3.3 Government and Public Services in the AEC service area

Fiber-optic networks provide a public infrastructure that can be used for an assortment of public benefits, including enhanced municipal utility management and service offerings, as well as new e-government applications that encourage interdepartmental collaboration and efficiencies through infrastructure sharing. In addition, the fiber network provides a platform for long-term adoption and smart community innovation, ranging from applications for energy management to enabling a community-scale platform for the Internet of Things.

As we look ahead, municipal governments need access to information and communications to do their jobs and serve the needs of the public and efficiently and effectively as possible. These organizations need broadband that lets them share streaming real-time video, detailed maps and blueprints, high resolution photographs, and other files. Mobile technology capable of sending and receiving bandwidth-intensive information can help all local departments, specifically coordinating the central roles of police, fire, and medical services during emergency response.

Emergency Management

Charter serves all buildings, 911 facilities and 9 fire departments as separate accounts and separate bills - 100Mbps connections, no down time, but there are some speed issues, mobile computers in cars via air cards, VPNs to facilities. Fiber to tower sites would be beneficial. A lot of services in the future, involved with FirstNet. Does GPS tracking of vehicles and personnel.

Between government offices, no problems with moving files around right now, but can see it coming in the future as they move more services paperless and online. EMS seems to have all tech needs now, but can see more needs coming in future.

2.3.4 Community Development

In order for a community to succeed and grow, community and social support organizations must thrive as well. These types of community institutions, whether volunteer, faith- or cause-based, must be the reliable go-to organizations for the special needs and interests of the community to be represented and served. These types of social support organizations must have the tools and resources to be the reliable go-to organizations for people, communities, and the special interests of the community to be represented and served.

Community institutions such as local chambers of commerce, community centers, churches, environmental-focused, and social services organizations help support the people in the community and connect them to services. These organizations are typically stationed on the front lines in the community to assess and respond as necessary to fill gaps in services, to address immediate and urgent needs, and to investigate opportunities to solve persistent community problems.
There is an acknowledgement of broadband and technology services that appeal to AEC residential and business consumers, and for Jefferson and Hamblen County to thrive, community organizations must thrive as well.

Broadband clearly plays a vital role in helping social organizations fulfill their missions. Whether as simple as a community church streaming their weekly service or the local chamber of commerce sharing news of their latest event through their website and email, communicating and accessing local information is central to the mission of community organizations. Broadband equips these organizations with the communication tools necessary to ensure they operate efficiently, helping to organize and enable often-volunteer staff of budget-conscious organizations to be successful in the execution of their important roles in the community.

Community growth strategies

Overall, the communities of Jefferson and Hamblen Counties face the same basic community and economic development challenges as other communities: maintain attractive and viable neighborhoods, retain existing companies, attract new companies, and create more jobs. Specifically, in Jefferson County, the community development focus acts as an economic development strategy, which is to become an attractive location for retirees.

Figure 35: Jefferson County aggressively markets to the active retiree community

In fact, the State of Tennessee Department of Tourist Development has staff dedicated to the "Retire Tennessee" program, which promotes Jefferson County and 18 other communities across the state to the national relocating retiree market. Through the process, the American Association of Retirement Communities has given Jefferson County its "Seal of Approval" for having the resources and amenities for attracting today's relocating retirees.¹³

¹³http://www.retiretennessee.org/communities
East Tennessee’s low taxes, natural beauty and central eastern U.S. location boosts the state’s image not only for recent retirees, but for also the endearing phenomenon known locally as the “half back” retiree. The generally assumed scenario is that a working couple retires from their Rust Belt city career and follows through with their dream of selling the family home that was paid off years earlier to move into a condo in sunny Florida. After a few years of living in the Florida humidity and dealing with tourists while sitting around in highway congestion, thoughts of leaving Florida become appealing. However, with dwindling retirement savings, the couple finds moving back to the expensive and cold northern U.S. difficult to imagine. Quite often these people decide to move to Tennessee, which happens to be halfway back home.

Broadband is certainly a sought-after amenity for retirees, which allows them to remain in contact with friends and family scattered all over the country. But for the 52% of retirees aged 60 and over who plan to work part-time or pursue second-career opportunities from home after retirement, having affordable fiber-optic broadband connectivity could prove to be a real asset to the county as it pursues its retiree-focused economic and community development strategy.

Figure 36: The Hamblen County government webpage

Similarly, Hamblen County uses technology to drive its economic and community development plans, much as the City of Morristown is doing. Already a hub of industry for much of middle east Tennessee, the lure of gigabit connectivity is leading Morristown to becoming a gathering ground for broadband intensive industries like call centers and media and design firms. However, the most valuable feat that has been accomplished may never be known, and that is MUS FiberNet’s role in retaining the large employers in the city and county.

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The online presence for Hamblen County, the City of Morristown, and the Chamber of Commerce is well represented and the message comes across loud and clear that industry is the economic driver of Hamblen County. Certainly, broadband has a role in retaining and growing existing business, but being attractive destination for company expansion and relocation is an aggressive strategy. Improved fiber connectivity throughout Hamblen County and into Jefferson County can lead to complementary or supporting industries locating in the AEC region.

### 2.4 Smart Communities and the Internet of Things

While the goal of AEC’s fiber infrastructure is to enhance the availability and affordability of local broadband services, it can also become an enabler of “smart” programs that increase efficiency, lower cost, reduce environmental impact, and enhance quality of life by relying more on these connected devices.

With a fiber network, Jefferson and Hamblen County communities can take advantage of emerging technologies to enhance the well-being and efficiency of the community, reduce costs and resource consumption while more effectively engaging its citizens. Smart Communities are more efficient at responding to local and national challenges, and are able to position themselves to be more successful than other communities that do not leverage these new technologies.

As AEC expands transport of online services, broadband will become an even more critical component of the daily operations that serve the community. Applications migrated to a community network enjoy greater availability and increased bandwidths over what has traditionally been available, which creates a more effective and efficient municipal organization. High-speed, reliable broadband enables these organizations to:

- Improve operational efficiencies
- Reduce direct and indirect costs
- Provide enhancements to public safety
- Better serve the local community
- Respond quickly to the local community
- Enable interactions with citizens and businesses
- Ensure better emergency preparedness
- Provide more information to citizens and businesses
To illustrate the growing excitement around smart community innovation from a residential perspective, in 2015, there were 174 million Smart Homes, and that number is expected to almost double to 339 million by the end of 2016. Consumer applications fueling the growth of smart homes are the lowering costs of smart TVs, smart bulbs and automation tools such as smart thermostats, home security systems and appliances that are working their way out of the home and into workplaces and public spaces. Overall, the total number of connected “things” inside and outside the home is expected to hit 1.6 billion this year, up from 1.2 billion in 2015.15

**The Internet of Things**

The relatively new concept of the “Internet of Things” refers to the networking of physical objects through the use of embedded sensors and other often wirelessly connected devices that collect or transmit information about a given object, device, or appliance. Examples in the consumer market include smart watches, fitness bands, and home-security systems. Examples in the business market include sensor-embedded production equipment and shipping and storage containers, like radio-frequency identification tags for inventory tracking and fleet monitoring.

In public-sector environments, the Internet of Things has exploded with perhaps more devices and applications than other sectors to drive efficiencies and citizen services. Sensors enable the optimization of vehicle parking availability and traffic flow, environmental sensors help better manage rainwater runoff or detect subtle changes to air quality, utilities can manage peak energy load balancing and usage through smart infrastructure applications and can detect leakages or contaminations to water supplies.

A multitude of citizen engagement applications drive the promise of the Smart City and Smart Communities movement through the marriage of consumer and industrial Internet of Things technologies. All such devices scattered by the hundreds, if not thousands, throughout a community are networked seamlessly through computer systems and generate an enormous amount of data. So while the Internet of Things can ease commute pains for individuals, for example, the macro cost savings will be tremendous for a municipal government.

Scaling city-level economic impacts to the state level, and then to a national level could be staggering. Gartner believes the Internet of Things will support total services spending of $235 billion in the U.S. in 2016, an increase of 22% from 2015. Looking at the global scale, according to a McKinsey Global Institute report, the networking efficiencies and opportunities created by the Internet of Things may have a collective financial and nonfinancial benefits of as much as $11 trillion per year by 2025 across multiple sectors.

Clearly, the Internet of Things is only now gaining full steam. Communities that can equip their IT architectures to capitalize on this connectivity trend have a tremendous opportunity to create new sources of value for residents and enjoy sustainable financial and operational benefits. Community-owned fiber can provide a public infrastructure that can be used for public benefits, including enhanced municipal utilities, new e-government applications, technology collaboration, and infrastructure sharing programs. In addition, a community-owned network provides a platform for long-term innovation of Smart Community technologies and applications, ranging from individual smart homes to unknown macro opportunities through the Internet of Things.

With the implementation of a wireless network that uses the fiber network infrastructure as a platform, Jefferson County can become a “Smart Community” and can take early advantage of the rising popularity of the “Internet of Things.” Local government can integrate the similar smart technologies to monitor components of the area’s civic operated and managed infrastructure in real time to become a smarter, more efficient community.

What makes the opportunities around the Internet of Things so significant is that it encompasses a number of different aspects of improving lives overall, including resource management for water and power; road management for safety and congestion relief; higher quality public healthcare; and better communications between cities and their citizens to enable greater efficiencies. Examples today include traffic control networks, energy systems, street lighting, and

16 www.gartner.com/newsroom/id/3165317
17 www.mckinsey.com/insights/preparing_it_systems_and_organizations_for_the_internet_of_things
more, with more innovation coming. By actively monitoring these systems in real time, the region can adjust delivery of services to meet the needs of the community while reducing costs.

Smart Cities is a specific application of broader ongoing Internet of Things efforts. But it needs and warrants its own unique approach because of the size of the opportunity and its ability to dramatically improve lives. Likewise, public engagement needs to focus on the direct and tangible benefits to their lives, like the ability to reduce traffic congestion or direct people to available parking spaces, for example, or a reduction in cost or delivery of some type of services with immediate benefits that can be seen.

Conversely, some business models must change because local governments need incentives to move forward in advance of any big payoff in improved efficiency. Since most Smart Community applications are pitched to the community on the promise of cost savings or some future benefit, suppliers and vendors must be more open to accepting compensation on the back end too, perhaps based on a percentage of money saved versus large upfront payments.

For example, a city investing hundreds of thousands of dollars on Smart Grid or Smart Lighting Systems may be hard to accept, but for vendors and community partners to deploy some of these applications slightly above cost with a payoff coming as savings are realized by the community could be a win-win for everyone. Having more people with “skin in the game” could speed deployment of applications that could otherwise prove to be a hard sell to a reluctant or more conservative community.

**Smart Grid Utilities and Advanced Metering Infrastructure**

Smart Grid technology allows for two-way communication between the utility and its customers, with networked sensors along the transmission lines making the grid smart. Like the Internet, the Smart Grid consists of controls, computers, automation, and new technologies and equipment working together, but in this case, these technologies work with the electrical grid to respond digitally to our quickly changing electricity demands.

Advanced Metering Infrastructure (AMI) is an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers. Customer systems include in-home displays, home area networks, energy management systems, and other customer-side-of-the-meter equipment that enable smart grid functions in residential, commercial, and industrial facilities.

The Smart Grid represents an unprecedented opportunity to move the energy industry into a new era of reliability, availability, and efficiency that will contribute to our economic and environment health. Smart Grid Utilities and AMI are highly reliant on high-speed communications and can be supported through community-owned fiber infrastructure.
Civic Innovations through Fiber Networks

As utilities and communities invest in fiber infrastructure, they are provided the baseline infrastructure required to support a multitude of technology-based initiatives that require connectivity. These initiatives can include broadband services, collaboration opportunities, public safety applications and energy and utility management functions and features.

Broadband Services

- Common Internet backbone for all anchors
- City and County
- Schools and libraries
- Hospitals and clinics
- Public Safety
- Community Support
- Interconnection with service providers
- Wi-Fi in public centers
- Internet of Things

IT Collaboration

- E-Government applications
- Bulk Internet purchasing
- Application sharing
- Disaster recovery
- EOC communications

Public Safety Applications

- Video monitoring
- First responder support
- Collaboration with state and federal agencies
- FirstNET preparedness

Future Energy and Utility Management

- Smart Grid and Demand Response
- Automated Meter Reading
- Advanced Metering Infrastructure
- SCADA communications and control
3. AEC Broadband Opportunities Assessment

The primary objectives of AEC deploying a service area fiber-optic network is to address many of the critically important items detailed in the needs assessment portions of this feasibility study. Building off those findings, this chapter establishes the framework for investments to improve access and availability of broadband services in the AEC territory, and help improve the lives of the AEC membership.

This chapter begins by presenting information about the current policies and regulatory environment that has shaped the state of broadband in the AEC service area today. Then we identify the opportunities before AEC and its service areas communities and set forth the discussion and recommendations for instituting broadband-friendly public policies. Public policy tools are frequently used to increase the supply of broadband infrastructure that is available to serve a municipality or a utility, and the same can benefit AEC’s service area businesses, residents and community anchors.

3.1 Broadband Policy Issues in the AEC Service Area

As an electric cooperative, AEC is limited by State of Tennessee statute with regard to providing retail telecommunications services. Recent action by the FCC in redefining broadband as a telecommunication service could open the door for AEC to get into this market; however, there is still much uncertainty.

3.1.1 Fiber Infrastructure Availability

There is a limited amount of both publicly and privately owned fiber infrastructure throughout east Tennessee; however, the direct use of this infrastructure by businesses and community anchors is restricted. Fiber infrastructure is not typically installed by providers in advance of revenue opportunities, and therefore puts the communities at risk when executing economic development efforts. These are specifically in areas such as downtowns, business and industrial parks, and residential areas targeted especially by the expressed desire to appeal as a location for retirees and vacation properties. Without the necessary infrastructure, the communities in the AEC service area will continue to experience issues when recruiting people and bandwidth intensive industries to the area.

While there are development opportunities throughout the county, they lack the necessary facilities to attract bandwidth intensive industries or companies. In many cases, businesses looking to potentially locate in these areas would have to spend significant amounts of money to build out the provider’s network infrastructure to then subscribe to costly service. Clearly, placing the economic future of the county in the hands of broadband service providers can have a negative effect on business recruiting efforts.
Being able to tap into any resources in the community that can be leveraged for fiber network infrastructure can save both time and money and could provide opportunities for network growth that might not otherwise be realized. However, the communities in Hamblen and Jefferson Counties served by AEC have the ability to have broadband infrastructure installed along existing electrical transmission equipment across the poles and rights-of-way already used by AEC. The full detail of this approach is included later in this report, though the point here is that Jefferson and Hamblen Counties have a unique opportunity to partner with the electric utility to deliver fiber-optic service to every existing AEC customer.

### 3.1.2 Uncertainties in the Local Broadband Market

Through analysis of the available broadband infrastructure in Hamblen County and Jefferson County communities and through discussions with the area’s broadband service providers, the communities in the AEC service territory are lacking the fiber distribution technology utilized to deliver Fiber to the Premises (FTTP) services. In most all cases, businesses must contract for services from multiple providers offering legacy network offerings, DSL and cable.

In discussions with the local incumbent service providers, it was noted that upgrades to current platforms are under consideration in select locations. However, there are no plans to build out more fiber infrastructure other than the dedicated service offerings to requesting customers. These connection arrangements are far more expensive than traditional services and only benefit larger enterprises and community anchors that can afford the cost, which is usually borne by the business or developer that requests the custom-built connection.

Compounding this problem with insufficient infrastructure, the county’s incumbent provider is in flux, as Charter is in the middle of a 3-way merger and could potentially divest existing local infrastructure. The new company, to be named New Charter, will be a cable TV operator that consolidates Charter Communications, Time Warner Cable and Bright House Networks. New Charter would service more than 23 million customers, rivaling Comcast as the number two cable operator in the U.S. The county should assume a “shake out” period after the merger and should not expect new investments or fiber deployments to be made for some time.

### 3.2 Tennessee Broadband Public Policy and Regulatory Analysis

The regulatory environment for broadband project in the State of Tennessee is very restrictive so any plan put forth will be subject to challenges and criticism. Early in this process, project partners sought legal opinion for the direction of the proposed plan from the Washington, D.C. law firm of Baller Herbst Stokes & Lide. Firm founder Jim Baller, known as “the Google attorney,” is respected nationally and has experience with broadband policy issues on many high profile projects for many years, most notably with the early growth of Google Fiber and as an early framer of the National Broadband Plan.
While nothing in the potential business plans and AEC-MUS partnership arrangements under consideration should cause for critical concern as a "deal breaker," it is important to be aware of the issues unique to Tennessee and those common with the rest of the country. An excerpt from the opening section of the legal opinion is below, with the full document provided in Appendix B:

"Morristown Utility Systems ("MUS") and Appalachian Electric Cooperative ("AEC") are planning to work together, along with a private entity, to introduce greater broadband capabilities to eastern portions of Tennessee through the development of the East Tennessee Network. Specifically, we understand that MUS and AEC have developed a business plan under which MUS will provide content to AEC at a point within Morristown's territorial limits. AEC will then transport the content to various locations in Eastern Tennessee under an agreement with a yet-to-be-determined private-sector service provider. The service provider, in turn, will sell the finished services to residential, business, and other customers. MUS and AEC have asked Baller Herbst Stokes & Lide ("BHSL") to provide an analysis of the relevant federal and State legal, regulatory and policy issues impacting the proposed project.

As discussed below, we believe that the proposed East Tennessee Network may be established in a manner that is legal under both federal and State law. Depending on the scope of services to be offered, however, Tennessee law imposes certain limitations that may require the parties to structure their relationship in such a way that AEC is not deemed to be offering cable or Internet services, but, rather is providing infrastructure and/or wholesale broadband transport. In structuring their business plan, MUS and AEC should also take into account some key regulatory requirements, such as federal universal service reporting and contribution obligations, and consider approaches that will minimize exposure to such requirements.

The document is organized as follows: We begin by providing a high-level overview of how communications services are generally treated under federal law, including definitions and explanations of key terms and concepts to which we will frequently refer throughout the remainder of the memo. We then discuss the authority issues under Tennessee law affecting the ability of municipal electric utilities and electric cooperatives to engage in the proposed communications activities. We then analyze the federal and state regulatory requirements that would apply to the proposed East Tennessee Network with respect to various communications services."
3.3 AEC’s Potential Impact on Local Broadband

Because the mission of AEC is different than that of any competitive Internet service provider that would otherwise serve households and businesses in the AEC service areas, AEC can have a tremendous social and economic impact on Hamblen and Jefferson Counties and the Lakeway Region. The “off balance sheet” benefits are far reaching.

3.3.1 Improving Affordability

By leveraging broadband assets that are already available and by leveraging MUS FiberNet headend services, the amount of new investment to bring services to the AEC service area can be reduced, including the reduction of investment necessary to provide services to subscribers. In the places where there is available conduit and fiber-optic infrastructure, “overbuilding” may not be necessary. One such recommendation is for AEC to institute a policy going forward that dictates that conduit and/or dark fiber are automatically installed anytime a new member comes online for new service or a new business or industrial park is planned anywhere in the AEC footprint. Over time these small incremental investments will add up to an important new asset.

3.3.2 Enhancing Economic Development

Increasing the availability of fiber-based services into the main business corridors and parks will allow the Lakeway Region and its local partners to enhance the economic development message regarding the Lakeway broadband capabilities. Through the deployment of fiber distribution technology, the communities within the AEC footprint can designate these areas as being “On-Net,” and as “Gigabit communities” allowing any business moving to the Lakeway Region to recognize that fiber services are readily available and prevalent at very competitive rates. This concept, partnered with a possible Data Center facility provided by MUS, would provide the message that a business can locate in any business center, or one of the many business and tech parks within the AEC service area and they will have next-generation broadband availability.

3.3.3 Increasing Adoption

Broadband adoption is influenced by two key factors: relevancy and affordability. An AEC-MUS partnership has the opportunity to improve affordability by leveraging a new fiber-optic network and the existing MUS headend and making measured investments in additional infrastructure. Affordability and adoption of broadband services are positively correlated. As affordability increases, so does adoption. AEC can positively influence adoption by negotiating agreements with broadband service providers, such as a third-party service provider referred to here as “Newco” to provide “lifeline” Internet services at low costs for disadvantaged residents, small businesses and other targeted populations in exchange for discounted use of its broadband assets. These incentive programs can help broadband service providers deploy more quickly and at lower costs in exchange for their participation in such lifeline programs.
3.3.4 Improving Public Efficiency and Effectiveness

Leveraging new AEC broadband assets through a third-party service provider (Newco), to connect public institutions throughout the community creates the opportunity to establish collaborative technology programs across multiple organizations. Establishing institutional access to AEC’s conduit and dark fiber networks would create a high-speed, inter-governmental backbone through which these organizations could collaborate with one another on all relevant projects and initiatives. Connecting schools, libraries, local government, public safety, and community organizations to one another could facilitate the sharing of technology resources among the organizations connected. Some of the potential benefits may include cost reductions through joint volume purchasing agreements, application sharing, and improvements to emergency operations and communications.

3.3.5 Reducing Taxpayer Spend

Improving public efficiency and effectiveness could reduce the costs of government to the local taxpayer. If employed effectively, AEC’s broadband initiatives can become a tool that facilitates cost reductions, not only for the utility itself but also for public organizations across the Lakeway Region, including schools, libraries and community organizations. An inter-governmental network connecting these public organizations could consolidate the purchasing power of all agencies for common information technology and communications services, resulting in lower overall costs. The network can also “futureproof” the connectivity needs of these agencies and protect them from cost increases as they require additional bandwidth. Not to mention the money that residents and business save can be spent elsewhere in the community, and the monthly revenue for operating the network will stay local, further churning local tax dollars.

3.3.6 Reducing Lead Times for Installation

The time to install and activate customer broadband services is significantly determined by the availability of infrastructure in the area. Businesses are negatively impacted by fiber construction lead-times, if available at all, that may result in delays to activate their services. 30 to 60 days is the typical industry standard lead-time for activation of fiber-optic broadband services, without a provision for special construction. In many cases, the lead-time may double or triple depending on how much additional fiber construction is necessary to reach the end user’s location. AEC’s conduit and dark fiber infrastructure can be used to supplement existing broadband service provider infrastructure to reduce these lead times.

3.3.7 Supporting Reliability and Performance

The AEC and MUS broadband assets can be used to support the reliability and performance of broadband services across the Lakeway Region. These assets can be employed to provide new physical route diversity to the networks of existing broadband service providers and increase capacity in existing routes. They can be used to increase backhaul capacity in areas of the AEC operating territory that are approaching their limit and equip more commercial wireless or cell towers with dark fiber connectivity, increasing the bandwidth available to mobile carriers serving
the AEC members wireless needs. Community organizations can utilize these assets to achieve significant upgrades in speed and connectivity between their facilities as well as diversity for their primary connectivity.

3.4 MUS FiberNet's Proven Impact

Perhaps the most significant opportunity for the AEC service area is the willingness of the adjacent MUS FiberNet to be a valuable partner in this feasibility study and a wealth of experience, which happens to be celebrating its 10th year as a broadband utility. In fact, in 2006, at request of Morristown City Council, MUS entered the retail telecommunications business. This action was in response to public demand for improved product offerings, better customer service, and competition for rate stability. Shortly after, MUS deployed a fiber-optic broadband system passing every premise in the city.

The system has greatly benefited residents and businesses with better quality of life and improved reliability and efficiency for businesses. The highly successful network has a 47% take rate and has transformed the community's ability to succeed in economic development and recruitment of business and industry.

This network has the ability to reach and impact many of the surrounding communities. Rural areas and towns around Morristown have long been interested in access to a similar technology, visiting multiple times to envision their path to high speed broadband services. FiberNet stands as an excited and willing partner to be the enabler of these services to a greater Lakeway area starving for high speed connectivity.

In the vision of Morristown, fiber-optic technology is considered to be essential infrastructure no different than electric, water, sewer, and roads. Fiber-optics have improved educational systems, workforce development, government, and utility operations in Morristown. To be competitive in the future, the investment was considered crucial and it is something surrounding areas should have the opportunity to share.

MUS accomplished this without a single tax payer dollar. The network was built and is sustained by local rate payer money, from revenue that previously left the community for out-of-state corporate profit. That money has been redirected into Morristown to reinvest into the network for the benefit of residents and businesses. Morristown now has met the original goal of offering advanced broadband products and rate stability.

3.4.1 Technology Capabilities at Arm’s Reach in Morristown

FiberNet offers unique and diverse products through a stable, high-technology Network Operations Center (NOC). Fiber based services can be expanded to Hamblen and Jefferson Counties and beyond without NOC services having to be repeated.

First, FiberNet provides superior video services and compliments that with local programming and advertising. Second, FiberNet maintains multiple redundant and diverse connections to the Internet to insure system reliability and true Gigabit connection for any and all customers. Third,
FiberNet is a CLEC (Competitive Local Exchange Carrier) with local dial tone origination that can provide telephony voice products and data connectivity anywhere in the state of Tennessee. These services include the latest technology for VOIP and hosted IP phone services. In addition, FiberNet can provide offsite backup of critical data, provisioning services, marketing assistance, contract administration, and technical call center services.

MUS FiberNet has a professional staff with network engineering experience to insure customers receive the best products for their business needs, and then support those products going forward with superior local customer service. This same support could be expanded to the Lakeway Region.

The current network offerings in Morristown by MUS FiberNet.

- 333 miles of 100% fiber optic cable passes every home and business
- Fast Internet increases business efficiency and productivity
- Multi-Gigabit Internet speeds, both upload and download
- MPLS & VPLS secure service options
- Customizable service plans for Internet, phone and video
- CLEC phone provider with PBX and hosted IP services
- Redundant offsite data vault storage
- Co-Location opportunities
- Core fiber-optic network includes redundant and diverse fiber rings
- Distribution hubs connected with redundant power, fiber, fire protection
- Critical components have 1+1 redundancy, replacement components stocked locally
- Use minimum of 4 Tier 2 Internet carriers on redundant paths for failover
- Mature staff with over 250 years of telecommunications experience
4. Broadband Options for AEC and its Communities

AEC is considering feasible broadband deployment and operations strategies. As such, it seeks a thorough understanding of its options by understanding broadband deployment concepts and business models. These prevailing models include a spectrum of broadband initiatives that local governments and utilities have implemented over the past 20 years.

What has been learned over this period is that no “cookie cutter” model exists to replicate the successes that some municipal providers have enjoyed. Each community is unique and each municipal or utility broadband program must be tailored specifically to community needs, organizational capabilities, and market conditions. Although the business strategy must be unique to AEC and the communities it serves, certain truths are consistent across all these initiatives, with similar sentiment shared by many of the stakeholders that have been engaged through the process of this study.

Summarizing these statements, the following themes emerge:

- Fiber-optic networks should be considered similar to road, water, and sewer systems as opposed to one-time projects.
- Strong local support from stakeholders must be gained through an approach rather than the technology to ensure that the community gains a clear understanding of the reasons for the initiative.
- Moving too quickly can be as risky as moving too slowly to achieve broadband goals, so a careful balance of community benefit and financial sustainability to remain successful over the long-term.
- Focus on organizational strengths when evaluating options for broadband and where organizations do not have competencies, consider public and private partnerships to fulfill the solution.

4.1 The Case for Different Business Models

Determining the right business model is key to the success of a broadband project. Selecting the appropriate model should be based on a number of factors, including the stage of broadband development, funding capacity, organizational capabilities, and desired benefits to the community. In many cases, municipal and utility networks have been forged over many years to become what they are today. Cities such as Bristol, Morristown, and Palo Alto did not develop their gigabit networks in one iteration. Similar to MUS FiberNet, their initial networks grew over time from small networks supporting specific utility or municipal needs into some of the most robust broadband networks in the country.
This feasibility study has presented an assessment of broadband needs of AEC service area households and businesses, a market analysis of current broadband service offerings from retail providers, and has provided evidence of the growing trajectory of the need for broadband. The report has also summarized opportunities and potential impacts that a fiber deployment could have on AEC communities, given the current Tennessee regulatory environment and limitations on municipal utilities and electric cooperatives.

Based on analyses of the retail broadband market in the AEC service area of Jefferson and Hamblen Counties, the area lacks critical local fiber-optic access infrastructure and fiber-optic backhaul infrastructure into and out of the region. As detailed earlier in this report, much of the broadband infrastructure owned and operated by incumbent providers is based on technologies that deliver services over copper-based networks. Although some fiber-optic infrastructure exists in the service area, it is very strictly managed in the area by only a few service providers or used exclusively for backhaul services. Analyses found no indication of available fiber-optic facilities to provide residential services.

In metropolitan markets, many broadband providers have upgraded their infrastructure to provide fiber-optic access to businesses and residents in the service areas. The large demand and population density in these areas allows them to justify the high cost of upgrading to fiber-optic infrastructure. The average fiber installation to a residential premise, known as a “per passing cost,” averages $1,500 for large providers or $2,000 for small providers. Multiply this by a neighborhood of 500 homes and this yields a total capital expense of $750,000 to $1,000,000 to the provider. This quickly expands as the provider deploys fiber-optic infrastructure in multiple service areas.

Unfortunately for smaller markets such as the communities in the AEC service area, the lack of modern retail broadband service options proves that providers cannot justify the capital investments necessary to upgrade their infrastructure. Due to the lower overall demand and lower population density, ROI-driven corporate Internet service providers choose to look elsewhere for more profitable investments.

As a result, communities like those in the AEC service area are “left behind” as the metropolitan areas progress and receive the latest broadband technologies, leaving rural areas to continue dealing with limited copper-based technologies. Growing tired of dealing with the shortcomings of the profit-driven broadband market, communities and utilities are coming together to create their own unique homegrown opportunities, being resourceful and drawing on the assets in and around their communities.

**Opportunities through Different Business Models**

With a clear understanding of MUS FiberNet resources and capabilities, the focus of this study shifts to answer the question, how can AEC use its electric utility assets and existing network to enable broadband services in the community? There are many options for AEC to consider in providing services, and a handful of business models that may be attractive to AEC and partners given the restrictive regulatory environment in Tennessee.
Magellan has determined that AEC has opportunities to develop a broadband transport model that provides broadband services to residents, business, and community anchors. AEC and MUS must have an existing inter-local Governmental Agreement to share resources for the common good of its rates payers and for system efficiencies. An evaluation builds on this to identify opportunities for AEC to develop a tremendous asset to serve the business and residential communities throughout the AEC service area.

Operating within the guidelines set forth by state law, AEC and MUS have a unique partnership opportunity to grow a fiber-optic network into underserved areas of the AEC service area. The opportunity exists for AEC and MUS to partner with a third-party provider to bring retail services to Hamblen and Jefferson County customers. This model would use MUS FiberNet as the wholesale provider and AEC’s fiber network as the data transport delivery infrastructure.

While AEC is restricted from serving retail broadband services, AEC can own its own fiber-optic cables for purposes of transporting data, including data exchanges for operational efficiencies and reliability of its electric system, as an example. At the same time, AEC could share this infrastructure to transform its customer base to a digitally enabled world.

Given these parameters, Magellan believes that AEC can consider several strategies to expand next-generation broadband to residents and businesses. These include action in the following general areas:

1. Implementation of broadband-friendly public policies (Section 4.2)
2. Development of broadband public-private partnerships (Section 4.3)
3. Deployment and operation of a utility-owned open-access network (Section 4.4)

### 4.2 Develop and Implement Broadband-Friendly Public Policies

Broadband-friendly public policies are low risk broadband development tools that utilities and cooperatives can utilize to accelerate deployment and reduce the cost of constructing broadband infrastructure within their jurisdictions. These policies enable entities in their operating area to create more opportunities for the installation of broadband infrastructure in conjunction with other public and private projects occurring within the AEC territory. Public policy tools are implemented according to each utility’s existing policies and processes; there is no “cookie cutter” approach to developing and implementing them.

#### 4.2.1 Comprehensive Broadband Standards

Integrating "broadband utility" standards into the city or county land development code will enable AEC and its communities to incorporate basic broadband infrastructure requirements into the land development process and encourage broadband construction to occur in conjunction with other capital projects. Real estate developments, subdivisions, shopping centers, road
widening, sidewalk, trail, and lighting projects all may be opportunities for the installation of basic conduit infrastructure at favorable costs.

By installing conduit in concert with these related capital projects, AEC and the local government can avoid incurring the significant costs of constructing this infrastructure by doing so when the ground is already open. Since considerable portions of the cost to build broadband infrastructure are incurred through trenching or boring and then resurfacing, this strategy can alleviate some costs of constructing underground infrastructure.

AEC’s policy alignment with communities it serves can determine which projects will help build usable infrastructure. The long-term goal of this strategy would be that after a period of years, AEC and the local government would have miles of relatively free underground conduit, possibly with fiber installed, throughout areas of the service area.

### 4.2.2 Joint Trenching Policies

Requiring a little more involvement and coordination than broadband utility standards in 4.1.1, joint trenching agreements are developed between public and private organizations to minimize the cost of constructing conduit in the local area, by allowing each entity to take advantage of trenches that have been opened through each other’s projects. Standardization of these agreements across all potential owners of underground infrastructure can be established to ensure all parties are aware of the joint trenching opportunities as they become available.

This process should also be coordinated with local service providers to minimize overbuilding and to ensure that service providers have an opportunity to place their infrastructure in capital projects as well. Joint trenching policies between communities, public works, AEC, and broadband providers can facilitate more opportunities to install conduit, fiber, and other infrastructure at much lower costs.

### 4.2.3 Infrastructure Fund

AEC should establish an infrastructure fund, monies set aside to allocate funding to build broadband infrastructure when opportunities arise, aligned with capital project schedules of communities in the service area. AEC could determine how much funding to allocate based on the capital project schedule and locations where the AEC could favorably build infrastructure at low costs. This fund would typically roll from year to year and maintain a reserve or set-aside for unanticipated projects.

### 4.2.4 Record Keeping

AEC should maintain a Geographic Information System (GIS) that contains detailed maps of the operating territory and each community’s right of way, easements and other information. Similar as AEC does now with its current utility assets, as AEC considers implementing broadband-friendly public policy measures, it should ensure that GIS documentation of any broadband infrastructure is made a requirement. This will allow AEC to maintain a clear understanding of available assets as well as an inventory of areas of need, through the records of locations of...
broadband infrastructure; which may include conduit, vaults, pull boxes, transitions, fiber-optic cable, and other outside plant resources.

**4.2.5 Implement Broadband-Friendly Public Policies**

Developing and then implementing broadband friendly-public policies requires AEC to evaluate its current land use, construction, and right-of-way policies to determine how these can be tailored to incentivize development of more broadband infrastructure in the Lakeway Region. AEC should adopt General Plan policies that incorporate broadband as a public utility and create a policy framework to promote its deployment in public and private projects as appropriate, including:

- Draft policies and standards to specific needs and adopt them into local policy, codes, and standards (including Sections 4.1.1 and 4.1.2 policy tools, dig-once, joint trenching, engineering standards, etc.).

- Identify opportunities to install broadband infrastructure in conjunction with public and private construction projects as appropriate.

- As AEC makes key infrastructure investments, maintain broadband infrastructure in its GIS system, requiring GIS-based builds and implementation of other means for accurate documentation.

- Evaluate ways to streamline the broadband permitting processes within public rights-of-way in conjunction with local authorities to ensure broadband providers do not face unnecessary obstacles to building infrastructure.

- Evaluate additional construction fees like last mile fees levied on broadband providers for constructing broadband infrastructure to ensure they do not discourage broadband investment.

**4.2.6 Potential Risks**

Implementing broadband-friendly public policies pose little financial risk because they require little upfront funding if managed correctly. Similarly, the policies pose little political risk because in most cases, the utility and local government and many property developers already perform many of these practices – many believe it’s just the right thing to do. Therefore, much of the effort would be taking many of the current "gentlemanly" practices and standardizing them into local code.

In some cases, entities have struggled with incorporating broadband into their existing land use policies because they are unfamiliar with how to manage a new “utility” type of asset. This requires the collaboration of multiple departments and the ability of these departments to work together to a common goal. AEC should expect that some new operational processes would be required as well as changes to existing processes in order for the policies to be effective.
4.3 Broadband Public-Private Partnerships

A broadband public-private partnership (PPP) is a negotiated contract between a public and private entity to fulfill certain obligations to expand broadband services in a given area. PPPs have gained popularity over recent years as more municipalities employ public broadband and utility infrastructure in conjunction with private broadband providers. PPPs leverage public broadband assets, such as fiber, conduit, poles and facilities with private broadband provider assets and expertise to increase the availability and access to broadband services.

Because of retail broadband restrictions placed on electric utility cooperatives in Tennessee, an attractive option to consider is an evaluation of public-private partnership opportunities with new or existing broadband providers. This can be a first step for AEC to take that will help it understand what benefits can be achieved working in partnership with broadband providers. As every public-private partnership is different, AEC should consider some key questions around these complex relationships.

By doing this, AEC would forgo “getting into the business” of providing retail services and instead, make their broadband infrastructure available to private broadband providers to enhance their communities and enhance services to their members.

4.3.1 Exploring a Broadband Public-Private Partnership

Both AEC and MUS have been seeking a possible solution that could overcome state regulatory issues and allow both entities to improve the quality of the lives of their members and constituents. One of the most logical solutions for the regulatory environment is to work toward some form of a public-private-partnership. The ability to leverage public assets through a private service provider not only overcomes regulatory restrictions but also allows both AEC and MUS FiberNet to achieve their goals with less risk, and in a much faster manner.

A public-private partnership may take different forms, depending on the specific needs of AEC and the partner organization. In AEC’s case, AEC would bring public broadband assets to the negotiating table with private broadband providers to achieve mutually desirable benefits to both the Lakeway Region and the partner(s). A Request For Information (RFI) is a public procurement vehicle that can be used to negotiate and execute public-private partnerships.

For example, once AEC has determined that it will pursue public-private partnership(s), an option would be to hold a competitive negotiation with one or more broadband providers. In this case, AEC and MUS would issue a public RFI through a public procurement that would invite broadband providers to submit information concerning how they would make use of the AEC’s broadband infrastructure to achieve a pre-defined set of goals laid out by AEC-MUS. In general, RFI’s are evaluated similarly to these types of procurements and are scored on the merits of each respondent’s ability to meet or exceed AEC’s goals.
4.3.2 Considerations in Developing a Broadband PPP

As AEC puts a PPP plan in place it is important that it considers the following questions to ensure it is making informed decisions about moving forward:

*Should AEC negotiate with one or multiple broadband providers?*

The decision to form a Broadband PPP with a single provider or multiple providers will determine how much power AEC-MUS maintains at the negotiating table with potential partners and how much of AEC’s “ask” is agreed to by the partner. In a single provider PPP, the provider will generally be incentivized by the opportunity to capture a large market through use of AEC and MUS FiberNet broadband assets and do so with no competition from other providers for those assets. In a multi-provider PPP, multiple providers will have access to those assets, reducing the incentives a single provider would enjoy. However, a multi-provider PPP may protect AEC from a lack of performance or a default of a single provider, which may render the PPP ineffective.

*What is the range of potential partners available to AEC?*

AEC should consider making RFI open and non-discriminatory, allowing all qualified providers the opportunity to submit their proposal to AEC. The RFI may be inclusive of current broadband providers in AEC’s service area, including incumbents, cable companies, and other competitive local providers with customers in the AEC service area. AEC may also want to consider the geographic scope of potential partners. Limiting the scope of qualified applicants to only those serving the market today could limit AEC’s range of proposals. AEC should consider expanding this scope to cover the greater US telecom and broadband markets to include potential partners that may deliver other new and innovative broadband solutions to AEC’s members.

*What incentives can AEC offer potential partners?*

AEC can make its broadband assets available to one or more partners at reduced or no cost to incentivize providers to accelerate broadband deployments in the Lakeway Region. These incentives may also help providers reduce costs to citizens, businesses, and community anchors and AEC utility members. AEC should clearly identify the assets that it will employ in the partnership, the value of these assets and the consideration given to partners for incentivized use of the assets. Doing so will ensure AEC and partner(s) clearly document the exchange of value between the partners.

*What conditions should AEC ask of broadband providers?*

AEC should clearly define its expectations in the partnership(s). These expectations may include offering specific types of services in target areas, guaranteeing performance and quality of services, and offering low-cost “lifeline” packages for economically disadvantaged residents and businesses. AEC should identify which components are required and non-negotiable in the partnership versus those components that may be negotiated.
Some of the critical “ask” terms for AEC could include:

- Providing reduced pricing for Internet service to public organizations
- Meeting price targets for specific tiers of service to residential and commercial customers
- Providing Gigabit services to residents and businesses
- Co-Marketing programs that AEC and local economic development can utilize to recruit new business and promote the Lakeway Region as a connected gigabit region
- Enabling low-cost “lifeline” broadband services for economically disadvantaged residents
- Equipping business parks, community redevelopment areas, and other designated places with broadband services
- Guaranteeing performance and reliability of services provided under the PPP

**How will the partnership be managed?**

AEC-MUS should anticipate the need for ongoing management of a broadband PPP. This will require AEC and MUS to establish resources to manage the PPP. The primary management functions include measuring the progress and performance of the partner(s), overseeing the broadband assets employed in the partnership, and managing ongoing operational functions such as new broadband buildouts.

**4.3.3 Desired Outcomes**

Outcomes are highly dependent on AEC and MUS goals in the project, value of the broadband assets, and desire to maintain control over how the broadband provider utilizes the assets. AEC and MUS should strive to accomplish several key items in negotiating with potential partners.

*Treat broadband providers as stakeholders in the community.*

- Consider their capital requirements
- Remember that their decision-making will be based on achieving the required return
- Understand that payback requirements are shorter than in the nonprofit world
- Understand their definition of ROI is primarily financial, rather than that of a cooperative, which has a mission based on the welfare and quality of life of constituents and members.

*Identify the target areas for broadband expansion in the PPP.*

- Identify the boundaries
- Pinpoint AEC’s broadband assets for use in these target areas
- Define the services that are expected to be provided by the broadband provider

*Enable providers to deploy services as quickly as possible by minimizing the following obstacles:*

- Permitting timeframes
- Requiring single versus bulk/blanket permits for their projects
- Strict construction requirements for placement of conduit, fiber and facilities
- Placing fiber in the supply space
Minimize fees to keep prices for broadband services low in the local market.
- Normalize, reduce or waive permitting fees for construction projects
- Minimize leasing fees for the broadband assets such as fiber and conduit
- Allow for lower cost construction methods, where possible

Clearly define the considerations given and received in the project with the broadband provider.
- Determine the value given by AEC-MUS to the provider in the PPP
- Determine the value generated by the provider to the community as a result of the PPP
- Define the timeframe for the community to receive the benefits of the PPP

Define how the PPP will be managed and governed, by answering questions like:
- How will the parties conduct business with one another and maintain alignment?
- How do the parties deal with shortfalls if either party isn’t able to meet the requirements in the timeframe desired?
- How is performance of the PPP and the partners measured?

Example: Google Fiber in Kansas City, Provo and Austin
These Google Fiber projects utilize a form of public-private partnership whereby each municipality developed agreements for the use of municipal broadband infrastructure and/or policy incentives to attract the provider to the city.

Example: Axcess Ontario, NY
Axcess Ontario builds the fiber infrastructure to supply/lease telecom technology, which enables carriers to provide service to their customers. Axcess Ontario collaborates with Verizon Wireless and Time Warner Telecom to leverage its fiber-optic network to bring more broadband services to the community.

4.3.4 Potential Risks
Broadband PPPs are relatively new to local governments but their popularity is growing because they align public organizations and private providers, leveraging each other’s core strengths. In most cases, PPPs alleviate municipalities and utilities from the requirements to provide retail or wholesale broadband services and allow them to employ their broadband infrastructure and policies with providers who take on these responsibilities.

Fundamental alignment between the public and private partner(s) is important for successful PPPs. AEC and MUS goals must be balanced with private sector goals and strategies. These goals and strategies must be forged early in the process and fulfill each party’s critical needs. The identification and selection of the right partner(s) is paramount to success in the project. Execution risks can be high for entities that do not have a clear understanding of the true needs of their communities or those of broadband providers.
4.4 Implement a Utility-Owned Open-Access Network

A general overview of this type of arrangement would be the following. A private investment group would invest in building a fiber-optic network on AEC assets and an arrangement would have to be made that would allow AEC to own its own fiber assets as part of the investment strategy. An alternative would be for AEC to make the necessary investments in the fiber-optic network, this network whether financed by private investors or the AEC membership would be the transport medium for retail customers to receive high speed broadband, voice and video and other services from the third party private provider.

The privately held third party service provider will be required to meet all the State of Tennessee incorporation requirements, including becoming a licensed Competitive Local Exchange Carrier (CLEC). For ease of reference we will refer to the new third-party service provider company as “Newco.” Newco would co-locate its electronics in a manner that allows it to receive whole content services from the MUS headend in Morristown. Newco would then enter into an agreement with MUS FiberNet to receive wholesale services provided by FiberNet.

FiberNet would also need to extend its relationship with NCTC that allows programming content to be transported to Newco and arrange necessary programming billing. In turn Newco would enter in to an agreement to use the AEC fiber network for wholesale transport services. Newco also would consider contracting MUS FiberNet for expanded services in the areas of NOC service, customer services, billing and provisioning and other possible services.

Newco would be responsible for sales, marketing, and totally independent financial and legal operations as a privately held company. There would be no equity positions taken by any of the private/public entities and all agreements would comply with all existing laws.

Magellan Advisors has proposed that a RFI be released which outlines requirements and general terms and conditions of entering in to a partnership with both AEC and MUS FiberNet and discover if any other parties might be interested in a partnership as previously described. The most important element of achieving these goals is a viable, and sustainable business model.

Based on building a viable business model, the deployment strategy will need to be considered and carefully executed in order not to break the model from a positive to a negative cash flow position. Some of the important elements that the business model needs to address are these general areas:

- Total cost of capital
- Form of network build-out financing
- ARPU
- Uptake rates
- Operations and maintenance cost
- SG&A expenses
- Payback period

While the ultimate goal is to provide Newco services to every member and constituent in the AEC service area, the timing of such build-outs will have to be tempered with market realities. Because of the sparsely populated areas of Hamblen and Jefferson Counties, it is critical that the more densely populated communities be used as a counterbalance for other communities.
Newco is able to move into more populated areas like downtown Newport and Pigeon Forge this could make the viability of the entire project much more achievable in terms of financing and market rate payback schedules.

One important aspect to Newco’s success will be the association and branding in conjunction with both MUS FiberNet and AEC. Both MUS FiberNet and AEC have a very loyal following and name recognition. It will be important that Newco, in conjunction with AEC and MUS FiberNet, leverage these positive attributes and also work hard at protecting those branding assets. Local responsive service, the best available technology, and stable and competitive pricing will be the marketing building blocks that Newco relies on to both attack and take a substantial market share as soon as possible.

Once put in place it is recommended that both AEC and MUS have board representatives on the Newco advisory board. Newco will be responsible for creating and executing the marketing, sales and business operations that support the agreed upon business model supporting the required investments.
5. AEC Broadband Financial Overview

This financial overview assumes a financial structure whereby either AEC or a private investor would fund the physical buildout of fiber-optic network components in AEC’s territory while retail services to customers would be provided by a third-party entity in compliance with all current State of Tennessee and federal statutes. Therefore, this financial overview focuses on the financial feasibility of such infrastructure and provides several options by which it could be funded publicly, jointly and privately.

In consideration of the evolving state and federal regulatory environment, and to reduce risk to AEC, it is important that AEC consider a phased approach for the funding and deployment of the network, focusing first on the areas that generate sufficient cash flow to help sustain the network in the early years. These areas are predominantly within the cities of White Pine, Dandridge, Jefferson City and the more populated areas in Hamblen County. Once these areas are constructed and provide sufficient income to warrant expansion, AEC should then consider phased deployments for Hamblen and Jefferson Counties.

This financial overview provides a plan for AEC to follow such an approach, which through three phases across five years, will allow AEC to equip its entire service area with a fiber-optic infrastructure, serving both city and rural households and businesses. Figure 37 illustrates this potential deployment plan for AEC fiber.

*Figure 37: Three-stage deployment approach for AEC fiber*
5.1 AEC Fiber Build Costs Per Community

Figure 38 illustrates the relative total costs to pass and connect each AEC community with the fiber-optic feeder/distribution network and the fiber-optic "drop" infrastructure required to provide fiber-to-the-premise services to household and business members.

*Figure 38: AEC fiber build costs per community (in millions of dollars)*

The costs to pass and the costs to connect are correlated with the density of homes and businesses in each community; the higher density, the lower the overall costs, and vice versa. These costs are also correlated with size of the service area; larger geographic areas will incur higher construction costs yet the cost per customer passing is lower. As we look to the fiber-optic network build costs for AEC, Figure 39 highlights the key metrics associated with the fiber build for each community. As discussed, denser areas have a higher customer per mile count than the unincorporated rural areas, making the more populated areas the target for initial deployment of fiber, due to lower per-customer cost and a higher concentration of customers.

*Figure 39: Fiber costs and density within the AEC service area*

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Primary Miles</th>
<th>Customer Count</th>
<th>Customers Per Mile</th>
<th>Linear Footage</th>
<th>Feeder / Distribution Cost</th>
<th>Average Cost Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamblen County</td>
<td>347</td>
<td>9,818</td>
<td>28</td>
<td>1,832,160</td>
<td>$15,298,536</td>
<td>$8.35</td>
</tr>
<tr>
<td>White Pine</td>
<td>32</td>
<td>1,260</td>
<td>40</td>
<td>166,848</td>
<td>$1,402,579</td>
<td>$8.41</td>
</tr>
<tr>
<td>Dandridge</td>
<td>67</td>
<td>1,841</td>
<td>27</td>
<td>355,872</td>
<td>$3,063,843</td>
<td>$8.61</td>
</tr>
<tr>
<td>Jefferson City</td>
<td>96</td>
<td>4,367</td>
<td>45</td>
<td>508,464</td>
<td>$3,554,201</td>
<td>$6.99</td>
</tr>
<tr>
<td>Unincorporated Jefferson County</td>
<td>1,297</td>
<td>17,545</td>
<td>14</td>
<td>6,848,160</td>
<td>$44,147,835</td>
<td>$6.45</td>
</tr>
<tr>
<td>Total</td>
<td>34,831</td>
<td></td>
<td></td>
<td>$67,466,993</td>
<td>$6.47</td>
<td></td>
</tr>
</tbody>
</table>
Figure 40 illustrates AEC’s total meters and the breakdown of residential and commercial meters per community. These meters represent the addressable market for AEC’s fiber network through which we calculate the size of each market in annual revenues. This information will be important to any third-party company looking to assess the opportunity to serve residential and business customers over an AEC-owned fiber infrastructure. In all, the total broadband market in annual revenues is estimated to be approximately $56 million per year.

**Figure 40: Markets in the AEC service area**

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Total Meters</th>
<th>Households</th>
<th>Businesses</th>
<th>ARPU Households/Businesses</th>
<th>Total Market Value Annual Households</th>
<th>Total Market Value Annual Businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamblen County</td>
<td>9,818</td>
<td>8,443</td>
<td>1,375</td>
<td>$120/$250</td>
<td>$12,158,611</td>
<td>$3,711,204</td>
</tr>
<tr>
<td>White Pine</td>
<td>1,260</td>
<td>1,084</td>
<td>176</td>
<td>$120/$250</td>
<td>$1,560,384</td>
<td>$476,280</td>
</tr>
<tr>
<td>Dandridge</td>
<td>1,841</td>
<td>1,583</td>
<td>258</td>
<td>$120/$250</td>
<td>$2,279,894</td>
<td>$695,898</td>
</tr>
<tr>
<td>Jefferson City</td>
<td>4,367</td>
<td>3,756</td>
<td>311</td>
<td>$120/$250</td>
<td>$5,408,093</td>
<td>$1,650,726</td>
</tr>
<tr>
<td>Unincorporated Jefferson County</td>
<td>17,545</td>
<td>15,089</td>
<td>2,456</td>
<td>$120/$250</td>
<td>$21,727,728</td>
<td>$6,632,010</td>
</tr>
</tbody>
</table>

### 5.2 Key Assumptions

The key variables and assumptions that help build the model to determine financial feasibility are represented in Figure 41. The current variables have been estimated based on similar broadband utility networks in rural and suburban environments. These estimates are preliminarily and should be refined as AEC and its representatives work through further feasibility analysis.

Average rates for services are estimated at $120 per month for residential service and $250 for commercial service. Residential services are comprised of three services: high-speed Internet up to 1 Gigabit per second; home telephone service, and; an expanded digital television service.

The Average Revenue Per User (ARPU) defines the average rate customers pay for services from the provider among the different packages offered. Commercial ARPU consists of business-grade high-speed Internet services, business telephone service, along with an option of value-added data management services.

Assumptions around fundamental costs drive the overall profitability of the financial model. Based on standard utility cost variables, which include Cost of Services, Margin and Sales, and General and Administrative Margins, the average cost to provide service to a household or business is estimated at 62% of gross revenues, leaving 38% of gross revenues available for AEC’s repayment of debt, funding of reserves, and funding for capital expansion.
Based on similar deployments in rural and suburban electric utility cooperative environments, an average uptake of customers is estimated at 50%, meaning that 50% of the addressable market would subscribe to services.

Figure 41: Key variables and assumptions

<table>
<thead>
<tr>
<th>Key Assumptions</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Total Meters Residential</td>
<td>Defines the total percentage of residential meters in AEC’s territory, received from AEC</td>
<td>86%</td>
</tr>
<tr>
<td>% of Total Meters Commercial</td>
<td>Defines the total percentage of commercial meters in AEC’s territory, received from AEC</td>
<td>14%</td>
</tr>
<tr>
<td>Capital Build Cost</td>
<td>Percent of the total estimate build cost realized in actual construction – estimated savings are currently projected at 20% on the total build</td>
<td>80%</td>
</tr>
<tr>
<td>Uptake</td>
<td>Total households and businesses that would subscribe to new fiber broadband services on the AEC infrastructure, estimated based on current competition and superior product offerings</td>
<td>50%</td>
</tr>
<tr>
<td>ARPU Residential</td>
<td>Average Revenue per User, calculated based on residential market study of AEC service area</td>
<td>$120</td>
</tr>
<tr>
<td>ARPU Commercial</td>
<td>Average Revenue per User, calculated based on commercial market study of AEC service area</td>
<td>$250</td>
</tr>
<tr>
<td>Cost of Services Load</td>
<td>Estimated cost of providing retail broadband services through a third-party provider leasing the AEC infrastructure</td>
<td>45%</td>
</tr>
<tr>
<td>SG&amp;A Load</td>
<td>Estimated sales, general and administrative costs of a third-party provider leasing the AEC infrastructure to deliver broadband services</td>
<td>17%</td>
</tr>
<tr>
<td>Tax Load (Applies to Private Partner Only)</td>
<td>Estimate income tax on profits of a third-party broadband provider</td>
<td>20%</td>
</tr>
</tbody>
</table>
5.3 AEC Fiber Build Costs and Financing

Based on these variable and assumption values, an Internal Rate of Return (IRR) was modeled to identify the cash flows available to AEC that would be used for repayment of debt used to fund the initial construction of the network. The model used to generate the IRR assumes that AEC finances the full cost of fiber infrastructure of $72 million using a revenue bond at 5% on a 20-year term and with a cost of issuance of 1%. The funding breakdown is illustrated in Figure 42.

Figure 42: AEC financing for fiber infrastructure

<table>
<thead>
<tr>
<th>Financing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Funding Required</td>
<td>$72,085,714</td>
</tr>
<tr>
<td>Additional Operations Funding Required</td>
<td>$5,625,596</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>5%</td>
</tr>
<tr>
<td>Term, in Years</td>
<td>20</td>
</tr>
<tr>
<td>Cost of Issuance</td>
<td>1%</td>
</tr>
<tr>
<td>Total Capital Funding</td>
<td>$72,806,572</td>
</tr>
<tr>
<td>Annual Payments (P&amp;I)</td>
<td>$5,784,344</td>
</tr>
<tr>
<td>Annual Free Cash Flow After Debt Service (Steady Run Rate)</td>
<td>$4,671,688</td>
</tr>
</tbody>
</table>

Figure 43 illustrates the IRR for AEC, based on the return on investment that each community achieves over periods of 10, 15 and 20 years. The IRR model assumes that AEC finances the full cost of fiber infrastructure. This also assumes that AEC would provide an additional fund for working capital to cover startup operating expenses for the first years of operations. The IRR values represent the rate of return to AEC after debt service is paid and reserve requirements are met, set at 10% of free cash flows per year. Table cells in red represent IRRs less than zero while IRRs in green are greater than zero.

Figure 43: AEC IRR analyzer

<table>
<thead>
<tr>
<th>Service Area</th>
<th>IRR Calculator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 Year</td>
</tr>
<tr>
<td>Hamblen County</td>
<td>-9.84%</td>
</tr>
<tr>
<td>White Pine</td>
<td>-4.11%</td>
</tr>
<tr>
<td>Dandridge</td>
<td>-11.36%</td>
</tr>
<tr>
<td>Jefferson City</td>
<td>0.72%</td>
</tr>
<tr>
<td>Unincorporated Jefferson County</td>
<td>-20.89%</td>
</tr>
<tr>
<td>Total Project</td>
<td>-14.47%</td>
</tr>
</tbody>
</table>
As important point to realize, as shown in Figure 43, is that some communities drive higher returns than other communities. Over time, the cities of White Pine, Dandridge and Jefferson City produce stronger financial performance than the rural and unincorporated areas so that the network generates a small positive IRR when all investments are made over the entire project. This demonstrates the potential to provide fiber-to-the-premise services to AEC’s entire region by deploying to both the urban and rural communities across a phased approach.

To understand whether a private investor would participate in this financing, a separate IRR table was constructed in Figure 44. This table illustrates the returns a private investor would generate if investing in the project under similar assumptions stated in Figure 41. However, in the case of a private investor, two key variables change.

First, the investor will have a higher cost of capital and rate of return requirement than AEC. Second, the private investor’s gains will be taxable, estimated at 20% of net income, rather than tax-free, resulting in lower overall cash flows returned to the investor. These two variables have been built into the financial modeling to determine the realized IRR for a private investor.

The results of this analysis are shown in Figure 44. The IRRs that fail to meet the requirements of private investment are shown in red while favorable private investment IRRs are shown in green. As demonstrated, only two cities show suitable IRRs for private investors, including White Pine over a 15-year investment with a 10% return, and Jefferson City over a wider span of investment return options.

![Figure 44: Investor IRR analyzer](image)

<table>
<thead>
<tr>
<th>Service Area</th>
<th>IRR Calculator</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 Year</td>
<td>15 Year</td>
<td>20 Year</td>
<td>10 Year</td>
<td>15 Year</td>
<td>20 Year</td>
</tr>
<tr>
<td>Hamblen County</td>
<td>1.53%</td>
<td>7.13%</td>
<td>9.24%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Pine</td>
<td>4.93%</td>
<td>10.01%</td>
<td>11.82%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dandridge</td>
<td>0.59%</td>
<td>6.36%</td>
<td>8.55%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jefferson City</td>
<td>8.15%</td>
<td>12.76%</td>
<td>14.31%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unincorporated Jefferson County</td>
<td>-3.92%</td>
<td>2.60%</td>
<td>5.25%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Project</td>
<td>-1.02%</td>
<td>5.01%</td>
<td>7.36%</td>
<td>Minimum Return 7% Privately Financed</td>
<td>Minimum Return 10% Privately Financed</td>
<td>Minimum Return 13% Privately Financed</td>
</tr>
</tbody>
</table>

With some effort, AEC could potentially attract private investment to some areas; however, it would likely need to be complemented with public investment. This sets the stage for a potential public-private partnership whereby public and private capital is deployed and both entities receive their required returns.
5.4 Business Model Recommendation

As mentioned elsewhere, the difficult demographics and rural population density of the unincorporated portions of the AEC service area makes the investment opportunity of the entire service area unattractive for private investors. However, long-term, low-interest federal loans are available, primarily from the USDA. Favorable rates of return can be realized across longer investment periods that makes for feasible investment scenarios for public entities like AEC, which typically are comfortable financing long-term public infrastructure projects.

As for business models, the willing partner of MUS FiberNet makes owning the fiber infrastructure and contracting for services through the neighboring municipal broadband utility an attractive option. Partnering with MUS FiberNet will allow AEC to forgo the costly expense for video and voice services, while providing member-customers a transparent, AEC-branded experience of the highest quality. Further, by skipping an open access model, more revenue can be retained locally and by local service providers while offering AEC customers broadband and all the future digital services they will need.

5.5 Phased Build-Out Recommendation

By starting small and focusing on generating early returns, and by plowing early revenues into future fiber infrastructure growth, a phased approach is an attractive option that will allow a low-risk method of growing the network and broadband services deeper into the AEC service area.

The phased build-out will begin with diverse and redundant fiber routes into and out of the AEC service area. Connections to MUS FiberNet should be arranged with a fiber connection established between MUS FiberNet and the AEC network operations center. Proceed with a phased network deployment, beginning with a "pilot" area, ideally an area with a relatively dense customer base and a mix of households and businesses.

In the interest of all AEC service area communities, any AEC broadband effort must start and find success in the cities. The early growth and adoption of services in each of the cities of the AEC service area will enable the prospects of growing and sustaining network operations into the rural reaches of the AEC service area.
5.6 **Next Steps**

- Begin putting together a comprehensive financial package to seek funding
- Prepare a detailed business plan as part of the above financial package
- Research funding sources
- Prepare and issue a Request for Interest (RFI) for a third-party service provider
- Identify initial pilot deployment area/s
- Issue a Request for Proposal for design-build of network
- Prepare governance documentation and AEC integration and management of the new fiber-optic asset
- Prepare Service Level Agreement to guarantee service rules of delivery to AEC members
- Engage local legal resources to review all agreements
- Establish an interlocking agreement between MUS, third-party service providers, and AEC
- Establish fiber project management team and reporting procedures
- Establish a target date to build to and serve pilot customers
- Estimate a timeframe for services to be broadly ready and available.
**Appendix A: Glossary of Terms**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G – Third Generation</td>
<td>The third generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.</td>
</tr>
<tr>
<td>4G – Fourth Generation</td>
<td>The fourth generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.</td>
</tr>
<tr>
<td>ADSL – Asymmetric Digital Subscriber Line</td>
<td>DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service.</td>
</tr>
<tr>
<td>AMI - Advanced Metering Infrastructure</td>
<td>Electrical meters that measure more than simple consumption and an associated communication network to report the measurements.</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>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).</td>
</tr>
<tr>
<td>Bit</td>
<td>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).</td>
</tr>
<tr>
<td>BPON – Broadband Passive Optical Network</td>
<td>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.</td>
</tr>
<tr>
<td>Broadband</td>
<td>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).</td>
</tr>
<tr>
<td>CAI – Community Anchor Institutions</td>
<td>The NTIA defines CAIs as &quot;Schools, libraries, medical and healthcare providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities.&quot; Universities, colleges, community colleges, social service providers, public safety, government, and municipal offices are all CAIs.</td>
</tr>
<tr>
<td>CLEC – Competitive Local Exchange Carrier</td>
<td>Wireline service provider authorized under state and Federal law to compete with ILECs to provide local telephone service. CLECs provide services by: 1) building or rebuilding telecommunications facilities of their own, 2) leasing capacity from another local telephone company (typically an ILEC) and reselling it, and 3) leasing discrete parts of the ILEC network referred to as UNEs.</td>
</tr>
<tr>
<td>CO – Central Office</td>
<td>A circuit switch where the phone lines in a geographical area come together, usually housed in a small building.</td>
</tr>
<tr>
<td>Coaxial Cable</td>
<td>A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this technology.</td>
</tr>
<tr>
<td>CPE – Customer Premise Equipment</td>
<td>Any terminal and associated equipment located at a subscriber’s premises and connected with a carrier’s telecommunication channel</td>
</tr>
<tr>
<td>Demarcation Point (“demarc”)</td>
<td>The point at which the public switched telephone network ends and connects with the customer’s on-premises wiring.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Dial-Up</strong></td>
<td>A technology that provides customers with access to the Internet over an existing telephone line.</td>
</tr>
<tr>
<td><strong>DLEC – Data Local Exchange Carrier</strong></td>
<td>DLECs deliver high-speed access to the Internet, not voice. Examples of DLECs include Covad, Northpoint and Rhythms.</td>
</tr>
<tr>
<td><strong>Downstream</strong></td>
<td>Data flowing from the Internet to a computer (browsing the net, getting E-mail, downloading a file).</td>
</tr>
<tr>
<td><strong>DSL – Digital Subscriber Line</strong></td>
<td>The use of a copper telephone line to deliver “always on” broadband Internet service.</td>
</tr>
<tr>
<td><strong>E-Rate</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>EON – Ethernet Optical Network</strong></td>
<td>The use of Ethernet LAN packets running over a fiber network.</td>
</tr>
<tr>
<td><strong>EvDO – Evolution Data Only</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>FCC – Federal Communications Commission</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>FTTP – Fiber to the premise (or FTTB – Fiber to the building)</strong></td>
<td>A fiber-optic system that connects directly from the carrier network to the user premises.</td>
</tr>
<tr>
<td><strong>GIS – Geographic Information Systems</strong></td>
<td>A system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.</td>
</tr>
<tr>
<td><strong>GPON – Gigabit-Capable Passive Optical Network</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>GPS – Global Positioning System</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>ICT – Information and Communications Technology</strong></td>
<td>Often used as an extended synonym for information technology (IT), but it is a 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.</td>
</tr>
<tr>
<td><strong>ILEC – Incumbent Local Exchange Carrier</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>ISDN – Integrated Services Digital Network</strong></td>
<td>An alternative method to simultaneously carry voice, data, and other traffic, using the switched telephone network.</td>
</tr>
<tr>
<td><strong>ISP – Internet Service Provider</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Glossary of Terms</strong></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>ITS – Intelligent Traffic System</strong></td>
<td>Advanced applications that, 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.</td>
</tr>
<tr>
<td><strong>Kbps – Kilobits per second</strong></td>
<td>1,000 bits per second. A measure of how fast data can be transmitted.</td>
</tr>
<tr>
<td><strong>LAN – Local Area Network</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>LATA – Local Access and Transport Areas</strong></td>
<td>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 typically include local and local toll services.</td>
</tr>
<tr>
<td><strong>Local Loop</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>MAN – Metropolitan Area Network</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Mbps – Megabits per second</strong></td>
<td>1,000,000 bits per second. A measure of how fast data can be transmitted.</td>
</tr>
<tr>
<td><strong>MPLS – Multiprotocol Label Switching</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Overbuilding</strong></td>
<td>The practice of building excess capacity. In this context, it involves investment in additional infrastructure projects to provide competition.</td>
</tr>
<tr>
<td><strong>OVS – Open Video Systems</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>PON – Passive Optical Network</strong></td>
<td>A PON consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer’s premises. 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 or couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared by many customers, thereby dramatically lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications.</td>
</tr>
<tr>
<td><strong>PPP – Public-Private Partnership</strong></td>
<td>A Public–Private Partnership (PPP) is a venture 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 P3.</td>
</tr>
<tr>
<td><strong>Glossary of Terms</strong></td>
<td><strong>QOS – Quality of Service</strong></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Definition</strong></td>
<td>Refers to a broad collection of networking technologies and techniques to provide guarantees on a network to deliver predictable results reflected in Service Level Agreements. Elements of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate. QoS involves prioritization of network traffic.</td>
</tr>
</tbody>
</table>

| **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 antennae. |

| **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. |


| **SONET – Synchronous Optical Network** | A family of fiber-optic transmission rates. |

| **Steaming** | Streamed data is any information/data that is 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. |

| **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 that manages the E-Rate program. |
| **VLAN – Virtual Local Area Network** | In computer networking, a single 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. |
| **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. |
| **Wi-Fi** | Wi-Fi is a popular technology that allows an electronic device to exchange data or connect to the Internet wirelessly using radio waves. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards." |
| **Wi-Max** | Wi-Max is a wireless technology that provides high-throughput broadband connections over long distances. Wi-Max 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. |
Appendix B:  Legal Analysis from Baller Herbst Stokes & Lide

Legal analysis of proposed AEC-MUS partnership model begins on next page.

By way of introduction, from the firm’s website, www.baller.com:

Jim Baller is president of Baller Herbst Stokes & Lide, PC, a national law firm based in Washington, DC. Baller Herbst Stokes & Lide represents clients in a broad range of communications matters nationally and in more than 35 states, including telecommunications, cable television, high-capacity broadband communications, the Internet, wireless communications, right-of-way management, pole and conduit attachments, barriers to community broadband initiatives, bankruptcy, privacy, and antitrust.

Jim’s clients include the American Public Power Association, the National Association of Telecommunications Officers and Advisors (NATOA), regional and state utility associations and municipal leagues, and numerous public and private entities in more than 35 states. Jim was the founder and president of the US Broadband Coalition, a large and diverse group that helped develop a national consensus on the need for a national broadband strategy. That recommended framework was subsequently reflected in the Federal Communications Commission’s National Broadband Plan. Jim served as a consultant to Google in Fiber for Communities projects and Gig.U projects.

The Fiber to the Home Council has recognized Jim as “the nation’s most experienced and knowledgeable attorney on public broadband matters.” In 2001, NATOA designated him as its Member of the Year. In 2006, MuniWireless presented him its first Esme Award for “working tirelessly to protect the interests of municipalities, many times in the face of huge opposition.”

As a litigator, Jim has had first-chair responsibility in numerous cases involving complex factual, legal and policy issues, multiple parties, and large amounts in controversy. He also works regularly with multi-disciplinary teams of legal, financial, accounting, engineering and other technical experts to assist local and regional government entities in making comprehensive telecommunications plans, establishing state-of-the-art communications systems, developing strategic partners, and integrating right-of-way and zoning ordinances, franchises, licenses, pole-attachment agreements, contracts, forms, permits and other related documents.

Jim is a frequent keynote speaker and author on communications matters. He is a graduate of Dartmouth College and Cornell Law School. He is a member of the Bars of the Supreme Court of the United States; the United States Circuit Courts of Appeal for the District of Columbia, Federal, Third, Fourth, Fifth, Sixth, Eighth, and Eleventh Circuits; and the courts of the District of Columbia. He holds Martindale-Hubbell’s highest AV Preeminent rating.
Morristown Utility Systems (“MUS”) and Appalachian Electric Cooperative (“AEC”) are planning to work together, along with a private entity, to introduce greater broadband capabilities to eastern portions of Tennessee through the development of the East Tennessee Network. Specifically, we understand that MUS and AEC have developed a business plan under which MUS will provide content to AEC at a point within Morristown’s territorial limits. AEC will then transport the content to various locations in Eastern Tennessee under an agreement with a yet-to-be-determined private-sector service provider. The service provider, in turn, will sell the finished services to residential, business, and other customers. MUS and AEC have asked Baller Herbst Stokes & Lide (“BHSL”) to provide an analysis of the relevant federal and State legal, regulatory and policy issues impacting the proposed project.\(^\text{18}\)

As discussed below, we believe that the proposed East Tennessee Network may be established in a manner that is legal under both federal and State law. Depending on the scope of services to be offered, however, Tennessee law imposes certain limitations that may require the parties to structure their relationship in such a way that AEC is not deemed to be offering cable or Internet services, but,\(^\text{18}\)

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18 BHSL has substantial experience with federal communications laws and with broadband networks around the country, including in Tennessee. We are not, however, licensed to practice Tennessee law. For definitive advice on Tennessee law MUS and AEC must ultimately rely on their in-house and local Tennessee counsel.
rather is providing infrastructure and/or wholesale broadband transport. In structuring their business plan, MUS and AEC should also take into account some key regulatory requirements, such as federal universal service reporting and contribution obligations, and consider approaches that will minimize exposure to such requirements.

The document is organized as follows: We begin by providing a high-level overview of how communications services are generally treated under federal law, including definitions and explanations of key terms and concepts to which we will frequently refer throughout the remainder of the memo. We then discuss the authority issues under Tennessee law affecting the ability of municipal electric utilities and electric cooperatives to engage in the proposed communications activities. We then analyze the federal and state regulatory requirements that would apply to the proposed East Tennessee Network with respect to various communications services.

I. OVERVIEW OF FEDERAL COMMUNICATIONS LAW

An understanding of federal regulatory obligations requires a thorough understanding of several key definitions and recurring concepts that have evolved over time. Before delving into a service-by-service regulatory analysis, we will therefore provide an overview of the key terms and general framework of federal law relating to telecommunications, broadband, and voice over Internet protocol (“VoIP”). While somewhat lengthy, this discussion will provide the context and background for the many issues addressed in this memo. It will also enable us to minimize repetition, streamline our subsequent service-by-service analysis, and provide a one-stop reference document to which MUS-AEC can turn should it ever need to do so in the future.

A. The Communications Act of 1934

In 1934, Congress enacted the first comprehensive federal communications law, the Communications Act of 1934, which incorporated many key federal principles and requirements that continue to exist today.

In the Communications Act, Congress established the Federal Communications Commission (“FCC”) and gave it exclusive jurisdiction over "all interstate and foreign communication" and "all persons engaged ... in such communication."19 To the states, Congress reserved jurisdiction "with respect to intrastate communication service ... of any carrier."20

As initially enacted, the Act gave the FCC jurisdiction only over “common carriers” – that is, entities that hold themselves out as being willing to provide services indiscriminately to all who want them and are willing to pay the going rate and comply with the carrier’s standard terms and conditions. The Act required such common carriers to provide their services at just and reasonable prices; to refrain from making unjust or unreasonable discriminations; to utilize just and reasonable practices, classifications and regulations; to keep records, make reports and file tariffs in accordance with FCC

19 Communications Act, Section 2(a), 47 U.S.C. § 152(a).
20 Communications Act, Section 2(b), 47 U.S.C. § 152(b).
requirements; to obtain FCC approval before acquiring or constructing new lines or terminating services; and to participate in FCC complaint processes. The Act did not apply similar requirements to “private carriers” – i.e., entities that provide communications pursuant to individually-tailored, individually-negotiated agreements. As discussed below, this distinction between common and private carriage is still critically important today.

The Communications Act of 1934 also established the precedent of dividing communications services into separate and distinct categories, each with its own history, definitions and substantive requirements. The Act separated telephone and telegraph services from radio services, regulating the former under Title II and the latter under Title III. The FCC followed that precedent in the early 1970s, when it began to treat computer-based data and information processing services as a separate, unregulated category of services called “enhanced” or “information” services. Congress did so as well in 1984, when it added a new Title VI to the Communications Act to regulate cable television services, and again in 1993, when it added a new part to Title III to deal with wireless telecommunications services. The FCC has struggled to keep these categories separate, but with the rapid convergence of services and providers today, and particularly with the explosive growth of the Internet, both Congress and the FCC have been under increasing pressure to discard the traditional regulatory distinctions and reinvent the communications laws.

Between 1934 and 1996, Congress amended the Communications Act many times to respond to significant technological, commercial, legal and other developments, and the FCC and the courts interpreted the Act on scores of occasions. As new services that defied easy classification came on the market, the FCC and the states repeatedly fought over who had jurisdiction over them. Similarly, as the lines between computer applications, data processing, and telecommunications blurred, the FCC and the telecommunications industry continuously battled over whether, and to what extent, the new services should be regulated or unregulated. In particular, in a line of FCC decisions known as the “Computer Inquiries,” begun in the late 1960’s and culminating in a decision in 1986 known as “Computer III,” the Commission established the principle that an “enhanced service” (essentially computer processing) offered through the use of a telecommunications service was not itself subject to federal regulation under Title II of the Communications Act and would not be treated as a common carrier “telecommunications service.”

Despite constant tensions, the Communications Act survived for decades without fundamental change. In the early 1990s, pressure for a major overhaul of the federal communications laws began to mount. Incumbent and potential new local and long distance telephone companies, wireless providers, cable operators, computer firms, data processors, electric utilities and entities of many other kinds were eager to enter each other’s lines of business but were thwarted by the 1934 Act’s cumbersome cross-ownership restrictions and other burdensome requirements. By the mid-1990s, Congress was ready for a new regulatory paradigm. In the Telecommunications Act of 1996, it established a framework that it hoped would enable “everybody [to] compete everywhere in everything.”

21 Statement of Sen. Majority Leader Trent Lott (R-MS), *Congressional Record* at S.7906 (June 7, 1995).
B. The Telecommunications Act of 1996

A thorough discussion of how federal law regulates various communications services would be far beyond the scope of this analysis. The following is a highly simplified overview of the structure of federal communications regulation as it exists today, as framed by the Telecommunications Act of 1996. In the following section, we explain the key regulatory classifications of interest to the Town in greater detail.22

1. “Telecommunications Service”

The linchpin of the Telecommunications Act is the term “telecommunications service.” Congress used that term throughout the Act to allocate incentives and burdens among established and new entrants in ways that Congress thought would stimulate vigorous competition in all fields of communication. Section 3(46) of the Communications Act, 47 U.S.C. § 153(46) defines “telecommunications service” as:

The term “telecommunications service” means the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.


The embedded term “telecommunications is defined in Section 3(43) of the Communications Act, 47 U.S.C. § 153(43), as follows:

The term "telecommunications" means the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.

In simplest terms, telecommunications is the transport of information, whether it be voice, video or data of the users choosing between one or more points.

As the FCC and the courts have frequently held, the terms “telecommunications,” and “telecommunications service” reflect Congress’s intent to distinguish between common carriage and private carriage of telecommunications. For example, in an order implementing the Universal Service provisions of the Telecommunications Act of 1996, the FCC stated:

Our analysis focuses on provisions included in the outline above, but there are several other statutes located elsewhere in the United States Code that come into play as well. These include, for example, informational privacy obligations (The Wiretap Act – 18 U.S.C. §§ 2510-2522, The Stored Wire and Electronic Communications and Transactional Records Access, 18 U.S.C. §§ 2701–2712); and the Communications Assistance for Law Enforcement Act (CALEA) (Chapter 9, 47 U.S.C. 1001); The Copyright Act, 17 U.S.C. §§ 101, et seq.), and U.S. Tax Code, 16 U.S.C. § 101 et seq.
Directly to the Public. We find that the definition of “telecommunications services” in which the phrase “directly to the public” appears is intended to encompass only telecommunications provided on a common carrier basis. This conclusion is based on the Joint Explanatory Statement, which explains that the term telecommunications service “is defined as those services and facilities offered on a ‘common carrier’ basis, recognizing the distinction between common carrier offerings that are provided to the public...and private services.” Federal precedent holds that a carrier may be a common carrier if it holds itself out “to service indifferently all potential users.” Such users, however, are not limited to end users. Common carrier services include services offered to other carriers, such as exchange access service, which is offered on a common carrier basis, but is offered primarily to other carriers. Precedent further holds that a carrier will not be a common carrier “where its practice is to make individualized decisions in particular cases whether and on what terms to serve.”

In a later order, the FCC elaborated:

In interpreting those statutory definitions, the DC Circuit affirmed the Commission’s conclusions that the term “telecommunications service” “is intended to encompass only telecommunications provided on a common carrier basis,” and (ii) the term “telecommunications carrier,” which was added to the Act in 1996, has essentially the same meaning as the pre-existing term “common carrier.” Courts construing “common carrier” have held, inter alia, that “the primary sine qua non of common carrier status is a quasi-public character, which arises out of the undertaking to carry for all people indifferently;” and a “second prerequisite to common carrier status” is that “customers transmit intelligence of their own design and choosing.” Such

An examination of the common law reveals that the primary sine qua non of common carrier status is a quasi-public character, which arises out of the undertaking “to carry for all people indifferently. ...” This does not mean that the particular services offered must practically be available to the entire public; a specialized carrier whose service is of possible use to only a fraction of the population may nonetheless be a common carrier if he holds himself out to serve indifferently all potential users. Nor is it essential that there be a statutory or other legal commandment to serve indiscriminately; it is the practice of such indifferent service that confers common carrier status. That is to say, a carrier will not be a common carrier where its practice is to make individualized decisions in particular cases whether and on what terms to serve.

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23 In the Matter of Federal-State Joint Board on Universal Service, 12 FCC Rcd 8776 ¶ 785 (1997), citing the Joint Explanatory Statement of the Conference Committee, S. Rep. No. 104-230, 104th Cong., 2d Sess. 115 (1996) and National Association of Regulatory Utility Commissioners v. FCC, 553 F.2d 601, 608 (DC Cir. 1976). In the latter case, the court had defined common carriage as follows:
offering of service indiscriminately to the public may be either a wholesale offering to other carriers or a retail offering to end users. 24

In summary, the only difference between “telecommunications” and “telecommunications service” is the manner in which the provider holds itself out to the public. If the provider offers its services indiscriminately to any purchaser willing to pay the going rate and meet the provider’s standard terms and conditions, the provider is considered a “common carrier,” and its services are considered a “telecommunications service[s].” This can include “carriers’ carrier” services offered to other carriers. 25 If, however, a provider negotiates deals one-one-one, with potentially different terms and conditions for each, then the provider is considered a “private carrier.” The services of private carriers may include “telecommunications,” but they do not meet the definition of “telecommunications service” because they are not offered on a common-carrier basis.

The FCC has also made clear that whether a carriers’ carrier service involves common carriage or private carriage must be determined on a case-by-case basis. For example, in the so-called Virgin Islands Submarine Cable case, the FCC found that AT&T was not acting as a common carrier in offering telecommunications to “a significantly restricted class of users, including common carrier cable consortia, common carriers, and large businesses.” According to the FCC (and later the DC Circuit), an important consideration was that “AT&T-SSI would have to engage in negotiations with each of its customers on the price and other terms which would vary depending on the customers' capacity needs, duration of the contract, and technical specifications.” 26

Another case that sheds light on the distinction between private and common carriage is American Tel. & Tel. Co. v. FCC, 572 F.2d 17 (2d Cir. 1978). In that case, the court noted,

The FCC found that sharing is not common carriage and, therefore, not subject to regulation under Title II of the Communications Act. 47 U.S.C. § 153(h). Certainly, the FCC is not at liberty to manipulate the definition of "common carrier" in such a way as to achieve pre-determined regulatory goals. National Association of Regulatory


25 In the Matter of Federal-State Joint Board on Universal Service, 12 FCC Rcd 8776; 1997 FCC LEXIS 5786, ¶ 786 (1996) (Common carrier services include services offered to other carriers, such as exchange access service, which is offered on a common carrier basis, but is offered primarily to other carriers.

Utility Commissioners v. F.C.C., supra, 525 F.2d [530] at 644 [(DC Cir.), cert. denied, 425 U.S. 92 (1976)]. However, in concluding that sharing is not common carriage, the FCC did not engage in such manipulation. By definition, "sharing is a non-profit arrangement in which several users collectively use communication services and facilities provided by a carrier, with each user paying the communications related costs associated herewith according to its pro rata usage. . . ." 60 F.C.C.2d at 263.

According to the FCC, “a bona fide sharing arrangement exists wherein each participant has a communications need (other than a need to resell the service to others) for the services and facilities being shared.” 60 F.C.C.2d at 316 (emphasis added). As so defined, we can see no error in the FCC's conclusion that such activity tends to be private and is unlikely to constitute an undertaking to serve the public indiscriminately for hire. The FCC explained that it plans to regulate nominal sharing operations that begin to take on the characteristics of common carriage. Thus, a sharing operation that ceases to be a non-profit arrangement will be regulated. Profit is a significant indicium of common carriage; it increases the likelihood that the party making the profit is also making an indiscriminate offering to the public. The FCC also said it would look to the use of advertising or of short-term joint arrangements as criteria, either of which might signal the existence of an indiscriminate offering to the public. The suggestion by petitioners that the FCC has made profit a test of common carriage, where the statute creates no such requirement, is not well taken. The FCC has not altered the statutory requirements, it has merely articulated criteria to which it will look to determine whether the statutory requirements are met. We find the use of such criteria both advisable and proper.

American Tel. & Tel., 572 F.2d at 26-27 (emphasis added). As discussed below, the above distinctions will affect the FCC’s characterization of the business arrangement among MUS, AEC and the third-party provider – i.e., is MUS of AEC providing “telecommunications,” and, if so, is it doing as a common carrier or a private carrier?

The requirement that “telecommunications services” be offered “for a fee” does not mean that the entity providing the service has to be a for-profit entity or that the service needs to be a for-profit service. It merely requires that compensation of any kind be provided in exchange for the service. Thus, the fact that both MUS and AEC are non-profit entities does not exempt the service from being a “telecommunications service.”

Among the many consequences of being classified as a common carrier of “telecommunications service” is that the carrier must provide service pursuant to non-discriminatory rates, terms and conditions; interconnect its facilities with those of other telecommunications service providers; and refrain from discriminating against disabled persons (Section 251); file reports and make contributions to the federal Universal Service Fund (USF) (Section 254); protect the privacy of its customers (Section 222); submit to the FCC’s enforcement authority and rules for maintaining services and reporting data (Section 208); and meet many other requirements that Title II imposes on common carriers.
At the same time the Act also offers benefits to providers of “telecommunications service,” including interconnection, unbundling, resale, and pole attachment rights. Providers of “telecommunications service” may also qualify for subsidies under various federal universal service programs (Section 254) and from protection from state and local barriers to entry (Section 253).27

2. Broadband Internet access service (“BIAS”)

Under the regulatory scheme introduced by the Telecommunications Act of 1996, as outlined above, there was no separate title or regulatory category for “broadband” or Internet-based services. As a result, in the late 1990s, as cable operators, telephone companies, and other providers began to offer similar Internet-based services through different technologies, questions arose about how such services should be classified and regulated. For example, if a cable operator provided Internet access as “cable modem service” over its cable system, was that service a “cable service,” a “telecommunications service,” or an “information service”?28 If a telephone company provided essentially the same service over its telephone network via Digital Subscriber Line (DSL) technology, was the service a “telecommunications service” or an “information service”? Similar questions arose about the proper regulatory classification of Voice over Internet Protocol, Internet Protocol Television, and other IP-enabled services that used Internet Protocol to provide traditional services in new and improved ways.

In 2002, the FCC attempted to reconcile the definitions of “telecommunications,” “telecommunications service,” and “information service” in a declaratory ruling on the classification and regulation of cable modem service. In the ruling, the FCC found that cable modem service is commonly offered to consumers as a combination of two services: an “information service” and “telecommunications,” as these terms are defined in the Communications Act (see above). According to the FCC, when these two services are inextricably bundled together and offered as a single service, the data transmission component loses its identity, and the combination becomes an unregulated “information service.” This decision was upheld by the Supreme Court of the United States, in a case commonly referred to as “Brand X.”29 The FCC then issued a series of decisions applying the rationale of its Cable Modem Declaratory Ruling to wireline, powerline, and wireless broadband

27 The Supreme Court has held that Section 253 does not protect public entities from state barriers to the provision of telecommunications services. Nixon v. Missouri Municipal League, 541 U.S.C. 125 (2004). Section 253 does, however, apply to cooperatives, which are not public entities.

28 The Telecommunications Act carried forward the principle of unregulated “enhanced services” and renamed them as “information services.” As amended by the Telecommunications Act, Section 3(20) of the Communications Act, 47 U.S.C. § 153(20), defined the term “information service” as “the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service.”

Internet access service.\textsuperscript{30} As a result, between 2005 and 2015, broadband Internet access services ("BIAS") was treated as an unregulated information service. This was a critically important issue for many reasons, including that providers of “Internet access services” were exempt from federal USF contribution requirements.

In February 2015, the FCC reversed course and reclassified BIAS as a telecommunications service in its \emph{Open Internet Order}.\textsuperscript{31} Justifying its change in direction, the FCC wrote:

\begin{quote}
[T]oday’s \emph{Order} concludes that the facts in the market today are very different from the facts that supported the Commission’s 2002 decision to treat cable broadband as an information service and its subsequent application to fixed and mobile broadband services. Those prior decisions were based largely on a factual record compiled over a decade ago, during an earlier time when, for example, many consumers would use homepages supplied by their broadband provider. In fact, the Brand X Court explicitly acknowledged that the Commission had previously classified the transmission service, which broadband providers offer, as a telecommunications service and that the Commission could return to that classification if it provided an adequate justification. Moreover, a number of parties who, in this proceeding, now oppose our reclassification of broadband Internet access service, previously argued that cable broadband should be deemed a telecommunications service. As the record reflects, times and usage patterns have changed and it is clear that broadband providers are offering both consumers and edge providers straightforward transmission capabilities that the Communications Act defines as a “telecommunications service.”\textsuperscript{32}
\end{quote}

Thus, the FCC now defines BIAS as: “[a] 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.”\textsuperscript{33} Anything meeting this description is considered BIAS and subject to Title II.


\textsuperscript{31} In the Matter of Protecting and Promoting the Open Internet, GN Docket No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, FCC 15-24, released March 12, 2015 (“Open Internet Order”).

\textsuperscript{32} Open Internet Order at ¶ 43.

\textsuperscript{33} Open Internet Order at ¶ 25.
The FCC’s *Open Internet Order* is currently being appealed in the United States Court of Appeals for the District of Columbia Circuit. Unless the *Open Internet Order* is overturned, retail broadband Internet access services will be classified as a telecommunications service subject to the common carrier regulations discussed below.

### 3. “Interconnected VoIP”

Voice-over-IP (VoIP) is a service that utilizes Internet Protocol transmission technology to transmit voice communication. There are various types of VoIP: some require the use of a computer and Internet connection at the both the calling and receiving end and do not connect with regular telephones (such as Skype’s traditional member-to-member service); some require a computer and Internet connection at the calling end, but can contact regular phones (such as Skype’s “SkypeOut,” Gmail chat, and others); and some do not require a computer at either end, relying instead on specialized adapters and/or software through which the calling phone is routed (such as Vonage’s Digital Voice service and the “digital phone” services commonly offered by cable companies).

The first type of VoIP described above is considered a pure “application” that uses the Internet, and it is not subject to federal or state regulation. The call never interacts with the public switched telephone network (PSTN) and is never routed to a local exchange carrier. In the second case, the caller is able to contact a phone using the PSTN, but another person using a phone cannot contact the VoIP user through the VoIP application. In the third case, the caller can contact a person on the PSTN, and a person using the PSTN can contact the VoIP user. The VoIP service is entirely transparent to both users.

Only the third case meets the definition of “interconnected VoIP,” as the FCC has interpreted that term for the purposes of federal law:

> [I]nterconnected VoIP services include those VoIP services that: (1) enable real-time, two-way voice communications; (2) require a broadband connection from the user’s location; (3) require IP-compatible customer premises equipment; and (4) permit users to receive calls from *and* terminate calls to the PSTN… To be clear, a service offering is ‘interconnected VoIP’ if it offers the *capability* for users to receive calls from and terminate calls to the PSTN; the offering is covered by CALEA for all VoIP communications, even those that do not involve the PSTN. Furthermore, the offering is covered regardless of how the interconnected VoIP provider facilitates access to and from the PSTN, whether directly or by making arrangements with a third party.

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35. There are some exceptions, such as Skype’s optional pay service that assigns a normal telephone number to the user.

The FCC has not yet decided whether “interconnected VoIP” is a regulated “telecommunications service” or an “information service.” Indeed, in the FCC’s Open Internet Order, the FCC specifically found that interconnected VoIP is a “non-BIAS data service.” The only clear pronouncement from the FCC is that interconnected VoIP is inherently an “interstate” in nature, so states are preempted from regulating VoIP providers’ entry, prices, or terms and conditions of sale.37

While the FCC has steadfastly refused to clarify the regulatory classification of interconnected VoIP, the FCC has imposed numerous regulatory requirements on interconnected VoIP telephone services that in many way mirror regulatory obligations on traditional voice telephone service, including requirements related to consumer privacy protection, E-911 and contributions to the federal USF. As a result, if an interconnected VoIP telephone service is offered as a service as part of the Eastern Tennessee Network will be subject to regulations as discussed below.

4. Cable Service

Cable service providers are regulated under the federal cable provisions of Title VI of the Communications Act and are required to register with the FCC and obtain a franchise at either the state or local level, depending on state law. As with telecommunications services and information services, the federal definitions related to the provision of cable service providers are important in defining the rights and responsibilities of video service providers.

The term “cable operator” is defined in Section 602(5) of the Communications Act, 47 U.S.C. § 522(5) (with our emphasis added):

[A]ny person or group of persons (A) who provides cable service over a cable system and directly or through one or more affiliates owns a significant interest in such cable system, or (B) who otherwise controls or is responsible for, through any arrangement, the management and operation of such a cable system;

The term “affiliate” is defined in Section 602(2), 47 U.S.C. § 522(2):

[W]hen used in relation to any person, [the term “affiliate”] means another person who owns or controls, is owned or controlled by, or is under common ownership or control with, such person.

The term “cable service” is defined in Section 602(6), 47 U.S.C. § 522(6):

(A) the one-way transmission to subscribers of (i) video programming, or (ii) other programming service, and (B) subscriber interaction, if any, which is required for the selection or use of such video programming or other programming service;

The term “video programming” is defined in Section 602(20), 47 U.S.C. § 522(20):

37 In re Vonage Holdings Corp., 19 FCC Rcd. 22404 (2004); upheld in Minnesota Public Utils. Com’n v. F.C.C., 483 F.3d 570 (8th Cir. 2007).
Finally, the term “cable system” is defined in Section 602(7), 47 U.S.C. § 522(7) (again with our emphasis added):

…a facility, consisting of a set of closed transmission paths and associated signal generation, reception, and control equipment that is designed to provide cable service which includes video programming and which is provided to multiple subscribers within a community, but such term does not include:

(A) a facility that serves only to retransmit the television signals of 1 or more television broadcast stations;
(B) a facility that serves subscribers without using any public right-of-way;
(C) a facility of a common carrier which is subject, in whole or in part, to the provisions of title II of this Act, except that such facility shall be considered a cable system (other than for purposes of section 621(c)) to the extent such facility is used in the transmission of video programming directly to subscribers, unless the extent of such use is solely to provide interactive on-demand services;
(D) an open video system that complies with section 653 of this title; or
(E) any facilities of any electric utility used solely for operating its electric utility systems.

II. AUTHORITY ISSUES

In this section we discuss MUS’s and AEC’s authority to provide or facilitate the provision of communications services under federal and state law. Because MUS and AEC are treated different under both federal and state law, we address their rights separately.

A. MUS’s Authority

1. Federal Law

While federal law encourages local government entities to provide communications services of all kinds, it does not affirmatively empower them to do so. For enabling authority, a local government entity must look to state and local law. Moreover, such authority must exist for each activity in question.38

38 For example, in City of Bristol, VA v. Earley, 145 F.Supp.2d 741, 745 (W.D. Va. 2001), the court held that the City has authority to provide telecommunications services, but in Marcus Cable Associates, L.L.C. v. City of Bristol, 237 F.Supp.2d 675, 678-79 (W.D.VA 2002), the same court held that the City does not have authority to provide cable television service. According to the court, the critical difference was that Virginia’s statute authorizing localities to establish “public utilities” applied to telecommunications services but not to cable television.
Section 253(a) of the Communications Act provides:

(a) IN GENERAL.--No State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.

Despite the broad sweep of this language, the courts have held that it does not affirmatively authorize municipalities to provide telecommunications services, nor does it even prohibit states from prohibiting municipalities from providing such services. Nixon v. Missouri Municipal League, 541 U.S. 125 (2004).

In contrast, with regard to broadband services, the FCC has recently found in its Section 706 Preemption Order\(^\text{39}\) that Section 706 of the Telecommunications Act of 1996\(^\text{40}\) empowers the FCC to preempt and remove state laws, such as the Tennessee and North Carolina measures that act as barriers to public broadband investment. In doing so, however, the FCC specifically limited its decision to instances which a state has authorized a municipal entity to provide an underlying broadband service and then imposed restrictions or barriers on the ability the entity to provide such services in conflict with federal policies. Thus, the FCC did not find that it could authorize a municipality to provide services that its state has not already authorized it to provide.

More specifically, in its Preemption Order, the FCC specifically preempted the language in Tennessee Code Section 7-52-601 (“Section 601”) that prevents municipal electric utilities from offering Internet and video programming services outside of their electric service territory. The FCC’s Preemption Order has been appealed by the State of Tennessee in the United States Court of Appeals for the Sixth Circuit.\(^\text{41}\)


\(^{40}\) Section 706(b), 47 U.S.C.§ 1302(b), provides that the Commission “shall, within 30 months after February 8, 1996, and annually thereafter, initiate a notice of inquiry concerning the availability of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) and shall complete the inquiry within 180 days after its initiation. In the inquiry, the Commission shall determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion. If the Commission’s determination is negative, it shall take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market.”

\(^{41}\) Oral argument in the appeal is scheduled for March 17, 2016.
2. State Authority for Municipal Utilities

Unless a municipality in Tennessee has adopted a “home rule” charter under Article XI, Section 9, of the Tennessee Constitution, interpretation of its powers is subject to a rule of strict statutory construction known as “Dillon’s Rule.” In City of Clarksville v. Dixon, 2005 WL 3504589 (Tenn.Ct.App.) (Not Reported in S.W.3d), the court succinctly summarized the rule as follows:

When this Court determines whether a municipality has the authority to act, we must apply Dillon’s Rule to construe the intent of the legislature. See Arnwine v. Union County Bd. of Educ., 120 S.W.3d 804, 807 (Tenn.2003). “At its most basic level, Dillon's Rule is a canon of statutory construction that calls for the strict and narrow construction of local governmental authority.” Id. Under this rule, a municipal government may act when:

(1) the power is granted in the “express words” of the statute, private act, or charter creating the municipal corporation; (2) the power is “necessarily or fairly implied in, or incident to[,] the powers expressly granted”; or (3) the power is one that is neither expressly granted nor fairly implied from the express grants of power, but is otherwise implied as “essential to the declared objects and purposes of the corporation.”

We understand that Morristown has not adopted a home rule charter and must therefore look to express grants of state authority under the general laws of Tennessee.

Under the general laws of Tennessee, municipal utilities have relatively broad authority to provide communications services within their electric service area but are generally prohibited from providing services other than telecommunications services outside of their electric service areas. Indeed, MUS already provides competitive cable, Internet and telephone services over its own broadband fiber optic network known as “FiberNet.”

a. Telecommunications services – bandwidth transport

The authority for Tennessee municipal electric systems, including MUS, to own and operate telecommunications systems is found in Chapter 531, Public Acts of 1997, codified as Tenn. Code Ann. §§ 7-52-401, et seq. The basic authority granted by that Chapter is described in the first sentence of Section 401, key language of which is highlighted:

Every municipality operating an electric plant, whether pursuant to this chapter, any other public or private act or the provisions of the charter of the municipality, county

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42 The Rule takes its name from John F. Dillon, a Federal Circuit Judge, Chief Justice of the Iowa Supreme Court. This rule was first adopted by the Tennessee Supreme Court in Mayor & City Council of Nashville v. Linck, 80 Tenn. (12 Lea.) 499 (1883).
or metropolitan government, has the power and is authorized, on behalf of its municipality acting through the authorization of the board or supervisory body having responsibility for the municipal electric plant, to acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant or equipment for the provision of telephone, telegraph, telecommunications services, or any other like system, plant, or equipment within or without the corporate or county limits of such municipality, and, with the consent of such other municipality, within the corporate or county limits of any other municipality, in compliance with title 65, chapters 4 and 5, and all other applicable state and federal laws, rules and regulations. A municipality shall only be authorized to provide telephone, telegraph or telecommunications services through its board or supervisory body having responsibility for the municipality's electric plant. A municipality providing any of the services authorized by this section may not dispose of all or substantially all of the system, plant and equipment used to provide such services except upon compliance with the procedures set forth in § 7-52-132. Notwithstanding § 65-4-101(6)(B) or any other provision of this code or of any private act, to the extent that any municipality provides any of the services authorized by this section, such municipality shall be subject to regulation by the Tennessee regulatory authority in the same manner and to the same extent as other certificated providers of telecommunications services, including, but not limited to, rules or orders governing anti-competitive practices, and shall be considered as and have the duties of a public utility, as defined in § 65-4-101, but only to the extent necessary to effect such regulation and only with respect to such municipality's provision of telephone, telegraph and communication services.

i. Scope of services authorized

The operative grant of authority under Section 401 is to “acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant or equipment for the provision of telephone, telegraph, telecommunications services.”

The phrase “telecommunications service” is defined in Section 1220-4-80.01 of the Tennessee Regulatory Authority Code as follows (with emphasis added).

(ee) Telecommunications Services - A generic term describing two-way communications services transmitted over communications facilities. These services include voice, data, and video transmissions. These services exclude the transmission of one-way or two-way television and radio communications over traditional cable television and broadcast facilities provided exclusively between TV or radio subscribers and the TV or radio service provider.

This definition and its focus on the transport of communications is in many ways comparable to the federal definition of “telecommunications” discussed above, and is not limited to common carrier offerings. To the extent that a municipal utility provides telecommunications – transport – on a common carrier basis, it will be subject to regulation by the TRA.
Further, the lease of dark fiber would appear to be authorized as it falls squarely within the “lease” of “plant or equipment for the provision of telephone, telegraph, telecommunications services.” By definition, “dark fiber” is unlit fiber optic cable that does not include the electronics necessary to transmit information. As one court has succinctly found, “[b]ecause dark fiber is bare capacity, it technically is neither a telecommunications service nor a cable service. In fact, it is not a service at all; it is simply an inactive fiber.” Gulf Power Co. v. FCC, 208 F.3d 1263, 1278 (11th Cir.), rev’d on other grounds sub nom, Nat’l Cable & Telecom. Ass’n v. Gulf Power Co., 547 U.S. 327 (2001). For the same reason, the FCC has repeatedly held that leasing dark fiber is neither “telecommunications” nor “telecommunications service.” For example, the FCC’s USF Form 499A has long had a line item for “Revenues other than U.S. telecommunications revenues, including information services, inside wiring maintenance, billing and collection customer premises equipment, published directory, dark fiber, Internet access, cable TV program transmission, foreign carrier operations, and non-telecommunications revenues.”43

ii. No territorial restriction

The authority granted under Section 401 is to build and operate telecommunications plant and provide telecommunications services is throughout the state. Specifically, the authority granted, is “within or without the corporate or county limits of such municipality, and, with the consent of such other municipality, within the corporate or county limits of any other municipality.”

iii. State regulation or restrictions

Under Title 7, Section 52, Part 4 of the Tennessee Code, “[a] municipality providing any of the services authorized by this section” is subject to a variety of regulatory and other requirements.

- Under Section 401, a municipality may not dispose of all or substantially all of the system, plant and equipment used to provide such services, except upon compliance with the procedures set forth in § 7-52-132;

- Under Section 401, a municipality is subject to regulation by the TRA in the same manner, and to the same extent, as other certificated providers of telecommunications services, including, but not limited to, rules or orders governing anti-competitive practices, and shall be considered as and have the duties of a public utility, as defined in § 65-4-101;

- Under Section 402, a municipality cannot cross-subsidize its communications services, but it may allocate electric plant for such services and lend funds at a rate of interest not less than the highest rate then earned by the municipality on invested electric plant funds, to acquire, construct, and provide working capital for the system;

- Under Section 403, a municipality may not provide services unrelated to its electric services within the service area of an existing telephone cooperative with fewer than one hundred thousand (100,000) total lines;

43 FCC, Universal Service Form 499A, Instructions for Completing Line 418 (emphasis added).
• Under Section 404, a municipality must make payments in lieu of taxes on the services in question;

• Under Section 405, a municipality shall allocate to the costs of providing services amounts reflecting its highest pole-attachment charges to third parties as well as any applicable rights-of-way fees, rentals, charges, or payments required by state or local law of a nongovernmental corporation that provides the identical services;

• Under Section 406, a municipality is prohibited from providing alarm or paging services.

Apart from the above requirements and limitations, there are no explicit restrictions on the ability of municipal electric utilities to contract to provide telecommunications plant – fiber, telecommunications on a wholesale basis, enter into private carrier agreements or enter into public-private partnerships related to the provision of telecommunications. Indeed, while telecommunications offerings by municipal utilities are subject to regulation by the TRA, they are only subject to such regulation to the same extent as other certificated providers of telecommunications services, and such other providers are not prohibited from entering into joint ventures, private carriage, or wholesale telecommunications transport offerings. Further Section 403(a) not only provides that municipal utilities providing telecommunications services, are subject to the same obligations as other providers, but it also states that they have all of the powers and authority granted to other entities providing such services.

To the extent that it provides any of the services authorized by § 7-52-401, a municipality has all the powers, obligations and authority granted entities providing telecommunications services under applicable laws of the United States or the state of Tennessee. To the extent that such authority and powers do not conflict with title 65, chapter 4 or 5, and any rules, regulations, or orders issued under title 65, chapter 4 or 5, a municipality providing any of the services authorized by § 7-52-401 has all the authority and powers with respect to such services as are enumerated in this chapter.

b. Internet and cable services

Section 601 authorizes municipal electric systems to provide Internet and cable services. Tenn. Code Ann. § 7-52-601, et seq. Although the language and structure of Section 601 is similar to that of Section 401, Section 601 contains a territorial limitation that is not present in Section 401:

Each municipality operating an electric plant described in § 7-52-401 has the power and is authorized within its service area, under this part and on behalf of its municipality acting through the authorization of the board or supervisory body having responsibility for the municipal electric plant, sometimes referred to as “governing board” in this part, to acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant, or equipment for the

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provision of cable service, two-way video transmission, video programming, Internet services, or any other like system, plant, or equipment within or without the corporate or county limits of such municipality, and, with the consent of such other municipality, within the corporate or county limits of any other municipality.\footnote{45}

The effect of the four words “within its service area” is to bar municipal electric systems in Tennessee from offering Internet and video services beyond the areas of their respective electric service territories.

As indicated, the FCC’s \textit{Preemption Order} specifically preempted the territorial restriction on the offering of Internet and cable services for municipal electric utilities in Tennessee, and that decision is the current state of the law in Tennessee. Given the on-going litigation of this decision, however, MUS has indicated that it wants to err on the side of caution in expanding its broadband and cable offerings outside of its electric service area pending the resolution of the court challenge. In other words, MUS wants to assume, for the purposes of this analysis, that the \textit{Preemption Order} is reversed on appeal.

An additional consideration is the impact of the FCC’s \textit{Open Internet Order} on the territorial restriction of Section 601. As indicated, in the \textit{Open Internet Order} the FCC reclassified broadband Internet access service as a telecommunications service under federal law. Section 401 authorizes municipal electric utilities to provide telecommunications services throughout the state in accordance with \textit{applicable state and federal laws, rules and regulations}.

Moreover, under the Broadband Business Certainty Act of 2006, Tennessee law looks to the FCC’s definitions and treatment of broadband Internet services for its classification of telecommunications services at the state level. Indeed, Tennessee Code § 65-5-202(b) specifically requires that telecommunications carriers in Tennessee treat services that are deemed to be telecommunications services under federal law – such as BIAS – as telecommunications services under state law as well.

(b) Nothing in this part shall permit any carrier to treat services that constitute telecommunications services under federal law as non-telecommunications services for any purpose under state law.

Thus, the FCC’s reclassification of BIAS as a telecommunications service arguably means that municipal electric utilities, such as MUS, may offer Internet access services outside of their electric service areas pursuant to their authority to offer telecommunications services statewide under Section 401. Again, however, given the on-going litigation of the FCC’s \textit{Open Internet Order}, we will conservatively assume that the \textit{Open Internet Order} is also reversed on appeal.

\begin{enumerate}
\item \textbf{Regulatory restrictions}
\end{enumerate}

\footnote{45} Tenn. Code Ann. § 7-52-601 (emphasis supplied).
In addition to the territorial restriction, municipalities providing Internet or cable services are subject to a variety of regulatory and other requirements. Many of these restrictions are comparable to the restrictions on the provision of telecommunications under Section 401.

- Under Section 601(a), a municipality may not dispose of all or substantially all of the system, plant and equipment used to provide Internet or cables services except upon compliance with the procedures set forth in § 7-52-132;

- Under Section 601(c), a municipal system may not provide Internet or cable services in an area served by a private cable television operator with 6,000 or fewer subscribers;

- Under Section 601(d), a municipal system may not provide Internet or cable service in an area in which a telephone cooperative has been providing cable service for not less than 10 years;

- Under Section 602, a municipal system must submit a detailed business plan with the office of the comptroller of the treasury, publish a public notice hold a hearing and a referendum on the offering of Internet or cable services;

- Under Section 603, a municipality cannot cross-subsidize its communications services but it may allocate electric plant for such services and lend funds at a rate of interest not less than the highest rate then earned by the municipality on invested electric plant funds, to acquire, construct, and provide working capital for the system;

- Under Section 603, a municipality shall impute to itself pole-attachment charges and apply comparable pole attachment terms and condition as are applied to private third party providers, as well as paying any applicable franchise fees required of private cable operators;

- Under Section 604, a municipal utility providing Internet or cable services shall be subject to audits and financial reports by the State’s comptroller;

- Under Section 606 a municipality must make payments in lieu of taxes on the services in question;

- Under Section 607, any bonds or notes issued to a municipality for Internet or cable services must be made in accordance with the procedures, requirements and limitations set forth in Title 7 chapter 34, or the Local Government Public Obligations Act of 1986.

Apart from the above requirements and territorial limitations, there are no explicit restrictions on the ability of municipal electric utilities with respect to their provision of Internet or cable service. Section 605 not only provides that municipal utilities providing Internet and cable services are subject to the same obligations as other providers, but it also states that they have all of the powers and authority granted to other entities providing such services.

To the extent that it provides any of the services authorized by this part, a municipal electric system shall have all the powers, obligations, and authority granted to other entities providing similar services under applicable laws of the United States, the state of
This authority includes the ability to enter into public-private partnerships related to the provision of Internet and cable services.

**B. AEC’s Authority**

1. **Federal Law**

As with municipal entities, federal law allows electric cooperatives to provide communications services of all kinds but does not affirmatively empower them to do so. For enabling authority, an electric cooperative must look to state law. Moreover, such authority must exist for each activity in question.

Unlike municipal utilities, however, there is a strong argument that federal law would preempt state barriers to an electric cooperative’s provision of telecommunications services. For convenience, we quote Section 253(a) again:

> No State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.

Section 253 applies to “any entity,” and case law supports the conclusion that this includes electric cooperatives. As private corporations, electric cooperatives are not subject to the limitations that the FCC has previously found with respect to the application of Section 253 to public entities.

In preemption cases under Section 253, the FCC has held, and the Supreme Court has affirmed, that state statutes barring municipalities and other political subdivisions of a state from entering local telecommunications markets implicate core state sovereignty concerns and are therefore subject to the requirement that the relevant statutory language must contain a “plain statement” of Congressional intent to preempt a core state function. In *Nixon v. Missouri Municipal League*, 541 U.S. 125 (2004), the Supreme Court upheld the FCC’s conclusion that it could not preempt state barriers to municipal telecommunications services was inappropriate because the term “any entity” in Section 253 was intended to encompass “public” entities such as municipal utilities. Therefore, the *Nixon Court* found that Section 253 did not apply to municipal utilities.

In contrast, since electric cooperatives are separate, private independent corporations and not part of the state, preemption analysis does not involve the FCC interfering with state decisions regarding its own political subdivisions. Nor do we believe that state regulation of electric cooperatives rises to the level of a core function of the state, and therefore does not implicate the higher level of scrutiny of Congressional intent that the FCC and the Supreme Court found were needed for municipal utilities.

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46 Tenn. Code 7-52-605.

47 The “clear statement” rule for preempting core state functions was set out by the Supreme Court in *Gregory v. Ashcroft*, 501 U.S. 452 (1991).
Thus, assuming that the FCC’s Open Internet Order is not overturned, to the extent that Section 253 preempts restrictions on electric cooperatives, it would apply to broadband Internet access services as well as telecommunications services.

Moreover, with regard to broadband services, the logic of the FCC’s Section 706 Preemption Order preempting state barriers in Tennessee regarding the ability of municipal electric utilities to provide broadband services would arguably apply equally to electric cooperatives.

2. **State Authority for Electric Cooperatives**

The rights of electric cooperatives in Tennessee are governed by the Rural Electric and Community Services Cooperative Act, Tenn. Code Ann. Section 65-25-101 et seq.:

Electric cooperatives may exercise only those powers expressly granted by the General Assembly in the Rural Electric and Community Services Cooperative Act, Tenn. Code Ann. §§ 65-25-201 to -235 (the “Act”). In addition to the “primary” purpose of selling electric power, a cooperative may also carry out “secondary” purposes, which include “[s]upplying or furnishing other community utility services as provided in §§ 65-25-202(3), 65-25-205(c) and 65-25-231.” Tenn. Code Ann. § 65-25-204(a)(2)(A).

Accordingly, to determine what communications services an electric cooperative may engage in as a “secondary purpose,” one must look to the provisions cited above.

a. **Telecommunications services – bandwidth transport**

Under Tennessee law, electric cooperatives are specifically authorized to provide telecommunications services. Section 65-25-134(a) of the Tennessee Code provides:

Every cooperative has the power and is authorized, acting through its board of directors, to acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant or equipment for the provision of telephone, telegraph, telecommunications services, or any other like system, plant, or equipment within and/or without the service area of such cooperative in compliance with title 65, chapters 4 and 5, and all other applicable state and federal laws, rules and regulations. Notwithstanding § 65-4-101(6)(A)(vi) or any other provision of this code or of any private act to the contrary, to the extent that any cooperative provides any of the services authorized by this section, such cooperative shall be subject to regulation by the Tennessee regulatory authority in the same manner and to the same extent as other certificated providers of telecommunications services, including, without limitation, rules or orders governing anti-competitive practices, and shall be

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48 Further, in reclassifying broadband as a telecommunications service, the FCC specifically held in its Open Internet Order that Section 253 applies to broadband Internet access services. Id., at n.1649.

considered as and have the duties of a public utility, as defined in § 65-4-101, but only to the extent necessary to effect such regulation and only with respect to such cooperative's provision of telephone, telegraph and communication services.

i. **Scope of services authorized**

As can be seen, the operative grant of authority to electric cooperatives under Section 134(a) is nearly identical to that given to municipal electric utilities under Section 401. Specifically, electric cooperatives have explicit authority to “acquire, construct, own, improve, operate, lease, maintain, sell, mortgage, pledge or otherwise dispose of any system, plant or equipment for the provision of telephone, telegraph, telecommunications services.”

Further, while telecommunications service offerings of electric cooperatives are subject to regulation by the TRA to the same extent as other certificated providers, electric cooperatives also have the same authority to provide services as other providers. Section 134(c) states, with emphasis added,

(c)(1) To the extent that it provides any of the services authorized by subsection (a), a cooperative has all the powers, obligations and authority granted entities providing telecommunications services under applicable laws of the United States or this state. To the extent that such authority and powers do not conflict with title 65, chapter 4 or 5, and any rules, regulations, or orders issued thereunder, a cooperative providing any of the services authorized by subsection (a) has all the authority and powers with respect to such services as are enumerated in this chapter.

This authority encompasses a wide-range of telecommunications and telecommunications offerings including, dark fiber, private carriage transport, wholesale transport and common carrier transport, as well as the ability to enter into joint ventures and public private partnerships. See the discussion below, however, on the territorial limitation of cooperatives participating in joint ventures under 65-25-131(a).

ii. **No territorial restriction**

The authority granted under Section 134(a) is to build and operate telecommunications plant and provide telecommunications services is throughout the state. Specifically, the authority granted, is “within and/or without the service area of such cooperative.”

iii. **State regulation or restrictions**

Under Title 65, Section 25, Part 134 of the Tennessee Code, an electric cooperative providing any of the telecommunications services or engaging in related activities is subject to a variety of regulatory and other requirements.

- Under Section 134(a), a cooperative is subject to regulation by the Tennessee Regulatory Authority (TRA) in the same manner and to the same extent as other certificated providers of telecommunications services, including, but not limited to, rules or orders governing anti-
competitive practices, and shall be considered as and have the duties of a public utility, as defined in § 65-4-101;

- Under Section 134(b), a cooperative cannot cross-subsidize its communications services but it may allocate electric plant for such services and lend funds at a rate of interest not less than the highest rate then earned by the municipality on invested electric plant funds, to acquire, construct, and provide working capital for the system;

- Under Section 134(c), a cooperative may not provide services unrelated to its electric services within the service area of an existing telephone cooperative with fewer than one hundred thousand (100,000) total lines;

- Under Section 134(d), a cooperative shall allocate to the costs of providing services amounts reflecting its highest pole-attachment charges to third parties as well as any applicable rights-of-way fees, rentals, charges, or payments required by state or local law of a nongovernmental corporation that provides the identical services;

- Under Section 134(e), a cooperative is prohibited from providing cable television services, alarm monitoring services or paging services.

b. Telecommunications Joint Ventures

Section 65-25-131 not only grants electric cooperatives authority to provide telecommunications, but it also provides cooperatives an express grant of authority to establish and participate in joint ventures to provide telecommunications services with any other entity.

(a)(1) Each cooperative may, within its service area and with the authorization of its board, contract to establish a telecommunications joint venture with any entity for the provision of telephone, telegraph, or telecommunications services in compliance with chapters 4 and 5 of this title, and all other applicable state and federal laws, rules and regulations. Notwithstanding § 65-4-101(6)(B) or any other provision of this code or of any private act, a telecommunication joint venture and every member of a telecommunication joint venture shall be subject to regulation by the Tennessee regulatory authority in the same manner and to the same extent as other certified providers of telecommunications services, including, without limitation, rules or orders governing anti-competitive practices, and shall be considered as and have the duties of a public utility, as defined in § 65-4-101, but only to the extent necessary to effect such regulation and only with respect to the provision of telephone, telegraph and telecommunication services.

Electric cooperatives forming telecommunications joint ventures have virtually the same rights and authority as electric cooperatives providing telecommunications on their own, and are subject to the same limitations and restrictions as cooperatives acting alone.50 **Significantly, however, the**

50 Tenn. Code 65-25-131 et seq.
activities of telecommunications joint ventures formed by electric cooperatives are limited to the service area of the cooperative.\textsuperscript{51}

Each cooperative may, \textit{within its service area} and with the authorization of its board, contract to establish a telecommunications joint venture with any entity for the provision of telephone, telegraph, or telecommunications services in compliance with chapters 4 and 5 of this title, and all other applicable state and federal laws, rules and regulations. Notwithstanding § 65-4-101(6)(B) or any other provision of this code or of any private act, a telecommunication joint venture and every member of a telecommunication joint venture shall be subject to regulation by the Tennessee regulatory authority in the same manner and to the same extent as other certified providers of telecommunications services, including, without limitation, rules or orders governing anti-competitive practices, and shall be considered as and have the duties of a public utility, as defined in § 65-4-101, but only to the extent necessary to effect such regulation and only with respect to the provision of telephone, telegraph and telecommunication services.

c. \textbf{Cable television services only through joint venture}

Unlike municipal utilities, electric cooperatives do not have the authority under Tennessee law to provide cable television services on their own. Instead, electric cooperatives may only provide cable television services through participation in a “cable joint venture.”

Neither this chapter nor any other law shall be construed to authorize a cooperative to own, operate or otherwise acquire a legal or beneficial interest in a city-franchised or county-franchised cable television system; provided, that each cooperative may, within its service area and with the authorization of its board, contract to establish a cable joint venture with an entity that is a current franchise holder under title 7, chapter 59, within the cooperative's service area and has been operating, either itself or its predecessor franchise holder, for not less than three (3) years at the time of the establishment of the cable joint venture. A cable joint venture shall be authorized to provide cable service, two-way video transmission, video programming, internet services, and other like services and shall comply in all respects with the requirements of § 65-25-130. The authority to establish a cable joint venture shall not apply to areas served by any existing telephone cooperative that has been providing cable service for not less than ten (10) years under the authority of the federal communications commission.

Tenn. Code Section 65-25-105(12)(c).\textsuperscript{52}

\textsuperscript{51} Tenn. Code 65-25-131(a) (\textit{emphasis added}).

\textsuperscript{52} See also, 65-25-134(d), (2) “Nothing in this chapter shall allow a cooperative to . . . operate a cable system as defined by § 7-59-201. Significantly, Tennessee law defines a cable system using the federal definition.
Moreover, an electric cooperative can only establish a cable joint venture with an entity that is already a current franchised cable operator in the cooperative’s service area, and has been so for at least three years. This limitation effectively restricts the ability of a coop to partner directly with anyone to provide cable service other than the incumbent operator. As discussed below, a cooperative may, however, be able to work with a new entrant cable provider through the provision of bandwidth transport where the cooperative would be acting as a telecommunications carrier and not a cable operator.

Cooperatives that form cable joint ventures are subject to comparable regulations regarding the avoidance of cross-subsidies, lending funds and imputing fees and taxes as they are subject to under telecommunications joint ventures. See, Section 65-25-130.

d. Internet services only through cable joint ventures

Tennessee law has been interpreted as only allowing electric cooperatives to provide Internet access services as part of a cable television joint venture.

A cable joint venture shall be authorized to provide cable service, two-way video transmission, video programming, internet services, and other like services and shall comply in all respects with the requirements of § 65-25-130.53

As explained in Attorney General Opinion 14-33,

Internet service can be provided by a cable joint venture established pursuant to Tenn. Code Ann. § 65-25-205(c). That section authorizes an electric cooperative to “contract to establish a cable joint venture with an entity that is a current franchise holder under title 7, chapter 59, within the cooperative’s service area and has been operating, either itself or its predecessor franchise holder, for not less than three (3) years at the time of the establishment of the cable joint venture.” Any such cable joint venture “shall comply in all respects with the requirements of § 65-25-230,” and “[t]he authority to establish a cable joint venture shall not apply to areas served by any existing telephone cooperative that has been providing cable service for not less than ten (10) years under the authority of the federal communications commission.” Tenn. Code Ann. § 65-25-205(c). Formation of a cable joint venture is the only means by which an electric cooperative is authorized to provide Internet service.

The Attorney General’s Opinion turns on a determination that cable joint ventures are the only vehicles that the Rural Electric and Community Services Cooperative Act explicitly authorizes cooperatives to use to provide Internet services. This determination was largely based on the Attorney General’s impression that Internet services are not “telecommunications services” under federal law.

Under Tenn. Code Ann. § 65-25-202(3), common utility services include telecommunications services, but Internet service is not a “telecommunications services”.

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“telecommunications service” as defined in Tenn. Code Ann. § 65-25-202(3), (13); that defined term is most clearly linked to cable television service. Nor does Internet service constitute a “telecommunications joint venture” under Tenn. Code Ann. § 65-25-231. The term “telecommunications” does not inherently include Internet service. Cable broadband Internet service, for example, has been classified as an information service, not a telecommunications service as defined in 47 U.S.C. § 153. See National Cable & Telecommunications Ass’n v. Brand X Internet Services, 545 U.S. 967, 987-88 (2005); see also Level 3 Communications, LLC v. Roberts, No. M2012-01085-COA-R3-CV, 2013 WL 5373143, at *9 (Tenn. Ct. App. Sept. 20, 2013) (holding that broadband Internet service is not a taxable “telecommunication service” under Tennessee law). Unless the term “telecommunications” is expressly defined to include Internet services, therefore, that term cannot be construed as including such services. 54

The Attorney General’s Opinion predates the FCC’s Open Internet Order, where the FCC explicitly held that broadband Internet access is a telecommunications service under federal law. This decision, when coupled with the Tennessee Broadband Business Certainty Act, which as discussed above, requires that Tennessee laws look to the federal definitions with respect to broadband. Moreover, that same law requires telecommunications providers to treat services that are deemed to be telecommunications services under federal law as telecommunications services for Tennessee law purposes as well.

Therefore, if the Open Internet Order is upheld, electric cooperatives will have a reasonable argument that they are authorized to provide Internet services as “telecommunications service providers or as part of telecommunication joint ventures. This is particularly true given the fact that, under Sections 65-25-131 and 65-25-134, cooperatives providing “telecommunications services” have “all the powers, obligations and authority granted entities providing telecommunications services under applicable laws of the United States or this state.”

Also, as noted above, if Tennessee law restricts electric cooperatives from providing “telecommunications services,” they may be entitled to federal preemption under Section 253 of the Communications Act. That is because they are private entities, not public entities. The FCC has specifically held that its Open Internet Order extends Section 253 rights to Internet service providers.

Assuming that the Open Internet Order is reversed and that a petition to the FCC for federal preemption is not a practical option, then Tennessee law will provide cooperatives only one exception to the general rule that they can provide Internet access service only through a cable joint venture with an incumbent cable operator that has been operating within the service area for at least three years. That extremely limited exception is provided by Tenn. Code Ann. Section 7-59-316(a)(1):

[A] county or municipality, or any entity otherwise authorized by law to act on a county or municipality’s behalf, or a cooperative is authorized to participate in a telecommunications joint venture that is created to provide broadband services to areas within the jurisdiction of the municipality, county or cooperative that has been

54 Attorney General Opinion 14-33, at 2.
determined to be an historically unserved area, meaning that the area does not have access to broadband Internet services, has been an area developed for residential use for more than five (5) years, and is outside the service area of a video or cable service local franchise holder or the franchise area of a holder of a state-issued certificate of franchise authority.

In order to serve such area, the joint venture would also have to request a finding from the TRA that the area is historically unserved and no private provider intends to serve the area.

III. IMPLICATIONS FOR POTENTIAL PARTNERSHIP MODELS

Having looked at the authority of municipal utilities and electric cooperatives to provide various communications services, we now look at potential partnership models for the East Tennessee Network.

It is our understanding that the primary idea is to have MUS utilize its existing capabilities from its broadband network to provide content to AEC at a point within Morristown’s territorial limits. AEC will then transport the content to various locations in Eastern Tennessee under an agreement with a yet-to-be-determined private-sector service provider.

A: MUS

It would appear that MUS’s role and authority is the most straightforward if it will be providing content – either broadband or video – from within its electric service area, because MUS is authorized under Tennessee law to provide a full range of services, transport, video, and Internet broadband from within its community.

MUS can contract with a third-party to take services that originate at its headend/meta switch and then are transported over another entity’s network outside of MUS’s authorized electric service area without running afoul of the prohibition on providing cable or Internet outside of its electric service area.

That is, if (1) MUS provides wholesale broadband transport service to AEC at MUS’s metaswitch or somewhere else within Morristown; (2) AEC provides the fiber transport out of Morristown and into other portions of eastern Tennessee and then resells the service to a third-party private entity that provides broadband Internet access and other services to residential and business customers; and (3) the reseller’s customers send and receive information over the Internet, then we believe that MUS can reasonably maintain that it is providing service within Morristown, in compliance with Tennessee law.55

55 We also understand that neither AEC nor the third-party retailer would be a marketing agent for MUS, but each would be a reseller that “owns” the customers of its service. This is an important distinction under the FCC’s Universal Service Rules, which hold original sellers as responsible for sales by marketing agents but not for those by resellers.
Depending on the services to be provided, MUS, AEC, and the retail provider(s) might have to enter into multiple agreements among themselves and with other parties. For example, if the reseller is going to be selling video content for a cable service offering, the reseller will need to contract with MUS as well as with the program content owners and broadcasters for retransmission rights.

B: AEC

Assuming that AEC cannot provide cable or Internet access services unless it is part of a cable joint venture with an existing cable operator, AEC will need to take pains to position itself as a middle man – i.e., as a provider of dark fiber, wholesale transport, or some combination of the two, and not as a retail provider or partner with a retail provider.

AEC will also have to comply with the accounting and other requirements described above related to the provision of telecommunications, and if it provides service on a common carrier basis, it will have to obtain a certificate from the TRA. AEC will also have to impute to itself the highest pole attachment rate that it charges communications providers.

For this model to work, AEC’s relationship with the retail service provider should probably be a non-exclusive, arms-length wholesale/retail arrangement that is not a joint venture or partnership. That is so because AEC is not allowed to provide cable or Internet services by itself or through a telecommunications joint venture. AEC is, however, allowed to provide infrastructure through lease of dark fiber, or wholesale transport to a retail ISP or cable operator.

AEC will also want to ensure that the retail provider obtains all necessary cable franchises and authorizations to provide its retail services.

IV. KEY FEDERAL REGULATORY COMPLIANCE STRUCTURE CONSIDERATIONS

Having provided an overview of the key terms and concepts as they relate to the communication services that MUS-EAC may be seeking to provide, we now review several important federal compliance obligations and structural considerations for such services.

A. Dark Fiber

As indicated, “dark fiber” is unlit fiber optic cable that does not include the electronics necessary to transmit information. The FCC has repeatedly held that leasing dark fiber is neither “telecommunications” nor “telecommunications service.” For example, the FCC’s USF Form 499A has long had a line item for “Revenues other than U.S. telecommunications revenues, including information services, inside wiring maintenance, billing and collection customer premises equipment,
published directory, *dark fiber*, Internet access, cable TV program transmission, foreign carrier operations, and non-telecommunications revenues.\(^{56}\)

To be sure, leasing dark fiber is a “service,” and it can even be a common carrier service under certain circumstances. The FCC reaffirmed this in its order authorizing schools and libraries to obtain subsidies from the federal E-Rate Program to lease dark fiber from non-common carriers, including government entities.\(^{57}\) But without the essential element of “transmission,” leasing or selling dark fiber cannot, by definition, be “telecommunications” or “telecommunications service.”

Leasing of dark fiber does not require any form of federal registration or certification and does not expose the lessor to any federal USF contribution or filing obligations. Nor does it subject the lessor to any CALEA, Form 477, CPNI, or other federal obligations. Dark fiber providers do not, however, have federally protected pole attachment rights.

### B. Bandwidth Transmission Services – Telecommunications

As discussed above, the federal definition of “telecommunications” is the “transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.”\(^{58}\) The definition does not hinge on the type of information being transmitted -- the transmission of voice, data or video of the users own choosing is all considered telecommunications. Thus, for example, if MUS and/or AEC provide wavelength transport as pure data transport, including operation of the electronics that transmit or receive the information in question, the service will qualify as “telecommunications.”

The term “telecommunications services” is defined as follows:

> The term “telecommunications service” means the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.\(^{59}\)

As discussed previously, the only difference between “telecommunications” and “telecommunications service” is the manner in which the provider holds itself out to the public. If the provider offers its services indiscriminately to any purchaser willing to pay the going rate and meet the provider’s standard terms and conditions, the provider is considered a “common carrier,” and its services are considered a “telecommunications service[s].” This can include “carriers’ carrier”

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56 FCC, Universal Service Form 499A, Instructions for Completing Line 418 (emphasis added).


services offered to other carriers. If, however, a provider negotiates deals one-one-one, with potentially different terms and conditions for each, then the provider is considered a “private carrier.” The services of private carriers may include “telecommunications,” but they do not meet the definition of “telecommunications service” because they are not offered on a common-carrier basis.

Further, the fact that an entity has set prices for some of its telecommunications offerings does not necessarily mean that these services are being offered on a common carrier basis. Price is only one indicium of common carriage. Other factors include the following:

- Whether contract terms are offered indiscriminately, or on a case-by-case basis;
- Whether the provider is using excess capacity, as distinguished from capacity developed to support the particular business in question;
- Whether, to what extent, and how the provider markets its services;
- Whether the provider serves a large number of transient customers, as distinguished from a small and stable number of customers;
- Whether the provider has a screening process that can result in rejection of potential customers for various reasons;
- Whether the service is regulated or certified by the state (i.e., CLEC certification);
- Whether the provider has sought to obtain regulatory, commercial, or other benefits that are available to common carriers.

Generally services that are offered through individually negotiated, long-term written contracts are viewed as private carrier agreements and are not telecommunications services.

Under federal law, an entity is only treated as a telecommunications carrier “to the extent” that it offers telecommunications services. 47 U.S.C. § 153(44).

1. Federal registration requirement

There is no federal requirement to obtain prior authorization or certification to provide domestic telecommunications services. All domestic interstate telecommunications service providers must, however, register with the FCC within one week of providing service. Registration is accomplished by filing with the Universal Service Administrative Company a signed copy of FCC Form 499-A, with completed pages 1, 2, 3 and 8. Among other things, the form requires a carrier to provide an agent for service of process in the District of Columbia and requires the carrier to furnish a list of states where the carrier provides or intends to provide service.

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60 In the Matter of Federal-State Joint Board on Universal Service, 12 FCC Rcd 8776; 1997 FCC LEXIS 5786, ¶ 786 (1996) (Common carrier services include services offered to other carriers, such as exchange access service, which is offered on a common carrier basis, but is offered primarily to other carriers.

While there is no federal registration requirement for telecommunication offered on a private-carrier basis, there are several reporting requirements that may become applicable depending on the nature of the service recipient and the level of revenue generated.

2. Reasonable, Non-Discriminatory Rates, Terms, and Conditions

Providers of “telecommunications services,” which are, by definition, common carriers, must provide their services on reasonable, non-discriminatory rates, terms and conditions. Section 201(b) of the Communications Act states:

All charges, practices, classifications, and regulations for and in connection with such communication service, shall be just and reasonable, and any such charge, practice, classification, or regulation that is unjust or unreasonable is hereby declared to be unlawful. 

Further, telecommunications service providers must also comply with Section 202(a) of the Communications Act, which states:

It shall be unlawful for any common carrier to make any unjust or unreasonable discrimination in charges, practices, classifications, regulations, facilities, or services for or in connection with like communication service, directly or indirectly, by any means or device, or to make or give any undue or unreasonable preference or advantage to any particular person, class of persons, or locality, or to subject any particular person, class of persons, or locality to any undue or unreasonable prejudice or disadvantage.

While telecommunications service providers, other than the incumbent local exchange carriers, are generally exempt from tariff filing, all telecommunications providers are required to provide service on a non-discriminatory basis.

3. The Federal Universal Service Program

Obligations created under the Universal Service Program (“USP”) apply to a variety of services, offered by a variety of different types of providers. The ramifications of USP compliance may be significant as a business matter, since payments to the federal government of more than 17 percent of a covered provider’s end-user revenues may be involved. In addition, the FCC has imposed huge fines and penalties for noncompliance with the USP.

The federal USP is highly complex and, in many ways, counterintuitive. Many of its requirements are widely misunderstood. Under the USP, providers of “interstate” and “international” “telecommunications,” “telecommunications service,” or “interconnected VoIP” must pay into the Universal Services Fund (“USF”) a certain percentage of their “end-user revenues” on sales of these

services. Each calendar quarter, the FCC announces the relevant percentage for that quarter, which is currently in the range of 17%.

Ordinarily, one thinks of an “end-user” as the last purchaser in a chain of distribution – typically a retail customer. Under the federal USP, however, “end-user” has a special meaning: it also includes purchasers of covered “telecommunications,” “telecommunications services,” or “interconnected VoIP” that do not make payments to the USF, either because they are exempt or because they have failed to comply with their contribution obligations. For example, if a carrier sells telecommunications services to an Internet Service Provider (ISP) that combines them with information services and sells the combined service at retail as Internet access services, the retail Internet access services are exempt from USF obligations, so the USP program treats the ISP as an “end-user,” and it requires the carrier to make payments to the USF on its sales to the ISP. In contrast, if the carrier sells telecommunications services to a telephone company that resells them at retail as telephone services, the retail telephone services are not exempt from USF obligations, so the USP treats the retail telephone customers as “end-users,” and it requires the telephone company to make the appropriate payments into the USF. If the carrier can document that the telephone company has actually made such payments, then the carrier is relieved of any obligation to make such payments itself.

Significantly, while the FCC has reclassified BIAS as a telecommunications service, the FCC specifically determined in its Open Internet Access Order that for now it was not requiring BIAS providers to contribute to the federal “USF.” At the same time, the FCC made clear that it is continuing to review this decision and it is anticipated that in the future that internet access providers will likely at some point be subject to universal service contributions. This could have significant implications for the business model.

While the general rules is that all providers of telecommunications, telecommunications service or VoIP must contribute to the USF, a potentially important exception has developed over the last several years for private carriers serving Internet access service providers. This exemption developed through a series of FCC cases and orders. For example, in a case involving U.S. TelePacific Corporation the FCC stated:

[I]f an entity provides broadband transmission service to an Internet Service Provider (ISP) on a non-common carrier (i.e. a private carriage basis), that entity is not required to contribute to universal service on the basis of revenues derived from the provision of that transmission service. Wireline Broadband Internet Access Services Order, 20 FCC Rcd at 14909-10, para.

64 The FCC has initiated a FCC rulemaking to determine whether it should revise the current categories of contributors to possibly include Internet Service Providers, among others. In the Matter of Universal Service Contribution Methodology, Further Notice of Proposed Rulemaking, WC Docket No. 06-122, released April 30, 2012.
103; id. at 14916 n.357; Interim Contribution Methodology Order, 21 FCC Rcd at 7549, n.206 (restating this holding).  

The Instructions to FCC Form 499-A now formally embrace this distinction:

Line 406 should include revenues from the transmission component of wireline broadband Internet access service to the extent described below, as well as other revenue from private line and special access service. Specifically, Line 406 includes all revenue from broadband service (including the transmission component of wireline broadband Internet access service) provided on a common carrier basis. Revenues for the provision of wireline broadband Internet access transmission on a non-common-carrier basis should be reported on Line 418. All other revenues from local private line service and special access service billed to end users must be reported on Line 406. Filers should report on Line 406 revenues derived from the sale of special access on a common carrier basis to providers of retail broadband Internet access service.  

In other words, common carriers, but not private carriers, must treat broadband Internet transport service provided to Internet service providers as assessable end-user revenues. This could be significant to MUS and/or EAC to the extent that they act as wholesale broadband transport providers for a retail ISP provider(s).

Unlike broadband Internet transport, wholesale transport of video programming for a cable operator or video service provider, whether offered on a private carriage or common carriage basis, is subject to USF contribution obligations.

Another important feature of the federal USP is that providers of “telecommunications,” “telecommunications service,” or “interconnected VoIP” need not make payments into the USF in any year in which their contributions would be “de minimis” – i.e., less than $10,000. In such a year, a person or entity that only provides private carriage “telecommunications” would not have to


67 To calculate its payment obligations, a provider must multiply its projected eligible end-user revenues by an “estimation factor” that the FCC publishes from time to time, and which historically has ranged from 12% - 15%. For example, if the FCC’s estimation factor was 10 percent, a provider would have to exceed $100,000 in eligible end-user revenues to meet the de minimis payment obligation of $10,000. Providers of telecommunications services and/or interconnected VoIP who fall below the de minimis threshold need to file the annual 499-A and the de minimis worksheet included in Appendix A of Form 499-A. Providers of telecommunications who fall within the de minimis threshold need not make any filing but must retain their calculation worksheet for five years.
file a Form 499A, but persons or entities that provide any “telecommunications service” or “interconnected VoIP” would still have to make such a filing, as well as make relatively small contributions to the federal funds supporting Telecommunications Relay Service, Local Number Portability, and the North American Numbering Plan Administration. Providers of “telecommunications service” or “interconnected VoIP” must make such filings and payments from the time they first begin to provide service and must continue to do so as long as they are providing these services.

4. CALEA

The Communications Assistance for Law Enforcement Act of 1994 requires providers of telecommunications services, Internet access services, and interconnected VoIP to build technical capabilities into their networks that will enable them to assist law enforcement officials in conducting authorized interceptions of content of communications content or call-identifying information. The House Report accompanying the Act stated its purposes as follows:

To [e]nsure that law enforcement can continue to conduct authorized wiretaps in the future, the bill requires telecommunications carriers to ensure their systems have the capability to:

(1) isolate expeditiously the content of targeted communications transmitted by the carrier within the carrier’s service area;
(2) isolate expeditiously information identifying the origin and destination of targeted communications;
(3) provide intercepted communications and call identifying information to law enforcement so they can be transmitted over lines or facilities leased by law enforcement to a location away from the carrier’s premises; and
(4) carry out intercepts unobtrusively, so targets are not made aware of the interception, and in a manner that does not compromise the privacy and security of other communications.68

Enforcement of CALEA obligations may come from a court, from the FCC, or from the Attorney General / FBI in the form of a civil action. A civil penalty may be assessed in the amount of $10,000 per day for noncompliance following a court order. While $10,000 per day is certainly a substantial penalty, and noncompliance is not to be taken lightly, it is worth noting that such a penalty will not be assessed until certain adjudicatory proceedings have come to pass. Moreover, in the several years since CALEA’s scope was conclusively expanded to include facilities-based broadband providers, we are aware of virtually no enforcement actions or penalties assessed. For a more detailed discussion of CALEA compliance requirements, options for compliance and other CALEA issues,

we direct your attention to a 2007 Baller Herbst / CTC paper available on our website,\(^{69}\) and to the FCC’s CALEA webpage.\(^{70}\)

5. **Customer Proprietary Network Information**

FCC rules require providers of telecommunication service (“telecommunications carriers”) and interconnected VoIP to take certain steps to safeguard customer information, known as Customer Proprietary Network Information” or “CPNI.” Annually, affected entities must file a certificate asserting compliance with the FCC’s rules pertaining to the treatment of CPNI:

A telecommunications carrier must have an officer, as an agent of the carrier, sign and file with the Commission a compliance certificate on an annual basis. The officer must state in the certification that he or she has personal knowledge that the company has established operating procedures that are adequate to ensure compliance with the rules in this subpart. The carrier must provide a statement accompanying the certificate explaining how its operating procedures ensure that it is or is not in compliance with the rules in this subpart. In addition, the carrier must include an explanation of any actions taken against data brokers and a summary of all customer complaints received in the past year concerning the unauthorized release of CPNI. This filing must be made annually with the Enforcement Bureau on or before March 1 in EB Docket No. 06-36, for data pertaining to the previous calendar year.

47 CFR § 64.2009(e).

Providers “telecommunications service” must comply with the CPNI rules, even if they possess little or no information about individual end-user customers. Fortunately, compliance is a relatively simple matter, requiring only the adoption of a short statement of policy with regard to treatment of customer information and the submission of an annual certification to the FCC, as described above. Over the past couple of years, the FCC has made a concerted effort to crack down on CPNI compliance by covered entities, in some cases leveling stiff fines for noncompliance.\(^{71}\)

6. **Local Competition and Broadband Reporting (Form 477).**

Form 477 collects information about wired and wireless local telephone services and broadband connections. The form – which requests a large amount of information and may take substantial time

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\(^{70}\) http://www.fcc.gov/calea

\(^{71}\) In an “omnibus” notice of liability from 2009, the FCC issued a long list of companies upon which it leveled a $20,000 fine for noncompliance.
to complete – must be submitted twice a year by local exchange carriers, providers of interconnected VoIP, and facilities-based broadband service providers (i.e., BIAS).

For the purposes of Form 477, an entity is a “facilities-based” provider of broadband connections to end user locations if any of the following conditions are met: (1) it owns the portion of the physical facility that terminates at the end user location; (2) it obtains unbundled network elements (UNEs), special access lines, or other leased facilities that terminate at the end user location and provisions/equips them as broadband, or (3) it provisions/equips a broadband wireless channel to the end user location over licensed or unlicensed spectrum.

In a wholesale/retail environment the FCC has clarified that it only wants one responder per end user broadband connection, in most cases it will be the entity that owns and controls the fiber and installs and controls the electronics at the end user premises.
Appendix C: Dandridge Supplemental Report
This community profile provides an overview of broadband services in Dandridge to give community members a sense of their current broadband environment. The profile provides some key issues regarding the availability and use of broadband today by Dandridge households and businesses, and offers strategies the community may consider as part of the regional AEC broadband initiative. The profile may also serve as the foundation for an initiative to bolster community planning and economic development efforts in Dandridge around broadband and technology development. This community profile also fits within the AEC Broadband Feasibility Study to understand the current state of broadband and build long-term strategies to enable access to affordable, next-generation broadband across all AEC service area communities.

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Figure 45: Aerial photo and shading of the town limits of Dandridge, Tennessee
1. Dandridge Households

The residential broadband market in Dandridge is served with cable service from Comcast and Charter and with DSL from AT&T. Fixed wireless providers also have coverage in parts of Dandridge including Planet Connect and UltraNet. Residential areas of Dandridge unserved by wireline providers or are outside the line of sight required by fixed wireless service providers rely on satellite providers, with Hughes and Excede being the providers most used. Many households report using their mobile wireless provider as their main source of household connectivity.

Of 712 Dandridge household survey respondents, 549 (77.1%) report subscribing to Internet service at their home. Of that group, 233 (42.4%) subscribe to cable or DSL, and approximately 18.2% of respondents subscribe to fixed wireless or satellite.

From the research conducted, it appears that all wireline residential broadband services are provided via copper telephone wire infrastructure owned by the local exchange carrier or coaxial cable infrastructure owned by the local cable company. Wireless services are provided through terrestrial fixed wireless systems and 3G and 4G mobile wireless carriers.

Broadband Internet download and upload speeds reported by the majority of residents surveyed were commensurate with cable and DSL services in the region. Samples were collected from residential broadband subscribers across Dandridge through an online speed test. Of the 153 of Dandridge respondents who completed the speed test portion of the survey, only 34 (22.2%) reported download speeds that meet or exceed the current federal government definition of broadband at 24 Mbps. These speeds were generally reported in the most populated areas that had a high density of single-family or multi-dwelling units. On the other hand, 81 (52.9%) of respondents reported download speeds less than 10Mbps.

Upload speeds were found to be considerably lower than download speeds, though consistent with asymmetrical DSL and cable broadband services. 49 household respondents (32%) reported upload speeds greater than 4 Mbps, which is the current federal government definition of minimum broadband upload speeds. Residents commented in the survey and in meetings that both upload and download speeds were inconsistent and at certain times of the day, and that services were considerably slower and more unreliable than at other times.

On the subject of reliability, 51.1% of Dandridge respondents reported that their services were somewhat to moderately reliable while 13.7% were not satisfied with the reliability of their service. 68.1% reported that services were disrupted or out between 1-8 hours per month, while only 10.1% say they experience no disruptions or outages.

It is important to note that the speeds reported are actual speeds recorded which may be different from the speeds residents purchase from service providers in the area. In general, DSL and cable broadband services are sold with speed increments that define a maximum speed for the service such as “Up to 18 megabits down and up to 3 megabits up.” Actual speeds vary depending on the physical location of the service and how many subscribers are concurrently on the system. The “maximum advertised speed” should not be construed to mean a sustained
maximum but instead the top speed of the service which may be considerably lower over long periods of time.

Through deeper analysis into Dandridge neighborhoods, these services were found to be available in some areas while others lacked access to these services. Magellan identified a number of residential sites, selected randomly in various sections of Dandridge by zip code and not necessarily in the downtown areas of Dandridge. Magellan’s team contacted each service provider identified as operating wireline services in the market to determine service availability. The results show that although there are two provider options for most addresses, the speeds and pricing varies.

**Figure 46: Dandridge household market analysis**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Site #1 - 382 Terry Point Road, Dandridge, TN 37725</td>
<td>AT&amp;T U-Verse up to 18Mbps/3Mbps</td>
<td>$42/month</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Cable up to 150Mbps/20Mbps</td>
</tr>
<tr>
<td>Residential Site #2 - 1050 Chestnut Grove Road, Dandridge, TN 37725</td>
<td>AT&amp;T U-Verse up to 18Mbps/3Mbps</td>
<td>$42/month</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
</tr>
<tr>
<td>Residential Site #3 - 1185 Carolina Drive, Dandridge, TN 37725</td>
<td>AT&amp;T Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
</tr>
<tr>
<td>Residential Site #4 - 1002 Southwind Circle, Dandridge, TN 37725</td>
<td>AT&amp;T U-Verse up to 12/1.5Mbps</td>
<td>$40/month</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
</tr>
<tr>
<td>Residential Site #5 - 3068 Beecarter Road, Dandridge, TN 37725</td>
<td>AT&amp;T Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

Internet service providers in Dandridge have not upgraded their DSL and cable infrastructure to support newer technologies, and as a result, higher top speeds are elusive. Analysis of the services available in the area indicates that providers are marketing service packages in some areas of up to 150 Mbps downstream and 20 Mbps upstream on cable-based networks, and 18 Mbps downstream and 3 Mbps upstream on DSL-based networks. Broadband coverage data also shows this availability on a widespread basis in Dandridge.

However, results of the speed test portion of the survey validated speeds up to 87Mbps in areas where these services were offered, while the majority of survey respondents recorded significantly lower speeds. Of the recorded speeds, only 17 of the 153 surveys with speed test
results were greater than 50 Mbps, all through cable connections. Even at the lowest price point paid by the cable subscribers the average speed was 61% less than the advertised speed. Actual results are generally much lower than the advertised speeds however, advertised speeds should be achieved periodically.

*Figure 47: Spatial distribution of Dandridge household market analysis sites*

Measuring the pricing for services against the actual speeds of services that residents received indicated that there was no correlation between the price paid for services and the amount of bandwidth received by residents. The general trend is that higher prices equal faster speeds, however, there were no significant findings to support this in Dandridge. For example, some cable customers pay less than DSL customers, yet often receive higher speeds, though this is not consistent in every situation. It seems as if households pay a price for connectivity and from there the service is a best effort. Although Dandridge prices are competitive to similar communities, the realized speeds are lower than communities where fiber broadband services have been deployed and there is healthier service provider competition.

### 2. Dandridge Businesses

Of the 54 businesses that responded to the assessment survey, 90.7% subscribe to broadband service. Most businesses in Dandridge subscribe to cable (46.9%) from Comcast or Charter, or DSL (22.4%) from AT&T. Beyond that, one Dandridge business reported utilizing fixed wireless from Planet Connect and three report subscribing to satellite, while seven small businesses reported no wireline service and operate their business with a mobile wireless connection. One Dandridge business reported subscribing to fiber-optic broadband services.
Through analysis of the commercial market in Dandridge, Magellan identified four commercial sites by zip code, selected randomly in various areas of Dandridge. Magellan’s team then contacted each telecommunications provider identified as operating wireline services in the market to determine service availability. Absent from this market analysis is Planet Connect, which depends on line-of-sight for connectivity, though pricing and speeds are competitive with DSL. The results show that although there are two provider options for most addresses, the speeds and pricing greatly vary.

**Figure 48: Dandridge commercial market analysis**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial Site #1 - 831 Epco Drive, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 1.5Mbps/786Kbps</td>
<td>$29.99/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #2 - 955 Pine Drive, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 786Kbps/786Kbps</td>
<td>$29.99/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$134.99/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #3 - 105 West Meeting Street, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$134.99/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td><strong>Commercial Site #4 - 428 Hwy 92 South, Dandridge, TN 37725</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
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<td>$134.99/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
</tbody>
</table>

In general, these services are branded as “business class” and come with a higher cost and a quality of service that prioritizes business services over residential services that run across the same physical infrastructure. Pricing for DSL and cable based services were found to range from $29.99 for the lowest speed service to $134.99 for the highest speed service. Just over 40% of business pay more than $100 each month for broadband service, which likely comes bundled with other services, such as telephone.

Of the 54 Dandridge businesses that responded to the assessment survey, only six businesses completed the speed test portion, and hardly enough to make broad assumptions across Dandridge. However, two of those six businesses reported download speeds greater than 24 Mbps, with both reporting approximately 65 Mbps through cable connections.
Likewise, upload speeds were not commensurate with business broadband services in other parts of the country, with only those same two businesses reporting greater than 4 Mbps upload, at approximately 4.3 Mbps. These speed thresholds are important because the current federal definition of broadband is 24 Mbps download and 4 Mbps upload.

Figure 49: Spatial distribution of commercial market analysis sites

Businesses clearly recognize the importance of broadband to their business, as 73.5% of respondents rated the importance of broadband with the highest rating, as critically important. In fact, 96% rated the importance as an 8 or greater. They reported file sharing, offsite data backups, communications and connectivity with regional locations, social media and customer retention, and international video-conferencing as the applications that were most important to their businesses and those most impacted by broadband issues.

Businesses reported moderate frustration with their current broadband Internet services as only 43.5% of respondents indicated that their current services were sufficient to meet their business needs. An equal 43.5% reported that their current services did not meet their business needs, with another 13% unsure. As such, the business community is divided on whether local providers fulfill the Internet and communications needs of their businesses.

Dandridge businesses cited examples of the issues they faced with their existing broadband services, providing numerous comments about how their broadband services were inadequate to transmit the data needed to run their operations. While 77.8% of responding businesses were
small and under 10 employees, many have equally large data needs and utilize significantly more 
bandwidth than larger companies in other industries that keep data “in house.” For these small 
businesses, unfortunately three current options exist: (1) accept the broadband issues, (2) pay 
significantly higher costs for required broadband or, (3) relocate to a community where these 
services are available and affordable.

As stated earlier, only one business reported utilizing 
fiber-optic broadband services in Dandridge, and it is considered a large employer between 100- 
150 employees. This public organization also happens to receive direct fiber connectivity from 
state contract vendors. They reported that their connections were reliable and provided the 
speeds that they required.

Conversely, the majority of Dandridge businesses cited speed (69.2%), high cost (65.4%), and 
poor reliability (53.8%) of local broadband services as negatively impacting their businesses. 
Somewhat surprisingly, 37% of businesses reported that their Internet service is disrupted a day 
or more each month. Almost three-fourths (73.1%) of businesses said they want to upgrade, but 
better services aren’t available.

One potential reason for these high prices is the lack of available fiber distribution infrastructure 
in Dandridge. Refusing to wait any longer, many communities are beginning to equip business 
and residential areas with fiber-to-the-premise infrastructure by overbuilding the existing DSL and 
cable infrastructure. This fiber distribution infrastructure is specifically designed to deliver high-
speed, reliable fiber broadband services to residents and businesses at lower costs than are 
available today. This study did not find any fiber distribution infrastructure in Dandridge that was 
available to retail business customers.

Demand for higher speed and higher reliability of service necessitates a less costly, more 
accessible solution for Dandridge businesses. While new businesses that are cultivated require 
these services to become mature, Dandridge businesses need a foundation of next-generation 
broadband to grow. All businesses would also benefit from these services as they begin to utilize 
more online applications that improve productivity and competitiveness.

3. Dandridge Community Organizations

Education

Schools in Dandridge are part of the Jefferson County School District, which has 13 schools and a 
total of 16 facilities. As the county seat of Jefferson County, the school district central office is 
located in Dandridge along with Dandridge Elementary and Maury Middle school. The high 
school is by far largest facility, which also ranks among the largest high schools in Tennessee by 
student population.

“We do our data backups between 2-4am 
because of cable Internet congestion.”
- Dandridge business

“Communications is everything we do, with banks, with vendors, 
with marketing. When the Internet is down, we’re closed.”
- Dandridge business
The Jefferson County School District is supplied with 1Gbps fiber-optic connectivity between schools, enabling high-bandwidth interconnection between schools. Internet connectivity is supplied through a fiber connection to the egress point at Jefferson County High School, which provides 500Mbps of Internet to the district’s schools.

**Figure 50: Jefferson County School District facilities and connectivity in Dandridge**

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Street Address</th>
<th>City</th>
<th>Staff</th>
<th>Rooms</th>
<th>Bldgs</th>
<th>Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dandridge Elementary</td>
<td>780 South Hwy 92</td>
<td>Dandridge</td>
<td>70</td>
<td>48</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson County High</td>
<td>115 West Dumplin Valley Rd</td>
<td>Dandridge</td>
<td>158</td>
<td>114</td>
<td>7</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Maury Middle</td>
<td>965 Maury Circle</td>
<td>Dandridge</td>
<td>65</td>
<td>29</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Central Office</td>
<td>1030 TN Hwy 92</td>
<td>Dandridge</td>
<td>13</td>
<td>--</td>
<td>1</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>1107 County Lane</td>
<td>Dandridge</td>
<td>4</td>
<td>--</td>
<td>1</td>
<td>100 Mbps</td>
</tr>
</tbody>
</table>

Jefferson County High School is egress for district - 300 Mbps burstable to 500 Mbps

Clearly the pressing concern on the minds of school leaders is related to the State of Tennessee Department of Education mandates for online curriculum and testing that are due to begin during calendar year 2017-2018. Textbooks will soon be online and only online, along with homework and study guides and an increasing array of student learning resources that utilize more online content to support lesson plans.

In a rural community like Dandridge, the lack of availability and affordability of residential broadband is a legitimate and critical concern in meeting those mandates, and school leaders recognize the fact that some areas will not be able to support those mandates once the child is outside the classroom. In talking with school leaders, the sky is the limit for envisioning of future needs, as leaders say the school district can use as much help as it can get regarding technology and student resources.

**Healthcare**

While the main hospital serving Dandridge and the county is Jefferson Memorial in Jefferson City, healthcare organizations in Dandridge could derive significant benefit from expanded broadband capabilities. Local healthcare organizations expressed issues with existing broadband connectivity and are looking for solutions to keep up with the latest electronic health technologies.

Lakeside Medical, Jefferson Family Practice, and Tennessee Community Health Services interconnect with their own respective health networks, which delivers a suite of Telehealth, telemedicine, and health information exchange services. These organizations serve Dandridge and its surrounding communities and need broadband connectivity between one another that allows them to use the latest technologies to deliver quality patient care. A DSL or cable connection for these services is barely enough bandwidth to enable these facilities to take advantage of new electronic health services that will be transported across these connections.
Local Government

The government offices in Dandridge have no interconnectivity between government departments, staff administrative offices and local officials. Each local department acquires Internet services much the same as a Dandridge business does, each negotiated on an individual basis. Evaluating the development of a common broadband network that connects all local government organizations to a single network could achieve many benefits and increase the visibility of Dandridge as a progressive and responsive government.

As the third oldest town in Tennessee, Dandridge has a lot going for it and has established priorities for economic growth, all of which will benefit from improved broadband. As a mountains and lakes destination, economic development centers around tourism and the recruitment of retirees who need the services to stay connected to family and friends back home.

The largest economic boon to Dandridge is due to the adjacent Douglas Lake, which brings an estimated impact of $52M each year from fishing tournaments, and has become a widely-known destination for bass fishing. As such, $2.7M for economic development has been raised and spent on marketing around the country. Still, local leaders lament the troubles of promoting and competing with the world.

This common broadband network would enable Dandridge to provide connectivity for municipal operations, utilities, public safety, general administration, economic development and tourism promotion. As one of the key stakeholders in Jefferson County, Dandridge can have a substantial impact on the development of local broadband to serve its own internal needs as well as the needs of the community and promote its own unique brand of economic development.

Water Department

Dandridge water department officials say "water is the health and the wealth of the community," and in Dandridge’s case it could not be more true. Water department staff does a fine job processing and managing the water operations, but broadband could help drive efficiencies and improve monitoring capability. Automatic meter reading is currently performed, and pump stations are monitored every 15 minutes, and every hour on non-essential water stations, which is currently performed with cellular wireless. With broadband, the water department could move to real-time monitoring to detect problems before customers identify leaks or other problems.

Police and Fire Departments

All Dandridge police vehicles are connected with video recording capability, and like most departments the data is downloaded to the server the moment each police car pulls into the station parking lot. The department subscribes to 60 Mbps cable services, and more speeds are needed, as the system speeds slows to a crawl when more than one car enters the Wi-Fi.

“Our broadband at the office, it’s out some days but some days it’s good. We just can’t depend on it.”

– Dandridge community organization
The overall use of technology could be improved for both fire and police. There is connectivity on a fire scene through mobile wireless devices carried by key personnel, but the departments have no advanced tools like personnel health monitoring, GPS tracking, or facial or automotive recognition software and cameras.

4. Dandridge Broadband Strategies

The lack of affordable, available next-generation broadband services in Dandridge poses a growing challenge to the town in terms of how it will meet stakeholder needs across the community including economic development, education, healthcare, and community support. As the broadband needs of these stakeholders continue to grow, providers are not visibly working to upgrade their infrastructure to meet these demands.

So the question remains whether Internet service providers can catch up with the demand for services at prices various stakeholders in the community can afford. For the majority of businesses in Dandridge these broadband services are simply not available, and where broadband does exist, the most beneficial speeds are prohibitively expensive.

To resolve this issue, Dandridge must decide what role it wants to play in developing next-generation broadband in its jurisdiction. Dandridge’s historic downtown and thriving lake scene is a nursery for economic development. However, as young companies and collaborative partnerships begin to grow, will access to next-generation broadband services be available to them at rates they can afford?

In communities that have taken an important step forward by helping to facilitate the deployment of community broadband networks that serve the needs of the community first, reduce taxpayer costs, and improve broadband services for residents and businesses. Using a combination of broadband-friendly public policy and wise investments in broadband infrastructure, Dandridge has the opportunity to futureproof itself and become a Gigabit Community. Below is a summary of the key strategies for consideration.

4.1 Public Policy Recommendations

- Partner with local developers to ensure parcels are equipped with basic broadband infrastructure, such as conduit for fiber-optic cable is placed in the ground at the same time as water and electric infrastructure.
- Develop joint trenching agreements with utility and broadband providers to reduce the cost of broadband construction and increase the amount of available broadband infrastructure.
- Develop broadband engineering standards that can be incorporated into land use codes, promoting lower cost of broadband infrastructure construction in conjunction with capital projects.
• Streamline the broadband permitting process within public rights of way to ensure minimal delays and costs for building infrastructure. Evaluate and reduce permitting fees to lower broadband provider construction costs in the town.

4.2 Record Keeping and Information Sharing

• As the county seat, develop local and county government processes to move more work flow to a paperless and digital environment that will enable convenient and efficient sharing of information between local departments.

• Insure that all paper documents are converted to digital format and archive existing paper documentation to digital files that can be digitally archived for required record keeping.

• Enable GIS systems and other broad reaching local government computer applications and technology resources to be shared among all local government departments to increase efficiencies through the share of information.

• Ensure that all broadband infrastructure built with the above-mentioned public policy tools has appropriate records and data is incorporated into the town’s GIS systems and share with utilities and other departments that could be impacted.

4.3 Education and Adoption Programs to Increase Demand

• Develop a program to educate the community regarding broadband services that are available in Dandridge. Community anchors and economic development personnel should connect current and prospective businesses with Dandridge service providers.

• Improve local broadband usage by focusing on community anchors that are currently not receiving adequate broadband service, and then work with community anchors that are using broadband to insure that it is being used for optimal benefit.

4.4 Develop Strategies to Build Community Network Engagement

• Identify broadband adoption and infrastructure programs at the state and federal levels that will allow Dandridge to expand the broadband in its area, based on qualifying portions of town. Work with service providers using public/private partnerships to access available funding programs using each other’s strengths to expand broadband in the area.

• Consider the development of a Dandridge or Jefferson County community broadband network that would interconnect town and county facilities and all potential community anchors in the area, which may include the Jefferson County School District, Jefferson County remote offices, local colleges like Walters State or Carson Newman, and others.

• Build a business case that shows a potential savings for the community by implementing its own network. Utilize this network in cooperation with broadband service providers to
• Bring expanded broadband to the area; allowing providers to lease capacity on the network to serve the Dandridge business community.

• Reinvest any revenues generated through broadband infrastructure to continue local buildout of the network to serve community needs related to digital literacy and technology and broadband adoption and utilization throughout Dandridge and Jefferson County.
Appendix D: Jefferson City Supplemental Report
This community profile provides an overview of broadband services in Jefferson City to give community members a sense of the current broadband environment. The profile presents some key issues regarding the availability and use of broadband today by Jefferson City households and businesses, and offers strategies the community may consider as part of the regional AEC broadband initiative. This profile may also serve as the foundation for a city initiative to bolster community planning and economic development efforts around broadband and technology development. This community profile fits within the AEC Broadband Feasibility Study to explain the current state of broadband in the AEC service area and build long-term strategies to enable access to affordable, next-generation broadband across all AEC service area communities.

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Figure 51: Aerial photo and shading of the city limits of Jefferson City, Tennessee
1. Jefferson City Households

The residential broadband market in Jefferson City is served with cable service from Charter and DSL from AT&T. Fixed wireless providers also have coverage in parts of Jefferson City including Planet Connect and UltraNet. Residential areas of Jefferson City unserved by wireline providers or are outside the line of sight required by fixed wireless service providers rely on satellite providers, with Hughes and Excede being the providers used most. Several Jefferson City households report using their mobile wireless provider as their source of household connectivity.

Of the 548 Jefferson City household survey respondents, 474 (84.2%) report subscribing to Internet service at their home. Of that group, 70.8% subscribe to cable or DSL, and approximately 7.5% of respondents subscribe to fixed wireless or satellite. From the research conducted, it appears that all wireline residential broadband services are provided via copper telephone wire infrastructure owned by the local exchange carrier or coaxial cable infrastructure owned by the local cable company. Wireless services are provided through terrestrial fixed wireless systems and 3G and 4G mobile wireless carriers.

Broadband Internet download and upload speeds reported by the majority of residents surveyed were commensurate with cable and DSL services in the region. Samples were collected from residential broadband subscribers across Jefferson City through an online speed test. Of the 72 Jefferson City respondents who completed the speed test portion of the survey, only 25 households (34.7%) reported download speeds that meet or exceed the current federal government definition of broadband at 24 Mbps. On the other hand, 30 (41.6%) respondents reported download speeds less than 10Mbps.

Upload speeds were found to be considerably slower than download speeds, though consistent with asymmetrical DSL and cable broadband services. Of the 67 household respondents that performed the test for upload speeds, 35 households (52.2%) reported upload speeds of 4 Mbps or greater, which is the current federal government definition of minimum broadband upload speeds. On the other hand, 15 households (22.4%) reported upload speeds of 1 Mbps or less. Residents commented in the survey and in meetings that both upload and download speeds were inconsistent and at certain times of the day, and that services were considerably slower and more unreliable than at other times.

On the subject of reliability, 51.1% of Jefferson City respondents reported that their services were somewhat to moderately reliable while 13.7% were not satisfied with the reliability of their service. 68.1% reported that services were disrupted or out between 1-8 hours per month, while only 10.1% of Internet households say they experience no disruptions or outages.

It is important to note that the speeds reported are actual speeds recorded which may be different from the speeds residents purchase from service providers in the area. In general, DSL and cable broadband services are sold with speed increments that define a maximum speed for the service such as “Up to 18 megabits down and up to 3 megabits up.” Actual speeds vary depending on the physical location of the service and how many subscribers are concurrently on
the system. The “maximum advertised speed” should not be construed to mean a sustained maximum but instead the top speed of the service which may be considerably lower over long periods of time.

Through deeper analysis into Jefferson City neighborhoods, some service levels were found to be available in some areas while others lacked access to the same services. Magellan identified a number of residential sites, selected randomly across Jefferson City by zip code and not necessarily in the city limits. Magellan’s team contacted each service provider identified as operating wireline services in the market to determine service availability. The results show that although there are two provider options for most addresses, the speeds and pricing varies.

**Figure S2: Jefferson City household market analysis**

<table>
<thead>
<tr>
<th>Residential Site</th>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1412 Clintwood Court, Jefferson City, TN 37760</td>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Residential Site</td>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>252 Andrea Lane, Jefferson City, TN 37760</td>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Residential Site</td>
<td>AT&amp;T</td>
<td>U-Verse up to 18Mbps/3Mbps</td>
<td>$42/month</td>
</tr>
<tr>
<td>1919 Kaylee Drive, Jefferson City, TN 37760</td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Residential Site</td>
<td>AT&amp;T</td>
<td>U-Verse up to 12Mbps/1.5Mbps</td>
<td>$40/month</td>
</tr>
<tr>
<td>454 Clearbrook Drive, Jefferson City, TN 37760</td>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td></td>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Internet service providers in Jefferson City have not upgraded their DSL and cable infrastructure to support newer technologies, and as a result, higher top speeds are elusive. Analysis of the services available in the area indicates that providers are offering packages in some areas of up to 100 Mbps downstream and 5 Mbps upstream on cable-based networks, and 18 Mbps downstream and 3 Mbps upstream on DSL-based networks. Broadband coverage data also shows this availability on a widespread basis in Jefferson City.

Results of the survey speed test validated download speeds up to 66 Mbps in areas of Jefferson City where these services were offered, however, the majority of survey respondents recorded significantly lower speeds. Of the recorded speeds, 14 of the 72 surveys with speed test results
were greater than 50 Mbps, all through cable connections. While actual results are generally much lower than the advertised speeds, advertised speeds should be achieved periodically.

*Figure 53: Spatial distribution of Jefferson City household market analysis sites*

Measuring the pricing for services against the actual speeds of services that residents received indicated that there was no correlation between the price paid for services and the amount of bandwidth received by residents. The general trend is that higher prices equal faster speeds, however, there were no significant findings to support this in Jefferson City. For example, some cable customers pay less than DSL customers, yet DSL often transmits at lower speeds, though this is not consistent in every situation. It seems as if Jefferson City households pay a price for connectivity and from there the service is a best effort. Although Jefferson City prices are competitive to similar communities, the realized speeds are lower than communities where fiber broadband services have been deployed and there is healthier service provider competition.

### 2. Jefferson City Businesses

Of the 46 Jefferson City businesses that responded to the assessment survey, 39 (84.8%) subscribe to broadband service. Most businesses in Jefferson City subscribe to cable (51.3%) from Charter, or DSL (20.5%) from AT&T. Beyond that, one Jefferson City business reported utilizing fixed wireless from Planet Connect, while one small businesses operates their business with a mobile wireless connection. Six Jefferson City business reported subscribing to fiber-optic broadband services.
Through analysis of the commercial market in Jefferson City, Magellan identified four commercial sites by zip code, selected randomly in various areas of Jefferson City. Magellan’s team then contacted each telecommunications provider identified as operating wireline services in the market to determine service availability. Absent from this market analysis is Planet Connect, which depends on line-of-sight for connectivity with tower locations, though pricing and speeds are competitive with DSL. The results show that although there are provider options for most addresses, the speeds and pricing greatly vary.

**Figure 54: Jefferson City commercial market analysis**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Site #1 - 221 East Broadway, Jefferson City, TN 37760</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 18Mbps/3Kbps</td>
<td>$95/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$134.99/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td>Commercial Site #2 - 402 Victor Villa Way, Jefferson City, TN 37760</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 75Mbps/3Mbps</td>
<td>$160/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td>Commercial Site #3 - 1171 East Highway 118, Jefferson City, TN 37760</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
<tr>
<td>Commercial Site #4 - 2226 Branner Avenue, Jefferson City, TN 37760</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 18Mbps/1.5Mbps</td>
<td>$95/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>$135/month</td>
</tr>
<tr>
<td>Comcast</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>$700/month</td>
</tr>
</tbody>
</table>

In general, these services are branded as “business class” and come with a higher cost and a quality of service that prioritizes business services over residential services that run across the same physical infrastructure. Pricing for DSL and cable based services were found to range from $49.99 for the lowest speed service to $160 for the highest speed service. Approximately 43.6% of business pay more than $100 each month for broadband service, which likely comes bundled with other services, such as telephone.

Of the 46 Jefferson City businesses that responded to the assessment survey, only seven businesses completed the speed test portion, and hardly enough to make broad assumptions across Jefferson City. However, two of those seven businesses reported download speeds greater than 24 Mbps, with both reporting approximately 65 Mbps through cable connections. Unfortunately, none of the six businesses with fiber connections completed the speed test portion of the survey.
Likewise, overall upload speeds were not commensurate with business broadband services in other parts of the country, with only those same two businesses reporting greater than 4 Mbps upload, at approximately 4.3 Mbps. These speed thresholds are important because the current federal definition of broadband is 24 Mbps download and 4 Mbps upload. Relating to business use, upload speed is an important indicator of the economic development capacity of a business and a community. To use upload speed would indicate a high level of productivity and work output generated and distributed, much in the way we think of export of goods. However, with a limited number of Jefferson City responses, it would be unfair to make broad assumptions about the upload capacity of service providers in the city.

Jefferson City businesses clearly recognize the importance of broadband to their business, as 76.9% of respondents rated the importance of broadband with the highest rating, as critically important. In fact, 89.8% rated the importance as an 8 or greater, and no rating was below 5. They reported computer-aided design and graphics file sharing, online backup solutions, inventory management, and internal video-conferencing as the applications that were most important to their businesses and those most impacted by broadband issues.

Jefferson City businesses reported better than expected levels of satisfaction with their current Internet services, as 69.2% of respondents indicated that their current services met their business needs. Only 17.9% of businesses reported that their current services did not meet their business needs, with another 12.8% unsure. Of the Jefferson City businesses that said their Internet services did not meet their needs, the overwhelming majority cited slow speed (91.7%) as their chief complaint.
Along similar lines, 48.8% of businesses report no disruption or minimal disruption of service of less than an hour per month. While that is a positive indicator of quality service, an almost equal amount of businesses (48.7%) report service disruptions totaling between 1 to 24 hours each month, with 2.6% claiming disruption of service of a day or more each month. Of course this represents a small sample size of only 39 businesses that answered this specific question, but in Jefferson City, reliability seems to be a mixed bag.

While 60.9% of responding businesses were small and between 1 to 10 employees, cable and DSL may be enough for most small businesses with low Internet needs or those businesses that keep data “in house.” Of the six business that utilize fiber-optic broadband services in Jefferson City, all are considered large employers, with three below 49 employees, one at 50-74 employees, and two over 150 employees.

Reflecting earlier findings, outside of low speeds, high cost (50%) and poor reliability (50%) were the next most complaints. Exactly 75% of Jefferson City businesses said they want to upgrade, but better broadband services aren’t available, while the remain 25% say they would upgrade but the cost is too high. For these small businesses, three current options exist: (1) accept the broadband issues, (2) pay significantly higher costs for required broadband, or (3) relocate to a community where these services are available and affordable.

One potential reason for these high prices is the lack of available distribution fiber infrastructure in Jefferson City. Falling behind and refusing to wait any longer, many communities with similar issues as Jefferson City are beginning to equip business and residential areas with fiber-to-the-premise infrastructure by overbuilding the existing DSL and cable infrastructure. This fiber distribution infrastructure is specifically designed to deliver high-speed, reliable fiber broadband services to residents and businesses at lower costs than are available today.

“**We have really bad T1 connectivity and we must limit our employees’ use of the network. We’re looking around for better broadband options.**”

– Jefferson City manufacturer

Demand for higher speed and more affordable services necessitates a more accessible solution for Jefferson City businesses. While new businesses that are cultivated require these services to mature, all Jefferson City businesses need a foundation of next-generation broadband to grow. All businesses would also benefit from these services as they begin to utilize more online applications that improve productivity and competitiveness.

In talking with several large Jefferson City businesses, some have corporate or private broadband arrangements, while others have budgets and data needs that justify their broadband expense in having dedicated fiber connections or multiple T1 connections to their facilities. However, all recognize the significance of a local fiber network and expressed strong interest in participating in the network once available.

“**Our current needs are met, but as ordering and more retail is moved to the website, with more remote sales reps accessing inventories, all could push our bandwidth limits.**”

– Jefferson City manufacturer
3. Jefferson City Community Organizations

Education

Schools in Jefferson City are part of the Jefferson County School District, which has 13 schools and a total of 16 facilities. As the main city in Jefferson County, Jefferson City claims a total of six elementary and middles schools, along with an alternative school that serves at-risk students with academic, emotional or behavioral problems.

The Jefferson County School District is supplied with 1 Gbps fiber-optic connectivity between most schools, enabling high-bandwidth interconnection between schools and the school district central office in Dandridge. Internet connectivity is supplied through a fiber connection to the egress point at Jefferson County High School, which provides 500 Mbps of Internet to the district’s schools.

Figure 56: Jefferson County School District facilities and connectivity in Jefferson City

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Street Address</th>
<th>City</th>
<th>Staff</th>
<th>Rooms</th>
<th>Bldgs</th>
<th>Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jefferson Elementary</td>
<td>321 West Broadway Blvd</td>
<td>Jefferson City</td>
<td>80</td>
<td>53</td>
<td>1</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Jefferson Middle</td>
<td>361 West Broadway Blvd</td>
<td>Jefferson City</td>
<td>70</td>
<td>35</td>
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<td>1 Gbps</td>
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<tr>
<td>Mount Horeb Elementary</td>
<td>500 East Dumplin Valley Rd</td>
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<td>100 Mbps</td>
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<td>419 West Dumplin Valley Rd</td>
<td>Jefferson City</td>
<td>60</td>
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<td>1</td>
<td>1 Gbps</td>
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<tr>
<td>Piedmont Elementary</td>
<td>1100 West Dumplin Valley Rd</td>
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<tr>
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<td>7</td>
<td>4</td>
<td>100 Mbps</td>
</tr>
</tbody>
</table>

Jefferson County High School is egress for district - 300 Mbps burstable to 500 Mbps

Clearly the pressing concern on the minds of school leaders is related to the State of Tennessee Department of Education mandates for online curriculum and testing that are due to begin during calendar year 2017-2018. Textbooks will soon be online and only online, along with homework and study guides and an increasing array of student learning resources that utilize more online content to support lesson plans.

As the research in this study has shown, in a rural community like Jefferson City the lack of available and affordable residential broadband is a legitimate and critical concern in meeting those mandates, and school leaders recognize the fact that some areas will not be able to support those mandates once the child is outside the classroom. School leaders say the school district can use as much help as it can get regarding technology and student resources – both in the classroom and the homes of students.

Of course as home to Carson-Newman University, Jefferson City has a lot going for it around the education and culture opportunities from a growing student body at an established and growing university. Exploring “Town and Gown” programs with Carson-Newman and the community around the fiber-optic network could innovate new public education opportunities and civic growth. Likewise, becoming a tech-savvy community around fiber-optic connectivity serve could attract and retain the sought after millennial generation and the digital workforce.
**Healthcare**

The main hospital serving Jefferson County is Jefferson Memorial in Jefferson City, which is part of the statewide Tennova Health Network. While fiber connectivity is adequate for the hospital, all healthcare organizations in Jefferson City would derive significant benefit from expanded broadband capabilities through a fiber-optic local network. A DSL or cable connection for telehealth services is barely enough bandwidth to enable healthcare facilities to take advantage of new electronic health services that will soon be transported across broadband connections.

Healthcare organizations that serve Jefferson City and surrounding communities need broadband connectivity between one another that allows them to use the latest technologies to run their all aspects of their operations efficiently as well as deliver quality patient care. Most acknowledge that to fully allow telehealth workers to interact audibly and visually and monitored over time with patients in the home will require fiber-optic connectivity to households.

Meeting with local healthcare organizations put a light on their broadband connectivity options and their use of broadband internally and with patients. Local healthcare leaders are tech savvy and knowledgeable and seemed ready explore ways to offer latest electronic health technology to residents of the area. Future telehealth plans of all healthcare providers that serve residents of Jefferson City should be considered.

A goal would be to establish community-focused partnerships around the community fiber network, to then explore strategies and lay out action plans for engaging AEC households in telehealth applications. Each local healthcare provider should be encouraged to explore interconnections with their own respective health information and education networks. And in partnership with local healthcare providers that want to participate, local health providers could offer and deliver a suite of telehealth, teletherapy, and health information exchange services to the residents of Jefferson and Hamblen County.

**Local Government**

The government offices in Jefferson City have no internal interconnectivity between government departments, staff administrative offices and local officials. Each local department acquires Internet services much the same as a Jefferson City business does, each negotiated on an individual basis. Evaluating the development of a common broadband network that connects all local government organizations to a single network could achieve many benefits and increase the visibility of Jefferson City as a progressive and responsive government.

Local codes officials manage and utilize many large policy documents and forms to generate, distribute, collect and file away. Large documents like site maps, plat diagrams, water systems, photos, and maps take forever to send via email and then the public constraints dealing with that.

The staff of the codes department and officials and staff of other important public organizations require lots of training required. Some of these course are online, many of those to earn the...
required CEU credits, which are not able to be viewed across all department broadband connections, so would be beneficial to move much training online.

The Jefferson City Water Department leadership and staff do a fine job processing and managing the water operations, but broadband could help drive efficiencies and improve monitoring capability. Automatic meter reading is current performed, and pump stations are monitored every 15 minutes, and every hour on non-essential water stations, which is currently performed with cellular wireless. With broadband, the water department could move to real-time monitoring to detect problems before customers identify leaks or other problems.

This common fiber-optic broadband network would enable Jefferson City to provide connectivity for municipal operations, utilities, public safety, and bring efficiencies and improved process to public administration and economic development. As one a central community of in Jefferson County, Jefferson City can have a substantial impact on the development of local broadband to serve its own internal needs as well as the needs of the community.

**Police and Fire Departments**

We live in a changing world where public safety agencies must address new threats and challenges both natural and man-made. Emergency service departments such as Police and Fire have a requirement of mobile broadband access while in the field. These groups require consistent access to law enforcement and national crime data and must be able to access these systems in real time in a mobile environment. However, quicker access to an assortment of time-critical information is required for the best public safety performance.

For example, the Jefferson City Fire Department keeps a log of industrial buildings of where hazardous materials are stored in each facility, but there are no electronic building diagrams or records management to allow access to this information from the field, or even quickly from a desktop computer. Likewise, police can record video from the field during a traffic slowdown or an accident but all written reports are completed in the office.

Various reporting procedures and processes are in place that record and store needed information, but the full build-out of a unified communications system is needed to make all needed information available digitally and accessible over broadband whenever and wherever needed to bring about more administrative efficiencies.

All Jefferson City police vehicles are connected with video recording capability, and like most departments the field-generated data is downloaded to the server the moment each police car pulls into the station parking lot across Wi-Fi to access the Fusion Network. Speed is an issue, especially when officers return from the field and enter station’s Wi-Fi to dump data to the national servers. The department subscribes to 60 Mbps cable service, and more speeds are needed, as the system speeds slows to a crawl when more than one car enters the Wi-Fi.

“The days of sending and receiving printed hard copies are over.”

– Jefferson City Police Department
The overall use of technology could be improved for both fire and police. There is connectivity on a fire scene through mobile wireless devices carried by key personnel, but the departments have no advanced tools like personnel health monitoring or GPS tracking of firemen in buildings, or facial or automotive recognition software and cameras in high crime areas.

Broadband technology and infrastructure is critical to the success of our first responders because it provides them with enhanced situational awareness in emergencies. By leveraging broadband networks, public safety organizations can gain access to site information, video surveillance data, medical information or patient records, and other information that would be useful in an emergency.

4. Jefferson City Broadband Strategies

The lack of affordable, available next-generation broadband services in Jefferson City poses a growing challenge to the city in terms of how it will meet stakeholder needs across the community including economic development, education, healthcare, and community support. As the broadband needs of these stakeholders continue to grow, providers are not visibly working to upgrade their infrastructure to meet these demands.

So the question remains whether Internet service providers can catch up with the demand for services at prices various stakeholders in the community can afford. For the majority of businesses in Jefferson City these broadband services are simply not available, and where broadband does exist, the most beneficial speeds are prohibitively expensive.

To resolve this issue, Jefferson City must decide what role it wants to play in developing next-generation broadband in its jurisdiction. Jefferson City’s historic and active downtown with youthful inventiveness spirit from economic development. However, as young companies and collaborative partnerships begin to grow, will access to next-generation broadband services be available to them at rates they can afford?

In communities that have taken an important step forward by helping to facilitate the deployment of community broadband networks that serve the needs of the community first, reduce taxpayer costs, and improve broadband services for residents and businesses. Using a combination of broadband-friendly public policy and wise investments in broadband infrastructure, Jefferson City has the opportunity to futureproof itself and become a Gigabit Community. Below is a summary of the key strategies for consideration.
4.1 Public Policy Recommendations

- Develop broadband engineering standards that can be incorporated into land use codes, promoting lower cost of broadband infrastructure construction in conjunction with capital projects.
- Streamline the broadband permitting process within public rights of way to ensure minimal delays and costs for building infrastructure. Evaluate and reduce permitting fees to lower broadband provider construction costs in the city.
- Develop joint trenching agreements with utility and broadband providers to reduce the cost of broadband construction and increase the amount of available broadband infrastructure.
- Educate and partner with local developers to ensure parcels are equipped with basic broadband infrastructure, such as conduit for fiber-optic cable is placed in the ground at the same time as water and electric infrastructure.

4.2 Record Keeping and Information Sharing

- Ensure that all broadband infrastructure built with the above-mentioned public policy tools has appropriate records and data is incorporated into the City GIS systems.
- Enable GIS systems and other broad reaching local government computer applications and technology resources to be shared among all local government departments to increase efficiencies through the share of information.

4.3 Education and Adoption Programs to Increase Demand

- Develop a program to educate the community regarding broadband services that are available in Jefferson City. Community anchors and economic development personnel should connect current and prospective businesses with Jefferson City service providers.
- Improve local broadband usage by focusing on community anchors that are currently not receiving adequate broadband service, and then work with community anchors that are using broadband to insure that it is being used for optimal benefit.

4.4 Develop Strategies to Build Community Network Engagement

- Identify broadband adoption and infrastructure programs at the state and federal levels that will allow Jefferson City to expand the broadband in its area, based on qualifying portions of the city. Work with service providers using partnerships to access available funding programs using each other’s strengths to expand broadband in the area.
- Consider the development of a Jefferson City or Jefferson County community broadband network that would interconnect city and county facilities and all potential community
anchors in the area, which may include the Jefferson County School District, Jefferson County remote offices, local colleges like Walters State or Carson Newman, and others.

• Build a business case that shows a potential savings for the community by implementing its own network. Utilize this network in cooperation with broadband service providers to bring expanded broadband to the area; allowing providers to lease capacity on the network to serve the Jefferson City business community.

• Reinvest revenues generated through leasing of broadband infrastructure to continue buildout of the network to serve more community needs.

• Draw on Jefferson City’s unique asset of Carson-Newman by engaging the student body, faculty and other university resources in “town and gown” activities around technology and broadband in such a way to create opportunities to improve the quality of life of Jefferson City residents.
Appendix E: White Pine Supplemental Report
This community profile provides an overview of broadband services in White Pine as way to provide community members insight into their current broadband environment. The profile presents some key issues regarding the availability and use of broadband today by White Pine households and businesses, and offers strategies the community may consider as part of a regional AEC broadband initiative. The profile may also serve as the foundation for a local initiative to bolster community planning and economic development efforts around broadband and technology. This community profile also fits within the AEC Broadband Feasibility Study to understand the current state of broadband and build long-term strategies to enable access to affordable, next-generation broadband across all AEC service area communities.

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Figure 57: Aerial photo and shading of the town limits of White Pine, Tennessee
1. White Pine Households

The residential broadband market in White Pine is served with cable service from Charter and with DSL from AT&T. Fixed wireless providers Planet Connect and UltraNet also have coverage and serve residential customers in parts of White Pine. Residential areas of White Pine unserved by wireline providers or are outside the line of sight required by fixed wireless service providers rely on satellite providers, with Hughes being the provider most chosen. Only one household reported using their mobile wireless provider as their main source of household connectivity.

Of the 76 White Pine household survey respondents, 82.9% report subscribing to Internet service at their home. Of that group, 65.9% subscribe to cable or DSL, and approximately 20.5% of respondents subscribe to satellite or fixed wireless. The remaining portion report using dial-up or their mobile phone for Internet connectivity in the home. No households in White Pine report having fiber-optic connections.

From the research conducted, it appears that all wireline residential services are provided via copper telephone wire infrastructure owned by the local exchange carrier, AT&T, or coaxial cable infrastructure owned by the local cable company, Charter. Unlike most areas of east Tennessee, Comcast is absent from the market, leaving White Pine with one cable provider. Wireless services are provided through terrestrial fixed wireless systems and mobile wireless carriers.

Both download and upload speeds reported by the majority of residents surveyed were proportionate with services in the region, with cable connections performing slightly better, both on download and upload speeds that other areas. Samples were collected from residential broadband subscribers across White Pine through an online speed test. Of the 34 White Pine respondents who completed the speed test portion of the survey, 17 (50%) reported download speeds that meet or exceed the current federal government definition of broadband at 24 Mbps, with 11 (32.4%) greater than 50 Mbps. On the other hand, 12 (35.3%) households reported download speeds less than 10 Mbps. This group included all the satellite and fixed wireless households, along with several DSL households.

Upload speeds were found to be considerably lower than download speeds, though consistent with asymmetrical DSL and cable broadband services found elsewhere. 18 households (52.9%) reported upload speeds greater than 4 Mbps, which is the current federal government definition of minimum broadband upload speeds. In fact, 23.5% of households reported upload speeds below 1 Mbps. Once again, the slowest upload speeds were reported by satellite and DSL households.

It is important to note that the speeds reported are actual speeds, which may be different from the speeds residents purchase from service providers in the area. In general, DSL and cable broadband services are sold with speed increments that define a maximum speed for the service, such as “Up to 18 megabits down and up to 3 megabits up.” Actual speeds vary depending on the physical location of the service and how many subscribers are concurrently on the system. The
“maximum advertised speed” should not be construed to mean a sustained maximum but instead the top speed of the service that may be considerably lower over long periods of time.

Through deeper analysis into White Pine neighborhoods, Figure 58 shows some services were found to be available in some areas while others lacked access to any broadband services. Magellan identified a number of residential sites, selected randomly in various sections of White Pine by zip code and not necessarily in the town limits of White Pine. Magellan’s team contacted each service provider identified as operating wireline services in the market to determine service availability. The results show that although there are two provider options for most addresses, the service level speeds and pricing varies.

**Figure 58: White Pine household broadband market analysis**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Type of Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Site #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Site #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Site #3</td>
<td></td>
<td></td>
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<tr>
<td>Residential Site #4</td>
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<td></td>
</tr>
<tr>
<td>Residential Site #5</td>
<td></td>
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</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>U-Verse DSL up to 12Mbps/1.5Mbps</td>
<td>$42/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>Charter</td>
<td>Not Available</td>
<td>N/A</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>DSL up to 786Kbps/786Kbps</td>
<td>$34/month</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/5Mbps</td>
<td>$99.99/month</td>
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</tbody>
</table>

Clearly, Internet service providers in White Pine have not upgraded their DSL and cable infrastructure to support newer technologies, and as a result, higher top speeds are elusive. Analysis of the services available in the area indicates that providers are offering packages in some areas of up to 100 Mbps downstream and 5 Mbps upstream on cable-based networks, and 12 Mbps downstream and 1.5 Mbps upstream on DSL-based networks. Broadband coverage data also shows this availability on a widespread basis in White Pine, thought mostly limited to addresses along main transportation corridors.

Measuring the price of services against the actual speeds of services that residents received indicate a strong correlation between the price paid for services and the amount of bandwidth received by residents. The general assumption is that higher monthly prices equal faster speeds, and this is certainly this case among cable broadband subscribers in White Pine as people who pay more for their service generally show higher speeds.

On the other hand, DSL service in White Pine looks to be very poor. Where DSL is available, speeds do not meet the federal definition of broadband service and looks to be priced accordingly. It seems as if White Pine households pay a low price for DSL connectivity and from

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*White Pine Supplemental Report*
there the service is a best effort. Although overall White Pine prices are competitive to similar communities, the realized speeds are lower than communities where fiber broadband services have been deployed and where there is healthier service provider competition.

Figure S9: Spatial distribution of White Pine household market analysis sites

On the subject of service reliability, 81.8% of White Pine respondents reported that their services were somewhat to moderately reliable, meaning their Internet service is disrupted less than 6 hours each month, while 13.6% report no disruption of their service. Only 6.8% say they experience disruptions last a day or more each month, and all of those responses were from households that use satellite connections.

While reliability seems to be generally acceptable in White Pine, by far the biggest complaints were about their connections not being fast enough (74.3%), which was tied by the percent of households that believe prices are too high for the level of services received (74.3%). In fact, supporting earlier findings, only 40% of households claim their service is unreliable.

Still yet, fast and affordable is what households want in their Internet connections, and this lack of speed and perception of value is reflected in the fact that 73.5% of White Pine households claim their current Internet service provider does not meet their household broadband needs. In most communities with healthier competition, one would simply subscribe to another provider, but when White Pine households were asked why they haven’t upgraded their service, 77.1% said “other services are not available in my area” and 31.4% say the “price is too high.”
2. **White Pine Businesses**

Of the six White Pine businesses that responded to the assessment survey, all subscribe to broadband service. Three businesses in White Pine subscribe to DSL, while two subscribe to satellite and one cable. Unfortunately, no White Pine business reported subscribing to fiber-optic broadband services.

Through analysis of the commercial market in White Pine, Magellan identified four commercial sites by zip code, selected randomly in various areas in and around White Pine. Magellan’s team then contacted each telecommunications provider identified as operating wireline services in the market to determine service availability. Absent from this market analysis is Planet Connect, which depends on line-of-sight for connectivity, though pricing and speeds are competitive with DSL. The results show that although there are two provider options for most addresses, the speeds and pricing greatly vary.

![Figure 60: White Pine commercial broadband market analysis](image)

<table>
<thead>
<tr>
<th>Provider</th>
<th>Commercial Site #1 - 1210 State Street, White Pine, TN 37890</th>
<th>Commercial Site #2 - 1564 Hollow Springs Way, White Pine, TN 37890</th>
<th>Commercial Site #3 - 1715 Main Street, White Pine, TN 37890</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>U-Verse DSL up to 18Mbps/1.5Mbps</td>
<td>AT&amp;T Not Available</td>
<td>AT&amp;T U-Verse DSL up to 18Mbps/1.5Mbps</td>
</tr>
<tr>
<td>Charter</td>
<td>Cable up to 100Mbps/7Mbps</td>
<td>Charter Not Available</td>
<td>Charter Cable up to 100Mbps/7Mbps</td>
</tr>
<tr>
<td>EarthLink</td>
<td>Fiber 10Mbps/10Mbps</td>
<td>EarthLink Fiber 10Mbps/10Mbps</td>
<td>EarthLink Fiber 10Mbps/10Mbps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>$94.99/month</td>
<td></td>
<td>$94.99/month</td>
</tr>
<tr>
<td>Charter</td>
<td>$134.99/month</td>
<td></td>
<td>$134.99/month</td>
</tr>
<tr>
<td>EarthLink</td>
<td>$700/month</td>
<td></td>
<td>$700/month</td>
</tr>
</tbody>
</table>

In general, these services are branded as “business class” and come with a higher cost and a quality of service that prioritizes business services over residential services that run across the same physical infrastructure. Three of the six White Pine business pay between $50-99 while one pays between $100-149, with one customer pays more than $300 each month for broadband service, which likely comes bundled with other services, such as telephone or television or security services.

Of the six White Pine businesses that responded to the assessment survey, three completed the speed test portion, and hardly enough to make broad assumptions across White Pine. However, none of those three businesses reported download speeds greater than 24 Mbps, with only the cable connection testing above 10 Mbps, with the DSL and satellite connections reporting 3.2 to 5.6 Mbps downloads. Likewise, upload speeds were not commensurate with business broadband services in other parts of the country, with only the cable subscribing business reporting greater than 2 Mbps upload.
Businesses clearly recognize the importance of broadband to their business, as five of the six (83.3%) of respondents rated the importance of broadband with the highest rating, as critically important. They reported email, communications, business market research, production order file transfers, and customer retention services as the applications that were most important to their businesses and those most impacted by broadband issues.

Businesses reported severe issues with their current broadband Internet services as 50% of respondents indicated that their current services were not sufficient to meet their business needs, with two stating they were "not sure." All businesses reported disruptions in their service that disrupt their operations, with 50% reporting their service is disrupted up to a day each month. One comment indicated that "every storm, every rainy day takes it out." As such, the business community is divided on whether local providers fulfill the Internet and communications needs of their business.

White Pine businesses cited numerous examples of the issues they faced with their existing broadband services, providing comments about how their broadband services were inadequate to process the data needed to run their operations. White Pine businesses cited speed (100%), high cost (75%), and poor reliability (75%) of their services as negatively impacting their businesses. Every White Pine businesses that responded to the survey said they wanted to upgrade to better services but every business said that better services aren't available to them.

While 83.3% of responding businesses were small and under 10 employees, many have large data needs since they utilize significantly more bandwidth than larger companies in other industries. For these small businesses, three options exist: (1) accept the broadband issues, (2) pay significantly higher costs for better broadband or, (3) relocate to a community where these services are available and affordable.
One reason for these high prices and poor reliability is the lack of available distribution fiber infrastructure in White Pine. Refusing to wait any longer on Internet service providers to improve their services, many communities are beginning to equip business and residential areas with fiber-to-the-premise infrastructure by overbuilding their existing DSL and cable infrastructure. This fiber distribution infrastructure is specifically designed to deliver high-speed, reliable fiber broadband services to residents and businesses at lower costs than are available today. This study did not find any fiber distribution infrastructure in or around White Pine that was available to retail business customers.

"If more than three users get on our Internet connection, access for everyone in the building bogs down."
– White Pine business

Demand for higher speed and higher reliability of service necessitates a less costly, more accessible solution for White Pine businesses. While new businesses that are cultivated require these services to become mature, every White Pine business needs a foundation of next-generation broadband to grow. All businesses would benefit from better broadband services as they begin to utilize more online applications that improve productivity and competitiveness.

In fact, established local businesses that came to meetings shared the processes they have developed for times when their Internet access becomes unusable. Many revert back to procedures that were common before the Internet was around, relying on pen and paper and phone. Another explained intricate workaround processes that must be endured because their Internet access can’t support functions that allow interaction with their other corporate facilities.

3. White Pine Community Organizations

Education

Schools in White Pine are part of the Jefferson County School District, which has 13 schools and a total of 16 facilities. As one of the smallest communities of Jefferson County, White Pine claims the largest K-8 campus in the county. The high school is the largest facility in the county, which also ranks among the largest high schools in Tennessee by student population.

The Jefferson County School District is supplied with 1 Gbps fiber-optic connectivity between schools, enabling high-bandwidth interconnection between schools. The four White Pine K-8 buildings are connected to each other via fiber and to the Central Office in Dandridge via 1 Gbps connection. Internet connectivity is supplied through a fiber connection to the egress point at Jefferson County High School, which provides 500Mbps of Internet to the district’s schools.

**Figure 62: Jefferson County School District facilities and connectivity in White Pine**

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Street Address</th>
<th>City</th>
<th>Staff</th>
<th>Rooms</th>
<th>Bldgs</th>
<th>Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Pine School</td>
<td>3060 Roy Messer Highway</td>
<td>White Pine</td>
<td>96</td>
<td>50</td>
<td>4</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Central Office</td>
<td>1030 TN Hwy 92</td>
<td>Dandridge</td>
<td>13</td>
<td>--</td>
<td>1</td>
<td>50 Mbps</td>
</tr>
<tr>
<td>Food and Nutrition</td>
<td>1107 County Lane</td>
<td>Dandridge</td>
<td>4</td>
<td>--</td>
<td>1</td>
<td>100 Mbps</td>
</tr>
</tbody>
</table>

Jefferson County High School is egress for district - 300 Mbps burstable to 500 Mbps
Clearly the pressing concern on the minds of school leaders in White Pine and all of Jefferson County is related to the State of Tennessee Department of Education mandates for online curriculum and testing that are due to begin during calendar year 2017-2018. Textbooks will soon be online and only online, along with homework and study guides and an increasing array of student learning resources that utilize more online content to support lesson plans.

In a rural community like White Pine, the lack of availability and affordability of residential broadband is a legitimate and critical concern in meeting those mandates, and school leaders recognize the fact that some areas will not be able to support those mandates once the child is outside the classroom. In talking with school leaders, the sky is the limit for envisioning of future needs, as leaders say the school district can use as much help as it can get regarding technology and student resources.

**Healthcare**

While the main hospital serving the county is Jefferson Memorial in Jefferson City, healthcare organizations in White Pine can derive significant benefit from expanded broadband capabilities. Local healthcare organizations expressed issues with existing broadband connectivity and are looking for solutions to “keep up” with the latest electronic health technologies.

The East Tennessee Health Center and the Family Practice Center in White Pine interconnect with their own respective health networks, as organizations such as Healthstar deliver a suite of telehealth, telemedicine, and health information exchange services. Healthcare organizations in White Pine and nearby communities need broadband connectivity between one another that allows each clinic to use the latest technologies to deliver quality patient assessments and care, and quickly make the determination to forward patients to nearby medical centers. A DSL or cable connection for these services is barely enough bandwidth to enable these facilities to take advantage of new electronic health services that will be transported across these connections.

**Local Government**

The government offices in White Pine have limited interconnectivity between government departments, staff administrative offices and local officials. Each local department acquires Internet services much the same as a White Pine business does, with each negotiated on an individual basis. Currently, departments located at City Hall share a 30 Mbps cable connection.

Evaluating the development of a common broadband network that connects all local government organizations to a single network could achieve many efficient goals and would increase the visibility of White Pine as a progressive and responsive government.

As a mountains and lakes destination straddled along I-81, economic development centers around modular construction, warehousing, logistics and transportation markets. A leading economic driver in White Pine is also due to the adjacent Douglas Lake, which brings an estimated impact of $52M each year from fishing events into Jefferson County. As such, $2.7M for economic development has been raised and spent on marketing around the county.
This common broadband network would enable White Pine to provide connectivity for municipal operations, utilities, public safety, and public administration. But first and foremost would allow for economic development around data-intensive and time-sensitive logistics industries. As one of the key stakeholders in Jefferson County, White Pine can have a substantial impact on the development of local broadband to serve its own internal needs as well as the needs of the community and promote its own unique brand of economic development.

**Public Works**

White Pine water department staff does a fine job processing and managing the water operations, but broadband could help drive efficiencies and improve monitoring capability. Currently there is no leak detection in the water system, but pump stations are monitored every 15mins, and every hour on non-essential water stations, performed with cellular wireless. With broadband, the water department could move to real-time monitoring to detect problems before customers identify leaks or other problems.

**Public Safety**

All White Pine vehicles are connected with video recording capability, and like most departments the data is downloaded to the server the moment each police car pulls into the station. The department subscribes to Charter cable services, with AT&T mobile wireless in cars. Leaders believe things work good for current need, but "never know about the need for technology down the road to support things like traffic cams, or license plate detection."

The overall use of technology could be improved for both fire and police. There is connectivity on a fire scene through mobile wireless devices carried by key personnel, but the departments have no advanced tools like personnel health monitoring or GPS tracking.

**Wastewater**

White Pine has an older water plant, and leaders believe they don’t Internet now, but with a newer plant will certainly integrate more online services. Some of the pump stations have no wired or wireless access around them. White Pine is not using SCADA but will need to in future as new sewer plant comes online. The water and sewer system is mapped on GIS, so the underlying ability to use technology is in place.
4. **Broadband Strategies**

The lack of affordable, available next-generation broadband services in White Pine poses a growing challenge to the town in terms of how it will meet stakeholder needs across the community including economic development, education, healthcare, and community support. As the broadband needs of these stakeholders continue to grow, providers are not visibly working to upgrade their infrastructure to meet these demands.

So the question remains whether Internet service providers can catch up with the demand for services at prices various stakeholders in the community can afford. For the majority of businesses in White Pine these broadband services are simply not available, and where broadband does exist, the most beneficial speeds are prohibitively expensive.

To resolve this issue, White Pine must decide what role it wants to play in developing next-generation broadband in its jurisdiction. White Pine’s quaint downtown, nearby lake scene and immediate access to Interstate 81 and proximity to Interstate 40 are all advantages for economic development. However, as young companies and collaborative partnerships begin to grow, will access to next-generation broadband services be available to them at rates they can afford?

Communities that have taken an important step forward have done so by helping to facilitate the deployment of networks that serve the needs of the community, reduce taxpayer costs, and improve broadband services for residents and businesses. Using a combination of broadband-friendly public policy and wise investments in broadband infrastructure, White Pine has the opportunity to futureproof itself and become a Gigabit Community. Below is a summary of the key strategies for consideration.

### 4.1 Public Policy Recommendations

- Develop broadband engineering standards that can be incorporated into land use codes, promoting lower cost of broadband infrastructure construction in conjunction with capital projects.

- Develop joint trenching agreements with utility and broadband providers to reduce the cost of broadband construction and increase the amount of available broadband infrastructure.

- Partner with local developers to ensure parcels are equipped with basic broadband infrastructure, such as conduit for fiber-optic cable is placed in the ground at the same time as water and electric infrastructure.
4.2 Record Keeping and Information Sharing

- Ensure that all broadband infrastructure built with the above-mentioned public policy tools has appropriate records and data is incorporated into the town’s GIS systems.
- Develop local government processes to move more workflow to a paperless and digital environment that will enable convenient and efficient sharing of information between local departments.
- Insure that all paper documents are converted to digital format and archive existing paper documentation to digital files that can be digitally archived for required record keeping.
- Enable GIS systems and other broad reaching local government computer applications and technology resources to be shared among all local government departments to increase efficiencies through the share of information.

4.3 Education and Adoption Programs to Increase Demand

- Improve local broadband usage by focusing on community anchors that are currently not receiving adequate broadband service, and then work with community anchors that are using broadband to insure that it is being used for optimal benefit.
- Develop programs to educate the community and civic organization regarding beneficial broadband services that are available in White Pine. Community anchors and economic development personnel should connect current and prospective businesses with White Pine service providers.

4.4 Develop Strategies to Build Community Network Engagement

- Consider the development of a White Pine or Jefferson County community broadband network that would interconnect town and county facilities and all potential community anchors in the area, which may include the Jefferson County School District, Jefferson County remote offices, local colleges like Walters State or Carson Newman, and others.
- Identify broadband adoption and infrastructure programs at the state and federal levels that will allow White Pine to expand the broadband in its area, based on qualifying portions of town. Work with service providers using public/private partnerships to access available funding programs using each other’s strengths to expand broadband in the area.
- Build a business case that shows a potential savings for the community by aggregating usage and finding applications that drive benefits. Utilize this network in cooperation with broadband service providers to bring expanded broadband to the area; allowing providers to lease capacity on the network to serve the White Pine business community.