

# Next-Generation Broadband Feasibility Study

Stark County Area Broadband Task Team

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## EXECUTIVE SUMMARY

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### INTRODUCTION

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Progressive communities are relying upon municipal and public-private fiber-optic networks to thrive in the new digital world. As constituents continue to adopt new digital platforms, more emphasis is being placed on meeting the growing demands for bandwidth, protective redundancy and competitive pricing. Communities that have invested in fiber infrastructure are reaping the economic benefits of these assets and are leveraging them to bring next-generation broadband to their residents, businesses, and governmental/community support organizations.

The Stark County Area Broadband Task Team (SCABBTT), a volunteer grassroots organization, has been working to encourage a regional approach to the promise of next generation connectivity and skills. Collaborating on an investment in the broadband infrastructure that will ensure inclusive opportunities for all to thrive in our digital economy, they believe, is the moral responsibility of a community. The Task Team’s vision is aspirational; members are passionate about the need for affordable Internet at globally competitive speeds. They share a long-term goal of a “gig” to every home and support a policy of free service to schools, libraries, and government/community support agencies.

Stark County and its governmental/community support organizations currently contract for leased lines by incumbent providers. These contracts account for millions of dollars that are paid to incumbent providers each year, which could otherwise be invested locally through key partnerships under the right business case. Many community anchor facilities currently contract for high-speed broadband delivered by fiber, however they report the need for more bandwidth, and in some cases the costs can be prohibitive. Though there are portions of the County that are well served, this is the exception – not the rule.

Current Stark County governmental entities own little in the way of wireline telecommunications assets. There is some fiber and conduit owned by municipalities and a few community anchors. The Stark County Area Broadband Task Team wants to change that. SCABBTT leaders believe Internet access is the “fourth utility” critical to a community’s ability to “go forth” (see [forthutility.org](http://forthutility.org)), and that all citizens, businesses and anchors need scalable, affordable access. SCABBTT realizes that this infrastructure is a key asset and has deemed additional investment necessary. Through the help of the Herbert W. Hoover Foundation and local partners, SCABBTT was able to secure funding to hire Magellan Advisors, LLC to develop this Broadband Study. SCABBTT has been working together for several years to devise options to increase the amount of local investment in broadband infrastructure. The team has repeatedly invited all current area Internet service providers to partner with them, and is committed to an ongoing public transparency and openness to any and all potential partners. The team realizes that this Study is necessary to propose a roadmap and strategy which will allow the community to more fully engage in the conversation and work together to invest in itself once again.

This Study outlines a high-level network strategy, design, and business model framework to support the needs of Stark County’s community anchors, businesses, and residents. It will continually evolve as more entities choose to share information and data that will likely have a positive effect on general cost estimates. This refined work will guide the Stark community through the steps to begin investing in broadband assets that will support the evolution of Stark County and will continue to support the community for decades to come.

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## OVERVIEW OF COMMUNITY BROADBAND

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Fiber is the gold standard for community/government communications, broadband services, and Internet access. Fiber is used to transmit large amounts of data securely over long distances with high reliability. It is flexible enough to support a wide range of applications and scalable enough to support nearly unlimited capacity and speed. It is considered a capital infrastructure asset similar to water, road, and electricity and has a lifespan of up to 50 years or more with the proper installation and maintenance.

Over 1,000 cities and communities in the US own some form of municipal fiber network and have used it for decades to support their operations. These networks are becoming increasingly important to cope with the rapid growth in connected devices. These devices run the gamut from utility assets and street lights, to traffic signals and surveillance cameras. Cities that maintain these networks are able to accommodate these “smart city” technologies which allow them to be more efficient, reduce costs, and increase the value they deliver to their constituents.

Within the past 15 years, some cities have expanded the use of these networks to enhance local broadband services in their communities. As broadband has become a key asset to support economic development, education, healthcare, and other community functions, communities have leveraged their networks to foster fiber-based broadband services, either directly, or more often through partnerships with their local broadband providers.

The US Chamber of Commerce made the support of public-private broadband partnerships a “2016 Public Policy Priority.” Organizations such as Smart Cities, The Intelligent Community Forum, and Next Century Cities have organized to share the successes of public-private initiatives and to promote public engagement and oversight, and here in Ohio the Dublin Institute has adopted a mission of “Intelligent Ohio.”

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## OPPORTUNITY STATEMENT

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Stark County and its communities have the opportunity to begin making strategic investments in broadband infrastructure which will pay dividends for decades to come. This infrastructure will support and enhance new middle-mile infrastructure<sup>1</sup> connecting community anchors and providing new capacity and assets to the individual communities throughout Stark County. In addition, these investments will form a community owned backbone capable of meeting the communications and technology needs of government and the greater Stark County community.

New broadband investments will become a key resource that Stark County, in partnership with the private sector, will leverage to drive value across a range of governmental and community functions from healthcare, to economic development, as well as bridging the digital divide and providing an overall better quality of life.

Community based investment in telecommunications assets will allow the County and its communities to make decisions on how their community is best served, including decisions around network speeds, content partners, and last-mile infrastructure buildout options. The proposed Stark Community Broadband Network (SCBN) would be funded through user fees paid by participating organizations, and excess network capacity (conduit, fiber, and other vertical assets) which can all be leveraged to generate additional revenue streams.

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<sup>1</sup> Middle Mile Infrastructure - The list of interconnection points between the service provider and the Internet backbone. These connections are capable of very high bandwidth, speeds, and capacities and may be service assured.

This network is foundational for the Stark community and will place local leaders into the driver’s seat when it comes to driving future investments in telecommunications assets and determining optimal services and service levels. Today, with the exception of Massillon, all investment decisions are made by incumbent providers at the State or National level – hence the reason for a major disparity in services offered and pricing for these services between the Stark region and other more metropolitan areas.

## BENEFITS OF A COMMUNITY BROADBAND NETWORK

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There are many benefits Stark County could experience through the development of the Stark Community Broadband Network. These include direct benefits to government, businesses, and residents along with additional “off-balance sheet” benefits such as economic development, better education, healthcare, and the myriad of operational efficiencies that can be realized regionally. While traditional providers cannot include these off-balance sheet benefits in their ROI, communities can – as the health, education, and welfare of its citizens is its primary mission.

### Leading Edge Broadband (Business and Residential)

A community broadband network can become a catalyst to accelerate deployment of leading edge broadband services in Stark County. Development of this network presents an opportunity for the Stark community and private Internet service providers to work together to bring the latest fiber-to-the-premise (FTTP) technologies to residents and businesses. By lowering cost barriers to deploy fiber-to-the-premise networks, Stark and its communities can take an active role by developing public-private partnerships with competitive broadband providers. If successful, these partnerships will yield positive economic and social benefits to the Stark community.

### Economic Development

Economic development will become a key beneficiary of the Stark Community Broadband Network. This asset can be used as a tool to reduce the cost of doing business in the region while delivering next-generation high-speed Internet services. The SCBN will have the capability to interconnect to regional data centers such as Secure Data 365 and potential centers in Akron, which can provide a gateway to numerous broadband, cloud, and application providers, increasing the number of choices local businesses have for their communications and technology needs. The County and its communities will be able to actively market areas of Stark County as “fiber ready” and provide prospective businesses with a range of available service providers. Stark County will also be able to develop strategic partnerships with current and future broadband providers to market the benefits of Stark County’s network and services to businesses.

### Education

The SCBN will provide a platform of advanced connectivity to support education in its evolution. Educational institutions around the country have become one of the greatest beneficiaries of community owned fiber networks, and Stark County has an opportunity to take a leadership role locally. Education has become a community responsibility with organizations such as libraries, businesses, and non-profits providing support, internships, and alternatives. Connecting to these new programs and tools requires high-speed, reliable, and affordable connectivity. Though many of Stark County’s schools are currently serviced, they question their future ability to upgrade bandwidth easily and cost effectively. As virtual reality, augmented reality, instant language support and access to free, world-class educational resources escalate, so does a community’s responsibility to provide for all of its learners – during and beyond the school day.

### Public Safety

Public Safety agencies in Stark County will benefit from additional connectivity throughout the region. The network will interconnect the Police and Fire stations to other key locations throughout the County. In addition, it can be used to provide key fiber interconnect points throughout the area to assist in the planning for community events. This network will support future technologies such as License Plate Recognition (LPR) cameras, surveillance cameras, and other types of sensor technology that can provide positive benefits to law enforcement. Regardless of what community broadband model chosen, these fiber-optic lines are, indeed, critical infrastructure. Their significance grows commensurate with technological advance mentioned throughout all sectors of our lives. Given emergency response our communities have come to expect from our first responders, healthcare providers, transportation and utility crews in times of cold weather extremes and worse, natural disasters such as hurricanes Sandy and Katrina, and to a lesser extent tornados and even earthquakes, these fiber networks significance and demands for service will only increase. It's obvious we can ill afford a repeat of Stark County's past experience with any backhaul network 911 outage issues. A community broadband network routed through a local carrier hotel, such as Secure Data 365, would greatly enhance our viability, redundancy and ability to handle the demands of data, voice or video as well as future NG911 demands tomorrow and far into the future.

### Healthcare

Healthcare organizations are rapidly expanding their use of data, as they move from episodic treatment to population health models that leverage their investment in electronic medical records. For these models to work optimally, the organizations and the patients they serve require access to high capacity, reliable broadband services. The patient population that will go online, reporting their data frequently, will expand from those with chronic conditions to those that are simply normal. The SCBN will include capabilities and capacity to support Stark's healthcare organizations, enabling them with fiber connectivity to interconnect hospitals, doctors' offices, clinics, and imaging centers, supporting their implementation of digital healthcare programs for Stark County's residents.

### Workforce Development

SCBN can create work opportunities, grow workforce capabilities, and increase citizens' incomes. Broadband gives workers more options for developing and deploying their talents. It is increasingly practical to get specialized knowledge to carry out most any tasks and use many tools on-demand, which makes workers more productive. Many professionals can live where they like and work wherever they're needed, which gives workers access to higher paying "gigs." Broadband opens up new, high-skill job opportunities as companies adopt and buy digital technologies. Even as SCBN makes new ways of working practical, the workforce adds to the value of SCBN for business and economic development. The businesses need skilled workers, workers need skill development, and it all depends on ultra-fast broadband. Digital tools, online learning, and telework are the future of workforce that this is happening now and SCBN can provide access to that future for Stark County's citizens.

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#### **Public Utility**

A public utility is a business that furnishes an everyday necessity to the public at large. Public utilities provide water, electricity, natural gas, telephone service, and other essentials. Utilities may be privately or publicly owned, but most are operated as a private business.

<http://legal-dictionary.thefreedictionary.com/Public+Utilities>

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## BROADBAND FEASIBILITY STUDY

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Today, the bulk of Stark County's telecommunications services are provided by traditional incumbent and regional competitive providers. The overwhelming majority of services are provided over legacy copper networks, with fiber-optic and point-to-point wireless services available in certain areas of the County. Community investment in the SCBN will allow regional organizations and businesses access to next-generation Internet services at competitive prices. Local investment will potentially reduce the ongoing operating costs of many governmental and community support organizations, futureproofing their telecommunications needs. This Broadband Feasibility Study outlines a roadmap to investment in middle-mile (backbone) fiber assets, which will connect community

anchors and provide new technology platforms and broadband assets for communities to further local investment and decision making in last-mile networks.

While SCABBTT's vision includes Gigabit for all, consensus have been developed amongst the Task Team to develop an actionable roadmap that will allow the community to begin making incremental, strategic investments in broadband. This Study cannot outline or recommend a "build and they will come" last-mile solution due to the size and geographic makeup of Stark County. Pulling relevant industry data from a recently released FTTH study for the City of Madison, WI – we can extrapolate cost structures that could apply to Stark County. In Madison's case, building a ubiquitous Fiber-to-the-Premise network would cost the City at least \$143.5 million and could cost as much as \$212 million depending on the business model selected. For Madison, best case estimates using a combination of aerial and underground construction and including all network electronic, drops, and customer premise equipment (CPE) are approximately \$194 million dollars to serve 35% of residents and businesses served by the fiber.

Stark County includes 165,000 residential units. If we utilize an average industry cost per passing (avg. cost per home served) of \$1,500 per unit, we can identify a full fiber buildout cost in the range of \$250 million. When we apply a cost of \$1,250 per subscriber connected (to cover drop fiber cable, CPE<sup>2</sup>, and battery backup) and apply a 35% uptake, we arrive at a budget just for subscribers connected of \$72.5 million. In addition to these costs, design/engineering, data center, network components, and operational requirements will likely push a FTTP project for Stark into the \$330 - \$400 million range – again, to connect 35% of premises in the County.

A \$330 - \$400 million investment to buildout a FTTP network throughout Stark County is unlikely at this point due to economic conditions and political will, however, a measured, strategic approach to making incremental investments in the County are likely to be supported if an actionable roadmap is clearly delivered.

## FINANCIAL SUMMARY

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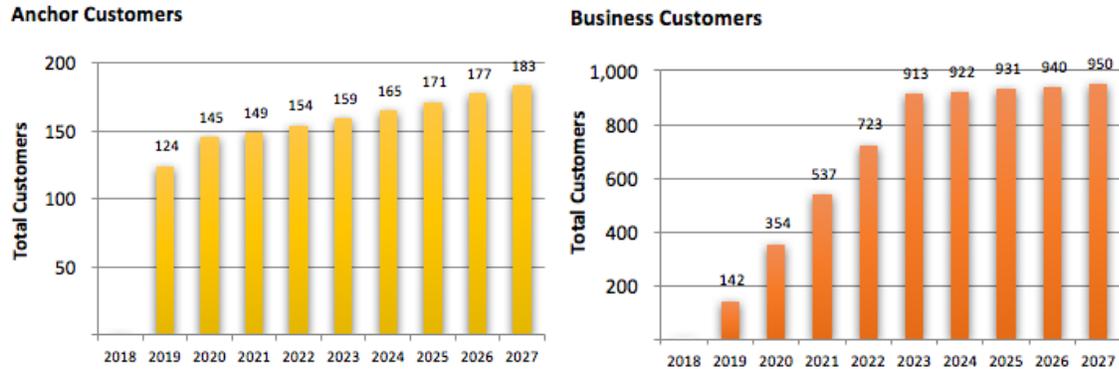
Stark County and its communities have the opportunity to invest in a locally owned and controlled fiber backbone network capable of connecting community anchors, businesses, and residential communities throughout the region. As outlined in this Study, the County could invest upwards of \$22 million to fund a fiber buildout of nearly 100 miles of backbone fiber and over 35 miles of lateral connections to connect 140 community anchor facilities and three regional data centers. This fiber network could provide capacity and infrastructure to drive last-mile investments to serve the greater Stark County market. In addition, these new fiber routes will pass over 10,000 Stark County based businesses who can take advantage of this new infrastructure.

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<sup>2</sup> Customer Premise Equipment - Any terminal and associated equipment located at a subscriber's premises and connected with a carrier's telecommunication channel at the demarcation point ("demarc").

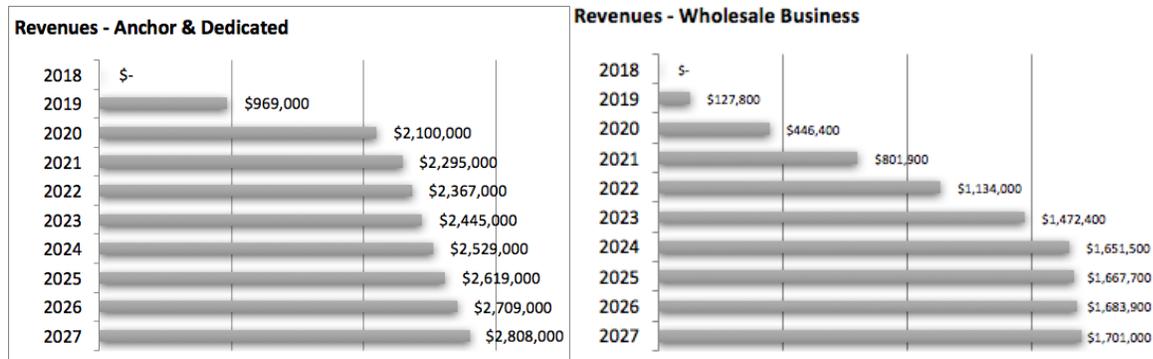
Over a projected 20-year period, this model assumes the connection of 140+ anchors over the first three years and additional wholesale business customers as outlined below in Figure 1. **Error! Reference source not found.**

FIGURE 1: PROJECTED ANCHOR AND BUSINESS CUSTOMER PROJECTIONS



With these projections, revenues from anchor and wholesale business customers will grow from an estimated \$2.5 million in Year 3 to nearly \$5 million by Year 10. These revenue models show community anchor revenue accounting for 66% percent of all system revenue. With additional growth in wholesale business services, plus the modest 10% uptake included in this model, revenues will grow much faster with additional subscribers taking service.

FIGURE 2: PROJECTED REVENUES-COMMUNITY ANCHOR AND WHOLESALE BUSINESS



Using the model’s stated assumptions, and as outlined below in Figure 3, the Stark Community Broadband Network will require \$22.5 million in funding, and can be financially sustainable over the long term with the right project execution. The revenue model covers all operating and capital requirements, debt service, and funding of necessary reserve balances. The model projects Cumulative Free Cash Flow of nearly \$22 million over the initial 20 Years. All financing instruments have been assumed at 20-year with 4% interest. Given these assumptions the network has an accelerated payback period of 15 years using excess free cash flow. This payback can be rapidly escalated as can increased system revenues with broader use of the network.

FIGURE 3: SCBN DASHBOARD



It is our opinion, that Stark County should take prudent steps to form partnerships and alliances where possible and to make strategic investments in these network assets once the proper governance, business, and financial models have been agreed to by all participating parties. These financial models are sensitive, and can be used to provide various levels of analysis around the sensitive points – service rates, uptake, and operating structures.

## CONCLUSIONS AND NEXT STEPS

Stark County must build consensus amongst the community and potential partners to develop final details beyond this Study. There are many answers that will have to be answered once the stakeholders are educated on the options. Magellan’s recommendations outlined in this action plan are to provide the group guidance to what process is used to develop consensus and to bring this network to fruition. The Task Team and community leaders will have to begin hosting workshops and developing supporting legislature to move this project forward. A good debate will ensue. Armed with the knowledge of what is possible, at what cost, and how these recommendations should be carried out, the Task Team and County can begin to move this process forward by taking strategic steps and making wise investments. With a business case, the County and its partners must understand the opportunity before them, and understand the basic concepts and benefits that this network will bring to the community. The community will have to support this project – at all levels – giving the necessary “buy in.”

The following tasks must be accomplished:

1. Finalize project partners (school district, county, cities and townships, healthcare providers)
2. Develop consensus on governance structure
3. Identify funding opportunities and loan requirements
4. Finalize site selections for facilities to be connected
5. Finalize fiber-optic routes
6. Identify potential last-mile projects and partners to develop a proof of concept
7. Perform a Design & Engineering Study to develop actual construction plans and engineers estimates for construction
8. Determine network components, systems, and data center requirements
9. Develop Business and Implementation Plans
10. Move into implementation

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## SECTION 1: BROADBAND AND ECONOMIC TRANSFORMATION

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Economic transformation is a simple reality for most people around the world: What we make and how we make it has changed over time, and this will continue to change. Digital technology, especially ubiquitous ultra-fast broadband, is part of that change and enables other changes. Our economy is transitioning to value intangible assets and intellectual activities over the physical and manual. Resources can be more flexibly acquired and deployed via information systems, and used more effectively based on algorithms and analytics. We can make most anything in small batches to meet specific needs. Real assets and durable goods are increasingly valued for their digital controls and intelligence. We can control and track most anything in our lives, and things can act on their own, autonomously and intelligently, for us. Behind all of this are advanced materials and production methods, lots of research and engineering, and a vast universe of code.

The world is digitally interconnected, and is getting more so. These changes are pervasive throughout the economy, across markets, in all sectors, from raw material through production and consumption to the land fill. Powerful new technologies continuously replace older technologies, which were revolutionary in their time. There is huge demand for the best and latest device. At the same time, personal experiences and relationships are increasing in value. People want to be connected and do real things together more than ever. All of the hardware and software churn is driven by improvements in how technology enables people. The technology and economic transformation, in the end, serve the purpose of humanity, and that's what's really real.

This section of the Study reviews Stark County demographics and economic metrics, then considers their implications. Some fundamentals of economics and technology are useful to understand the issues and opportunities the community faces. A summary of economics highlights the fact that digital technology has created a whole new sector as well as impacting both consumption and production. A discussion of telecommunications shows how technology, regulations, costs, and functionality are all intertwined. It also reveals how the technology impacts the economy, making us more productive and prosperous even while devouring old jobs, firms, and whole industries.

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### CHAPTER 1. ECONOMIC TRANSFORMATION IN STARK COUNTY AND BEYOND

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Stark County's story, like the history of the United States, is one of economic transformation. The yearning to be free, the excitement of discovery, of new lands and new vistas, and the American dream of better life through hard work. Stark County has experienced economic transformation. Even as the dream took form, George Washington, among others, was mapping Ohio; identifying bountiful regions and recording the trails brave souls might follow to discover the brave new worlds beyond the Appalachians. By 1769, Washington had returned to Virginia to take up the protest of "taxation without representation."

Originally agriculture-based, the area's economy transitioned to heavy industry in the 19<sup>th</sup> century, enabled by abundant natural resources. From the 17<sup>th</sup> through the 19<sup>th</sup> century in the United States, local economies took root and grew from natural assets—river towns, mining towns, oil towns, cattle towns, mill towns, rail towns, and steel towns, among others. Workers came from around the world. The great majority came from Europe, settled east, then moved west and south. Fortunes were made, families grew and futures were assured or threatened, prospered or poisoned by the actual depth of the fact or fiction of resources produced and/or processed through each "town." People lived where they worked.

Steel, oil, machinery, consumer products, and chemicals were—and to some extent, remain—mainstays of the Stark County's regional economy. Those industries radically contracted in the late 20<sup>th</sup> century as a result of the coincidence of resource depletion, new technology, labor costs, and global competition. Economic transformation

drove growth in and around Stark County until the mid-20<sup>th</sup> century, when the region began to be left behind. This reality shows up in recent population growth trends.

### STARK COUNTY BY THE NUMBERS

Stark County, Ohio, the “County”, is located in northeast Ohio and is comprised of 36 cities, towns, and villages. The total area of the County is 581 square miles with 5.3 square miles being water. The County had an estimated population of 375,165 in July of 2015. Canton is by far the largest city in the County, and the County seat, with 71,885 residents. The population of both the city and the County have declined slightly in recent years while the population of the state and nation, even more so, have grown, as illustrated in Figure 4.

FIGURE 4: STARK COUNTY HAS SEEN NEGATIVE POPULATION GROWTH IN RECENT YEARS

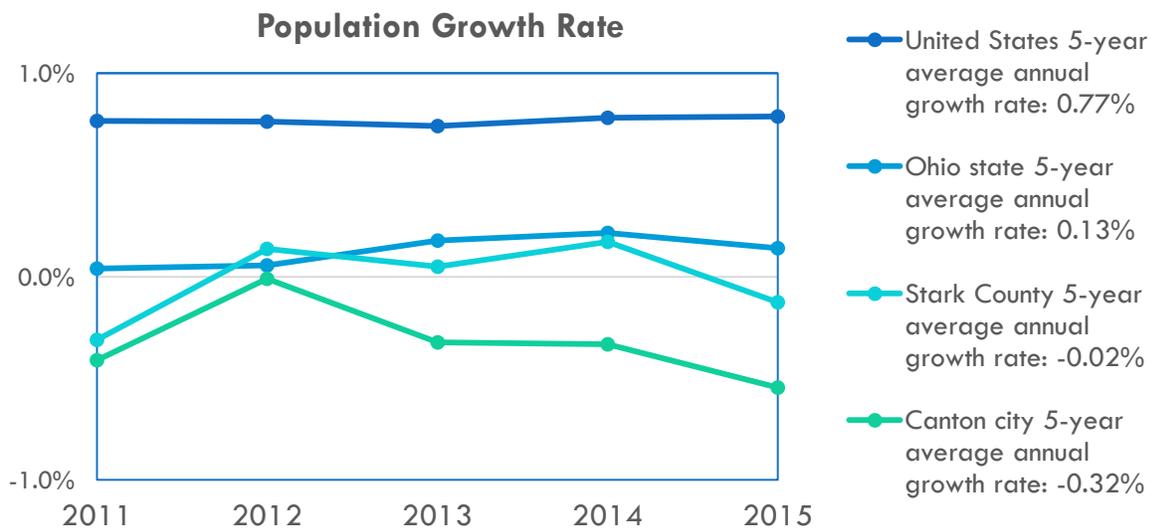


Table 1, below, shows the population changes in Stark County between 2000 and 2010. Over this same time the average age of Stark County residents rose by 2.9 years, which is consistent with the Ohio 2.6-year increase in average age, and the County’s population of individuals over the age of 60 years-old increased 3%, which matches the national change. Sixty-five and half percent of the population in the County is living in a family household and 30% of the population under the age of 19. A great portion of Stark County is comprised of families with children living in the home. Fifteen percent of individuals in the Stark County area, and nearly a third individuals in Canton, were living below the poverty line as of 2010, according to Census data.<sup>3</sup> Both areas had 19.2% of individuals in poverty in 2000. Stark County’s level of poverty is comparable to the national and Ohio levels of 15.6% and 15.9%, respectively. The percentage of individuals living in poverty in the City of Canton is double the percentage for the county, state, and nation. Generally, the population in Stark County has been aging and getting poorer with kids.

<sup>3</sup> Source: United States Census Bureau, American Factfinder, <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

TABLE 1. POPULATION CHANGE IN STARK COUNTY BETWEEN 2000 AND 2010

<b>Geographic Area</b>	<b>Population Change</b>
<i>Stark County</i>	-2,512
<i>Canton</i>	-7,799
<i>Alliance</i>	-931
<i>North Canton</i>	1,119
<i>Massillon</i>	824

The high school graduation rate in Stark County cities range from 83.6% to 93.6%. Over half of the workforce in Stark County (over 180,000 people age 25 or over) did not have a college degree as of 2014. A college degree is not necessary for the digital or innovation economy, but it is an important indicator of a workforce’s overall capabilities and ability to adapt and learn. Even college graduates have to continually add to their knowledge base and upgrade their skills. The challenge and opportunity in Stark County, as in many other communities, is to provide an on-ramp to economic transformation for citizens.

There is cause for concern about “brain drain.” The County is losing young, high-potential earning residents. Stark County stakeholders expressed the view that the phenomenon has not ceased, and they expect that the 2020 Census will reveal additional population drain.<sup>4</sup> Residents have also commented that educated individuals are leaving the Stark County area causing the population to become “fewer, older, and poorer.” While this may be the case, the aging population is in line with the national average. Students of Kent State University, Stark State, and other local higher education institutions tend to leave the region after graduation. They have to live and work elsewhere in order to be gainfully employed, away from family, friends, and their hometown. Over 50% of graduates leave without ever coming back. The Stark County communities will invest an average of \$250,000 per high school graduate over their life in the public education system – and 50% leave. Many would consider this a poor return on investment.

The statistics in Table 2 indicate that workforce capabilities improving, but the simple fact is that economic transformation requires this improvement to (a) speed up and (b) be closely aligned with changing economic activities. Ubiquitous ultra-fast broadband helps. It provides the infrastructure and platform for flexibly accessing knowledge and training resources. Interpersonal, human connections are critical to improving capabilities quickly in alignment with employers’ evolving needs. In-person learning activities supported by social media are the key to capability development because they bring together learning content and inter-personal connections.

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<sup>4</sup> In-person conversations with community stakeholders, July 14, 2016.

TABLE 2. EDUCATIONAL ACHIEVEMENT HAS INCREASED IN STARK COUNTY BUT A LARGE PORTION OF THE POPULATION IS UNDER-EDUCATED.<sup>5</sup>

<b>Educational Attainment</b>	<b>Stark County</b>		<b>Canton-Massillon MSA</b>	
	2014 % population	Change 2010- 2014	2014 % population	Change 2010- 2014
<i>Less than 9th grade</i>	2.8%	-5.5%	2.9%	-8.0%
<i>9th to 12th grade, no diploma</i>	7.4%	-18.4%	7.6%	-18.3%
<i>High school graduate<sup>6</sup></i>	38.7%	-4.1%	39.4%	-3.7%
<i>Some college, no degree</i>	21.2%	7.7%	21.0%	8.1%
<i>Associate's degree</i>	8.4%	21.5%	8.4%	23.0%
<i>Bachelor's degree</i>	14.3%	5.9%	13.7%	5.1%
<i>Graduate or professional degree</i>	7.2%	6.9%	7.0%	6.2%

Since the 1950s, production, jobs, and families have moved south. At the same time the national outputs of manufacturing and related industries tripled. Production became more efficient, decreasing demand for labor, even as producers sought out locations with lower-cost labor. The result is that Stark County has been left with legacy industrial occupations, service industry jobs, and higher paying professional occupations—particularly in healthcare. The region is strong in some occupations that are associated with basic industries, which export and drive capital in-flows, but those occupations tend to have relatively low pay.<sup>7</sup> (See Table 3.)

TABLE 3. CANTON-MASSILLON MSA<sup>8</sup> HAS RELATIVELY STRONG EMPLOYMENT IN RELATIVELY LOW-PAYING OCCUPATIONS

<b>Occupations</b>	<b>Employment</b>	<b>% of Jobs</b>	<b>LQ</b>	<b>Annual Income</b>	
				<b>Average</b>	<b>Median</b>
<i>Production</i>	19,050	11.51%	1.75	\$32,770	\$31,210
<i>Healthcare Support</i>	8,000	4.83%	1.67	\$26,480	\$23,130
<i>Healthcare Practitioners</i>	11,530	6.96%	1.20	\$72,130	\$54,900
<i>Food Preparation and Related</i>	18,130	10.95%	1.20	\$20,810	\$18,780
<i>Installation, Maintenance, and Repair</i>	6,820	4.12%	1.06	\$41,680	\$39,320
<i>Transportation and Related</i>	12,190	7.36%	1.06	\$33,340	\$31,030

<sup>5</sup> Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates.

<sup>6</sup> Includes equivalency (GED).

<sup>7</sup> As indicated by location quotient (LQ), which is calculated as an occupation's the percentage of local employment divided by its percentage of national employment. An LQ over 1 indicates that an area has relatively more jobs in the occupation than elsewhere in the country. The higher the LQ, the higher the prevalence of that occupation relative to the nation.

<sup>8</sup> MSA is Metropolitan Statistical Area, as defined by the US Census Bureau. The Canton-Massillon MSA smaller than Stark County and includes areas in an adjacent county. It is referenced as representative of the region's urban-suburban-rural characteristics. Source: US Bureau of Labor Statistics Occupational and Employment Statistics [http://www.bls.gov/oes/current/oes\\_15940.htm](http://www.bls.gov/oes/current/oes_15940.htm).

By the end of the 20<sup>th</sup> century, workers were pretty well situated, from a home-to-work perspective, although families in general had continued to spread farther apart across the country due to the ease of travel, the expanded relationships workers had developed from college into their early career years and the opportunities created by the general expansion of the US economy. In the IT industry, for example, prospective careers beckoned in Austin, Boston, and pretty much anywhere in California. By the end of the first decade of the 21<sup>st</sup> century, IT career prospects appeared in many more regions. At the same time, population has moved from rural areas to major metros. High-paying, technically skilled occupations cluster and concentrate in particular, often urban areas, drawing from small and midsize communities.

Stark County has few of the high-paying occupations in basic industry and innovation activities, which draw capital into the local economy. (See Table 4.) Healthcare occupations are prevalent in the area and pay well, they are likely serving local consumers (patients). The fact that average salaries tend to be higher than median salaries indicates that most workers are earning in the lower end of the income range.<sup>9</sup> For example, the average wage per employee in 2012 for manufacturing—which employs most production occupations with relatively small difference between average and median wages—was \$46,818 per year, while it was \$38,914 per year in healthcare and social services. Recent activity in the natural gas industry has created more high-paying jobs in basic industries, but it is unclear how robust or long-lived this “boom” will be.

TABLE 4. THE CANTON-MASSILLON MSA TENDS TO BE WEAK IN THE HIGHEST-PAYING OCCUPATIONS, PARTICULARLY THOSE THAT GENERATE CAPITAL IN-FLOWS.

<i>Occupations</i>	<b>Employment</b>	<b>% of Jobs</b>	<b>LQ</b>	<b>Annual Income</b>	
				<b>Average</b>	<b>Median</b>
<i>Management</i>	6,270	3.79%	0.75	\$87,890	\$77,060
<i>Healthcare Practitioners</i>	11,530	6.96%	1.20	\$72,130	\$54,900
<i>Architecture and Engineering</i>	1,650	1.00%	0.55	\$66,530	\$59,470
<i>Life, Physical, and Social Science</i>	550	0.33%	0.40	\$61,690	\$48,750
<i>Computer and Mathematical</i>	1,800	1.09%	0.37	\$58,740	\$56,520
<i>Business and Financial Operations</i>	5,040	3.04%	0.60	\$55,770	\$51,660

Generally, Stark County has seen an increase in product along with a decrease in the number of employees and establishments. Workers’ incomes have generally increased, with notable exceptions. This means organizations have gotten smaller, more efficient, and better at meeting market demand. Reduction in payroll, especially where greater than changes in employment, indicates deskilling and lack of adequate capabilities. Increases in payroll greater than changes in employment indicate increases in worker capabilities and productivity. All of this should be considered in conjunction with the occupational data, above, and the economic imperative to increase capital in-flows in a virtualized, global, digital economy.

<sup>9</sup> For example, the median income in healthcare occupations is 76% of the average income, while production occupations median income is 95% of the average. This means that most healthcare workers earn less than \$54,000 a year while a few earn a lot more. Most production workers, in contrast, are earn around \$32,000 a year.

TABLE 5. CHANGES IN MAJOR ECONOMIC METRICS BETWEEN 2002 AND 2012 FOR STARK COUNTY<sup>10</sup>

<i>Sector</i>	<b>Employment</b>	<b>Establishments</b>	<b>Payroll</b>	<b>Product</b>
<i>Manufacturing</i>	-34%	-16%	-21%	44%
<i>Wholesale trade</i>	NA	-32%	NA	NA
<i>Retail trade</i>	-13%	-17%	2%	29%
<i>Information</i>	-13%	-5%	-10%	NA
<i>Real estate and rental and leasing</i>	-15%	-1%	31%	24%
<i>Professional, scientific, and technical services</i>	NA	-8%	NA	NA
<i>Administrative, support, and waste services</i>	3%	-8%	45%	37%
<i>Educational services</i>	NA	27%	NA	NA
<i>Healthcare and social assistance</i>	12%	5%	45%	49%
<i>Arts, entertainment, and recreation</i>	NA	-5%	NA	NA
<i>Accommodation and food services</i>	1%	-1%	36%	40%
<i>Other services (except public administration)</i>	-9%	-13%	30%	39%
<b>Change in Total</b>	<b>2%</b>	<b>2%</b>	<b>27%</b>	<b>59%</b>
Change in Sector Average	-32%	-18%	-15%	11%
Average change across sectors	-8%	-6%	20%	37%

Manufacturing has seen possibly the most extreme changes, with some of the largest drops in employment, establishment, and payroll along with one of the largest gains in product. With about 22,700 employees in 2012, this sector was second only to healthcare and social services. In Stark County, this sector includes primarily materials and component manufacturers, most notably Diebold-Nixdorf (transaction kiosks), PCC Airfoils (turbine parts), Timken Company (bearings and drivetrains) and TimkenSteel. LG recently made a major investment in fuel cell production. There are several smaller companies in Stark County that specialize in other materials. The area also has a strong food products sub-sector. These companies represent key local competencies in materials and processes that have global economic value.

Healthcare and social services has seen the largest growth, and the growth was across all four metrics, which means more consumers and workers are benefiting in more places. It is the largest sector in terms of employment

<sup>10</sup> The metrics are number of employees, number of establishments (not firms, as firms may have multiple establishments), total annual payroll, and total value of sales, shipments, receipts, revenue, or business done (product). Stark County tends to fall between the city of Canton and the state of Ohio in terms of changes in these metrics. “Change in Total” and “Change in Sector Average” compares sum and mean metric statistics from 2002 to 2012. “Average change across sectors” is the mean of percent change in metrics from 2002 to 2012. Source: The Economic Census of the United States, 2002 and 2012. “NA” indicates data is not available. The following sectors are not included due to lack of data: Construction; Finance and insurance; Management of companies and enterprises; Mining, quarrying, and oil and gas extraction; Transportation and warehousing; and, Utilities.

with over 28,000 employees in 2012. Major employers include Aultman Hospital and Mercy Medical Center. Other service industries have increased their product and payroll with relatively small changes in employment and establishments. These sectors generally support industries that serve local consumers, although some portion of the growth are attributable to export (patients coming to Canton for medical treatment, for example).

Possibly the greatest change in Stark County since 2012 has been the development of the Pro Football Hall of Fame (HoF) and the Hall of Fame Village. The HoF is an important tourism asset that draws football fans from around the country and world to Canton, but tourism generally pays low wages and is subject to socioeconomic vagaries. The HoF Village includes a conference center and sports and entertainment complex that includes “high-tech virtual reality experiences.” Tourism is only part of the development, though. The HoF Village also includes an assisted living facility, a state-of-the-art youth sports complex, and center of excellence for athletic health and performance, coaching, officiating, safety, and sports business. These resources are important because they elevate the HoF above one-time experience for many consumers, driving recurring high-value consumer demand. These “value-added” features also involve high-skill, high-pay occupations. As with manufacturing competencies related to advanced materials and processing, the HoF Village is developing a cluster of specialized competencies that have global economic value. Many, if not most, of those who come to the HoF Village will be from somewhere else, and will spend substantial money in Stark County.

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## STARK COUNTY IN GLOBAL CONTEXT

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The global economic transformation has been generally positive, leading to higher incomes and improved quality of life overall. But, it has negatively impacted some, including many in Stark County and across the “Rust Belt.” The Stark County regional reality is tied to the larger global reality: Production, especially of commodity products, has shifted to locations with low labor and facility costs, and closer to customers. Timken Steel, for example, has plants in China and elsewhere. Production in higher cost areas has shifted to customized, small batch, specialized goods and services, which require advanced skills and close customer relationships. The nature of capital has shifted along with the rest of the economy. Much of the old built capital, including buildings and equipment, has been simply abandoned and scrapped. Natural capital has refocused on reclamation and renewable resources, especially for agriculture and recreation. Human and social capital are ascendant, particularly where they can be continuously cultivated and improved.

Economics is all about capital and labor, consumption and production, demand and supply, and how scarce resources are allocated to effectively unlimited needs. Digital technology, including broadband, allow economies to move easy and fast. The companies, people, and places that combine capital and labor to most efficiently meet consumer demands are the ones that generate the most revenue and biggest profits. Markets will favor them over other companies, people, and places. Broadband plays an important role in access to markets and productivity.

Market prices are simply an indicator of demand and supply. As demand increases, prices go up. Supply results from combining capital and labor via an organization. As supply increases, prices go down. Increasing supply also drives up the costs for capital and labor (due to increased demand). In contrast, as prices go up, supply tends to go up, too, but demand tends to go down. These axioms hold for broadband. Broadband just allows transactions to occur faster, on a wider scale, and broader geographic scope than ever before.

Economics have spatial characteristics: prices for goods and services vary from place to place, as do the availability of capital and labor. A good or service that is produced in one place but consumed in another place is an export (or import if you’re buying). This includes services for which one must travel in order to consume, e.g., tourism, as well as digital content and software. Capital flows from places that import products to places that export them. This tends to shift wealth from importers to exporters, unless the imports are used to produce even more valuable products, which are then exported. Broadband facilitates transactions of traditional physical goods and services, but also enables whole new classes of products. Often, it is the merchant who actually does the

exporting/importing who profits from the process—captures the excess rents and producer surplus, as economists say—rather than those who produced the product. This holds true for online transactions!

Workers get paid a salary or wage, which allows them to consume goods and services. Generally, increasing household earnings leads to increases in consumer demand, especially for non-staple, “luxury” goods and services. These goods and services are often imported from elsewhere. Broadband facilitates this. Education and experience increase workers’ productive abilities, if not their capacity, which allows them to produce higher value goods and services. Broadband facilitates learning, too, and provides new, more flexible opportunities to generate income. When a worker’s productive ability increases, her or his income also increases. This may seem self-evident, but is an important point about technology: Technical know-how means more money. Thus education and experience lead to economic growth, stronger demand for luxury goods and services, and increased imports. And, thus broadband help can benefit Stark County by enabling more intellectual forms of labor by facilitating access to intangible capital assets—code, data, etc.

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## TECHNOLOGY AND INNOVATION

Improving technology is possibly the most powerful driver of economic transformation. Innovation, the process of bringing a fundamentally new product to market, is enabled by technological change. Innovation changes how consumers spend their money and how producers produce, often disrupting existing markets and leading to the demise of market-dominating producers. Computers, steel, retail, and entertainment are classic examples of markets that were disrupted by innovations. Information services has been profoundly impacted by digital technology. Incremental and process innovations lead to improvements in existing products and services. Incremental innovation leads to higher quality products at lower price, but doesn’t totally disrupt markets. Automobiles, financial services, and healthcare markets have been transformed by incremental innovation. Digital technology is critical to many of these process improvements.

Economists note that economies follow trajectories—they are “path dependent”—that don’t radically change: Any transformation depends on preceding circumstances. Established producers find it difficult to innovate because they want to fully exploit existing technology in order to generate maximum profit from existing customers. Innovation often—and most economically—comes from looking at problems with the current situation in a different way, or simply seeing problems that others don’t, and doggedly developing solutions others don’t want to bother with. Consequently, innovations tend to come from new companies that grow quickly at the expense of, and by focusing on customers and using technologies dismissed by, their larger competitors. Those factors don’t appear out of nowhere; they germinate and grow in the detritus of the current economy, in response to current production and consumption.

Innovation has a general impact on the economy: it changes the nature of capital and labor, consumption and production, and demand and supply. Economists say that technological advance substitutes capital for labor, but it’s really more complicated. Capital has become more intangible, and labor has become more intellectual. Originally, capital and the means of production were physical: natural resources, tools for extracting and milling those resources, even money itself. Labor was largely a matter of brute force. Cultural, human, political, social, and other intangible forms of capital have always been important but over the centuries they have come to have a greater and greater role in creating economic value. The scale of production increased along with this shift toward intangible capital, until something broke.

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## VIRTUALIZATION AND DIGITAL TECHNOLOGIES

The logical aspects of production broke loose from the physical aspects. This allowed production to become more and more automated, flexible, and smaller scale, in both batch size and actual size. It also made the interconnection of facilities, people, and processes—from production through consumption and back again—much more practical and critical. The transformation of capital from tangible to intangible—from things to ideas—and of

labor from manual to intellectual has accelerated over the last three decades. First, microcomputers, then the Internet, now smartphone apps, next... It shows no signs of slowing down. The general innovation—*virtualization*—is enabling a huge number of other innovations in products and services, processes, and in the very structure of markets and organizations.

Virtualization is made possible by digital technologies that reduce uncertainty—which is one of the worst things for the economy—by enabling faster communication and smarter control. “Digital” simply means anything a computer can read and process. It involves code that tells computers how to process data and the data itself, which are generated as people use computers to create content and track activities. Today, the actual, physical world, is overlaid by a virtual realm consisting of digital representations of everything that happens in the “analog” realm. Algorithms coded into computers generate forecasts, models, and simulations from the data that allow us to act more intelligently and proactively. Companies that use digital technology effectively have a huge competitive advantage. Whole sectors of the economy capitalize on digital technology to grow and improve, and totally new sectors have been added to the economy that focus on producing digital goods and services. Indeed, today’s largest and most valuable companies are those that focus on digital rather than physical assets, products, and services.

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## THE ROLE OF GOVERNMENT

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Economic activities require public goods that can benefit everyone for the same cost they can be provided to just a few people. Public safety is possibly the only “pure” public good, but market spaces, transportation and utility infrastructure, sanitation, education, and disease control are “quasi” public goods. Economic activities also draw on common pool resources that hurts everyone if anyone overuses them. The environment is the best general example of common pool resources. And, economic activities are undermined by market failures that occur when consumers and workers don’t have enough information, options, or power to act in their best interests. Lastly, economic activities often fundamentally shift due to new technologies, which are often the result of long-term investments in basic research. Not only are such investments impractical for most, if not all, businesses, it is also economically important for these innovations to be available to all—economic benefits of a new technology are achieved faster and more completely when there are no market barriers to its adoption and use.

Government can and does address all of these issues. Governments at all levels work to assure that certain facilities and services are available at no charge for use. Governments also police the use and quality of common pool resource to assure they aren’t depleted or polluted. Also, governments provide nominally unbiased information and protections for citizens in their roles as consumers and workers. Governments can force changes in the behavior and structure of firms that are seen to be acting anti-competitively or against consumers’ interests. All of these activities—from public investment through information sharing to forceful action—are funded by taxes, fines, and fees. The dual issues for citizens to address are exactly what role(s) government—local, state, and federal—should play, and how to cover the costs of those roles, recognizing that governments are inherently inefficient (especially in the economic sense). For the purposes of the current discussion, it is particularly relevant to note that interactions of technologists and entrepreneurs working together to transform government-funded innovations into marketable products is a powerful driver of economic transformation. Such interactions, for all practical purposes, can only happen in quasi-public spaces, which private firms find it difficult to provide (although there are important exceptions, as discussed below). Government action can boost innovation and productivity and can provide a level of certainty that both consumers and producers require.

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## ECONOMIC DEVELOPMENT AS A PHENOMENON AND A PRACTICE

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Economic development is essentially an increase in productive capacity in a place. Economic growth comes from not only producing more, but also selling it elsewhere in order to generate a profit. When you sell something somewhere else for more than you could sell it locally, you’re experiencing economic growth. When you scale up production in order to meet demand, and generate more profit, you’re engaged in economic development. In the

process, you have to invest in fixed capital—equipment and facilities—purchase materials, which is called stock or working capital, and hire workers to provide labor. Economic development is place-based because production and consumption have to happen somewhere, and consumers and producers need a place to meet, negotiate, and transact money for goods and services.

Economic development as a practice is basically just an effort to encourage and facilitate increases in productive capacity. Traditionally, since the early 20<sup>th</sup> century, this has been done by investing in public goods, subsidizing fixed capital, or abating taxes. Nominally, practice focuses on “attracting investment” and “creating jobs” but it’s really about reducing the cost of doing business in a place. Other approaches began emerging in the 1970s. Initially, these focused on providing technical assistance to existing businesses or on large-scale innovation activities by tapping academic resources paid for with public dollars. Over time these practices have scaled down and become less dependent on large institutions (following the virtualization mega-trend). Today, there are essentially three different economic development systems: one focused on industrial real estate and workforce development, a second focused on technical assistance for small and medium size businesses, and a third focused on entrepreneurs, technological innovations, and high-growth potential startup companies. It is practically inevitable that the practice of economic development and the role of government will continue to evolve as the effects of the digital revolution extend deeper and farther into the economy.

#### LOCAL ECONOMIC DEVELOPMENT RESOURCES

Stark County has six cities,<sup>11</sup> multiple townships and villages, and numerous economic assets that one might find in other communities. The county has multiple chambers of commerce, city economic development offices, development corporations/foundations, a development board that includes a port authority and foreign trade zones, and at least two multi-county regional economic development organizations.<sup>12</sup> Stark County has multiple local organizations for creatives, entrepreneurs, and innovators, including Arts in Stark, Braintree Business Development Center, Canton Hacker and Maker Place, Small Business Development Center (Kent State University at Stark), and Stark Entrepreneurship Alliance. There are regional programs to help entrepreneurs and manufacturers, and several coworking spaces.<sup>13</sup> The Timken Company collaborated with Stark State College to establish a technology and test center, LG Fuel Cell Systems is the anchor tenant in Stark State College fuel cell prototyping center, and TimkenSteel has a steel research facility in Stark County.

#### WORKFORCE DEVELOPMENT

Workforce is key to economic transformation because firms can’t change what they make and how they make it if they don’t have capable employees. The County has abundant workforce development resources. Multiple colleges and universities, including a Kent State campus and Stark State College, as well as several private schools are located in the County. Stark State College has multiple centers and satellite locations throughout the County. The Stark County Community Action Agency has a Center of Education and Employment Opportunities, and Stark County District Library provides job and career training resources via its online “Smart Store.” Ohio Means Jobs,

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<sup>11</sup> The cities in Stark County are Alliance, Canal Fulton, Canton (the county seat), Louisville, Massillon, and North Canton. The county government’s website is <http://www.starkcountyohio.gov/>.

<sup>12</sup> Specific resources include the Alliance Area Development Foundation, Alliance Area Chamber of Commerce, Canton Regional Chamber of Commerce, Canton City Economic Development Office, Cleveland Plus, Jackson-Belden Chamber of Commerce, JobsOhio, Louisville Chamber of Commerce, Massillon Development Foundation, Massillon West Stark Chamber of Commerce, North Canton Chamber of Commerce, North Canton Economic Development Office, Northeast Ohio Trade and Economic Consortium, Stark County Development Board, and TeamNEO.

<sup>13</sup> These include the Impact Angel Fund, JumpStart, and MAGNET (Manufacturing Advocacy and Growth Network). See the comprehensive article about coworking facilities in Stark County and how they benefit entrepreneurs at <http://www.cantonrep.com/article/20120827/NEWS/308279925>.

the state’s employment system operated by Monster.com under the auspices of the Ohio Development Services Agency, provides services focused on Stark County and neighboring Tuscarawas County. The County has multiple local school districts, served by the Stark County Educational Services Center.

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## ECONOMIC TRANSFORMATION FOR STARK COUNTY

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In order to achieve sustained growth in today’s digital economy, Stark County must either increase its capabilities—especially for technologically enabling both internal process innovations and external market innovations—or resign itself to shrinking economy and population. The key to increasing capabilities is to recognize that capabilities are about what you can *do*. Every individual in Stark County is capable, and those capabilities are combined via organizations across the County. Together, they add up to Stark County’s competitive position and value proposition: What you are collectively good at doing. The core challenge is to get a common sense of collective capabilities in order to understand the part each individual plays, develop those capabilities, and capitalize on them.

Today, it is possible to live most anywhere and work everywhere. It is no longer necessary to leave a small rural area in order to take part in the global economy. As long as you have broadband, of course. Too many areas simply do not have adequate supply of broadband to drive prices down and performance up. Over a century ago, the United States launched an electrification initiative to power our houses, schools, and hospitals. Before that the country was interconnected via railroad and telegraph. The imperative for today is to connect communities and citizens via the Internet. And now, just as before, with electricity, roads, streetlights, plumbing, telephones; even medicine, many small rural areas are left behind.

Rural areas and small towns provide many amenities and necessities, not the least of which is refuge from the big cities. Slower, more convivial, and less complicated can be attractive to high-earning professionals with kids, especially if the community assets and institutions are high quality. Every community offers something a little different. Broadband and other digital technologies have a great deal to offer small towns that have the leadership and technology talent—or at least potential talent—to aggressively adopt it. Duplication and fragmentation undermine technology adoption, as well as other forms of socioeconomic progress. Reliance on old ways of doing things and unwillingness to learn can be huge impediments to progress, too. These traits are not necessarily a characteristic of rural, small towns, and it’s definitely not a trait of those communities that are capitalizing on digital technology.

Success in the new economic reality comes down to applying local capabilities to global interests or problems. This comes from combining local capital and knowledge of how to *do* things with global capital and knowledge of what needs to be *done*. You can’t do everything, so focus on doing what you do well. Generally, this involves advanced materials, automation and robotics, code and data, flexible production equipment (computer-numeric controlled machines and 3D printers), and very fast, highly reliable communication networks, all integrated and working together. It focuses on creating a memorable experience and enhancing the value of people rather than just “making stuff.” The specifics depend on the problem to be solved and relationships that make the solution possible. Success in the new, global, digital economy requires dedicated, creative, collaborative people who love to learn.

It is the last component of economic transformation that is most critical but also most difficult to develop: People who love to learn. It is a matter of culture. It requires leadership. Individuals, especially those who control resources, must be willing to invest their time and effort as well as money to make activities and assets available, and to personally model and reward active, productive learning. Cultural change requires open, inclusive, accessible resources, but it also requires “social marketing” by connectors and doers who actively draw in others. It depends as much on the human need for belonging as for the needs for autonomy and competence. People are self-directed to learn about things they love. A great place to start positive economic transformation is by focusing

on things people care about! This is pretty easy because “things people care about” tend to persist, even if they are sometimes under-appreciated and taken for granted.

It is important to engage all stakeholders, ideally working together as benefactors and beneficiaries of regional growth, establish a shared vision for economic vitality, adopt a true regional agenda, and act to attain the vision. As many as possible should help with prioritized, incremental improvements and removing structural barriers to the new vision. For broadband this means that it is important to aggregate demand of as many community anchor institutes as possible. This spreads the capital investment and operating cost across many organizations, and allows community stakeholders to be true partners in next generation infrastructure development. It also means working to make sure the partners realize maximum positive benefits from broadband at minimal costs. The best way to do this is, again, by focusing on what they care about.

A simple way to assess “what people care about” is to look at changes in economic activities and at community assets. A somewhat cursory assessment is appropriate at this because the details are contingent on clear common understanding of purpose, goals, and key results. In other words, before you dig very deep, make sure you’re digging in the right spot. It is essential to have both a focus and precedent for economic transformation—especially in an area with abundant and diverse resources—so people can watch, see results, and replicate. Stark County has both a focus and a precedent—actually *dual* focuses and precedents. The places to dig in Stark County appear to be around advanced materials and athletic performance.

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## MATERIALS AND ATHLETICS: ECONOMIC TRANSFORMATION FOCAL POINTS

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The first focus, which comes from manufacturing, is advanced materials, and the precedent is exemplified by the Timken Company and TimkenSteel technology centers. There are numerous other companies, including high-growth potential startups, in similar, parallel lines of business. The production and use of advance materials requires high degrees of precision and control, which are provided by digital technologies. The second focus is athletic performance and precedent set by the value-added facilities and services associated with the Pro Football Hall of Fame. The HoF is driven by outside investment but has deep cultural roots in Stark County. It is going to need a lot of bandwidth, driven by activities in its sports and training facilities rather than traditional tourism activities.

Advanced materials production and athletic performance services are two very different economic assets that share a need for empirical analysis. They are based on clusters of specialized knowledge and consist of physical spaces. The spaces are places for knowledgeable persons to interact, create, and produce together. The activities and places need to be interconnected for ideas and information to flow among today’s workers. Advanced materials and athletic performance are economic statements about what the community, region, and world value. They provide solid anchor points for broadband, along with and complementing community institutions. Most importantly and relevantly, the HoF centers of excellence, testing centers, and similar facilities give the region a springboard for new, high-value economic activities. Generally, these activities include:

- **Collaborative effort** by business, education, and government in Stark County to
- **Evolve what is produced**—goods and services—and how it is produced by
- **Investing in intangible capital**—software and systems—and intellectual labor and
- **Interconnecting local assets** and connecting them with global assets to
- **Develop local workforce capabilities**, particularly digital and technical skills, to
- **Produce high-value goods** and services for export, thereby
- **Increasing business profitability, household incomes, and quality of place.**

Economic transformation is all about *activities*; it is a change in what we make (do) and how we make (do) it. Unlike past economic transformation, which were akin to cataclysmic acts of God—there is an opportunity to undertake the current transformation in an intentional, proactive manner. Such change necessarily involves

broader, higher layer of activities—learning, planning, testing, etc.—that must be undertaken by those involved in and ideally those impacted by the transformation.

The focal points in Stark County are not just loci of new economic activities, they are hubs that can drive change across the region. Change activities can occur in traditional institutional facilities such as school classrooms, if those institutions have change agents and are connected to the hubs. The change activities can also occur in non-traditional spaces such as coffee shops, co-working spaces, and business incubators. The key elements are (1) change activities such as classes, workshops, or even informal learning or planning sessions, (2) a location for the activities, (3) a person to act as catalyst, coach, facilitator, and/or moderator, and (4) a way to connect to each other and the world. Advanced materials and athletic performance are bringing these elements together already in Stark County. Thus they make great focal points for broadband-enabled economic transformation.

## MODELS FOR FACILITATING ECONOMIC TRANSFORMATION

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There are a multitude of examples of facilities for economic transformation. The facilities themselves are almost inconsequential. Activities, events, programs, etc., are the key—this point really can't be overstated: it's the *activities* that matter—as is a facilitator. It is also important to market the activities effectively by identifying target audiences, their core interests and motivators, and how to best reach them. All of this requires resources, so there needs to be a source of funding and a business model for sustaining the activities, facilities, and facilitators. This section describes a few models that combine all of these elements. It is advisable for key stakeholders and leading change agents to use these as a jumping off point for “digging” into economic transformation.

Project HOME in Philadelphia, PA, is a prime example of focusing on activities and programs to catalyze change, with buildings literally as facilities to achieve those ends. Project HOME sees itself as a community, rather than a project, that seeks to:

*... empower adults, children, and families to break the cycle of homelessness and poverty, to alleviate the underlying causes of poverty, and to enable all to attain their fullest potential as individuals and as members of the broader society. They strive to create a safe and respectful environment where they support each other in struggles for self-esteem, recovery, and the confidence to move toward self-actualization.*<sup>14</sup>

Project HOME operates a wide variety of programs literally at the street level and up to achieve this mission. One of its landmarks—again, literally—is the Honickman Learning Center and Comcast Technology Labs (HLCCTL), which provides state of the art technology as a resource for revitalizing North Central Philadelphia. The HLCCTL brings together art, education, and enterprise via programs that are tailored to the neighborhood in which it is located, including college access, summer camps, after-school, and adult learning. Toronto's Career Skills Incubator (CSCI) helps un- and under-employed persons to develop new skills, and move them into new careers. CSCI provides programs, mentorship, workshops, and custom-made volunteer opportunities. CSCI has developed a web application, Menteeer, to create, develop, and track progress of mentoring relationships. Exemplifying the grassroots, open nature of CSCI, Menteeer is open source software that anyone can use to create a mentoring system. Both Project Home and CSCI are non-profits supported by donations and grants with some revenue generating services.

WE Labs, Long Beach, CA is nominally a coworking space (or spaces, since it now has two locations). But is really a “collision space” and community, deeply embedded in its neighborhoods, where entrepreneurs, technologists, and visionaries can interact, learn, and share with each other. WE Labs space includes a maker space, a stage, and hammocks, as well as a variety of work spaces. The relationships developed with others are what enables the success of WE Labs members, but their capabilities and those relationships are developed via the formal programs

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<sup>14</sup> From the Project HOME website, <https://projecthome.org/mission>.

and informal interactions at WE Labs. The Skillery in Nashville, TN, is similar to WE Labs but is even more focused on learning and entrepreneurship. The Skillery promotes itself as a *group* of freelancers, entrepreneurs, and independent professionals working in small teams. The Skillery team, along with its clients, builds dynamic spaces and educational programming. They are dedicated to action and learning, and are very transparent about this. They are also highly collaborative, with a clear focus on what they do and enthusiastic willingness to promote other entities. Both organizations' business model is a reasonably simple subscription model with multiple tiers of access and fees. WE Labs position their services as "an investment in yourself," that also builds your support network, improves access to services, and simply makes members more productive. The Skillery has a similar line but also encourages customers to "rediscover what you once enjoyed about work — a sense of ownership, a spirit of control, and the feeling of fun."<sup>15</sup>

Totally focused on learning, General Assembly could be seen as just another online course company, but with 16 locations it is definitely place-based. "What began as a co-working space in 2011 has since grown into a global learning experience with campuses in 15 cities and over 25,000 graduates worldwide."<sup>16</sup> It is totally about learning activities, but it is also about making connections. The two functions are mutually reinforcing. The company has high-quality online learning content in high-value digital skills: web development (coding), data analysis, user experience, etc. Along with dynamic, innovative learning for award-winning education, General Assembly develops professional relationships with employers—they coin it as "educating companies." The locations are integral to this as true *learning facilities*. The company charges individuals and companies to take classes, workshops, and other events, for custom training, and for talent acquisition and evaluation services.

Incubators are well-established as an economic development talent. Maker spaces are becoming commonplace, if not as an economic development practice. There are innovative efforts to combine and enhance both in order to facilitate innovation. New Lab is a combination of co-working space, incubator, and maker space in Brooklyn, NY, designed to support entrepreneurs working in emerging technologies such as robotics, artificial intelligence, and connected devices. Focused on next-generation hardware, New Lab has fabrication shops featuring advanced manufacturing technologies as well as standard workshop gear. The facilities also provide facilitators who know manufacturing processes, and partnerships with leading technology companies. New Lab receives public funding, is supported by private companies, and generates revenues from memberships.

FirstBuild, in Louisville, KY, has partnership at its foundation. Billing itself as a "co-creation community," FirstBuild was founded and is backed by GE Appliances as a way to do "open innovation," to change the way products come to market, rather than just how they are made or even what those products are. FirstBuild is based on the belief that "By letting a community influence the product from the very beginning, we can quickly deliver better products that improve the lives of our consumers." FirstBuild does this by putting entrepreneurs and makers together with world-class engineering and design talent to bring ideas to life, micro-manufacture real products on small scale, and introduce those products to the world. At the heart of FirstBuild are a prototyping lab, fabrication shop, and micro-factory that uses advanced manufacturing techniques and rapid prototyping tools to quickly move from concept to creation to showroom floor. Any member of the public can access the lab, anyone who has earned a "craftsman badge" can use the shop, and, while only employees can use the micro-factory, they use it to build products generated in the lab and worked out in the shop. One of FirstBuild's innovation is Co-Create, a Pinterest-like online system for sharing and tracking challenges, how-tos, ideas, and projects.

The Digital Manufacturing and Design Innovation Institute (DMDII) is one of the *Manufacturing USA* institutes that constitute the National Network for Manufacturing Innovation. All of the institutes represent valuable assets to support economic transformation involving manufacturing, but DMDII is especially relevant. Its goal is to provide

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<sup>15</sup> From the Skillery's website, <http://www.theskillery.com/coworking/why/>.

<sup>16</sup> From General Assembly's website, <https://generalassembly.ly/about>

US factories with the tools, software, and expertise they need to build things more efficiently, less expensively, and more quickly, so they can win more business and bring jobs back to the US. DMDII combines research and development with technical assistance to manufacturers and workforce development. While it is publicly funded, DMDII also generates revenue from memberships that center around knowledge sharing programs. The larger goal is to make manufacturing ever more efficient and flexible by linking every stage of the production process—including consumption—via a digital thread. This digital thread involves analytics, automation, interconnected devices (Industrial Internet of Things or IIoT), product and process modeling, supply chain integration, and, of course, cybersecurity. DMDII has a demonstration facility, and is developing online open source Digital Manufacturing Commons for sharing digital manufacturing know-how and tools. Much of DMDII’s work happens via open project calls, via which its members identify major problems facing manufacturing and solicit proposals to solve the problems.

These models exemplify critical features for economic transformation:

- A combination of virtual resources, especially social software, with physical facilities for connecting people around ideas and knowledge
- Activities and facilities tailored to the needs and interests of supporters, sponsors, and members
- An emphasis on collaboration and learning, through informal interactions as well as formal classes
- Inclusivity and openness, so anyone, especially disadvantaged persons, can get hands on experience and actually make things (It bears emphasizing that inclusivity and openness are not ideological; they are driven by economic rationales: they lead to better solutions and broader talent pools.)
- Multiple revenue sources from supporters, sponsors, and members
- Project-oriented problem-solving with clearly defined goals and key results

While broadband is not explicitly noted in any of these models, ultra-fast network connections are implicitly essential to all of them and everything they do.

Stark County has abundant resources, and it has focal areas and precedents for economic transformation in materials and athletics. Materials production methods and testing are an important starting point, as are the materials themselves. What else can you do with these things? Athletic training and analytics go hand-in-hand, and they’re advancing rapidly with new evidence-base practices and technologies that make those practices possible. What can you make that enhances these activities? The general answers depend on engaging more, different people, as well as existing resources. The impacts from answering these questions depend on this even more. “More, different people” includes experts and interested parties from around the country and world, and it includes under-educated and under-employed persons in Stark County. These general groups are the means and media for economic transformation. Networks, equipment, and buildings simply provide connections and facilities for sharing, developing, and applying the ideas and knowledge that drive economic transformation. The challenge and opportunity is to refocus Stark County’s resources, to invest in more intangible capital and intellectual labor (especially for more, different people), and to collaborate around adding value to focal areas, particularly advanced materials and athletic performance.

## BROADBAND AND ECONOMIC TRANSFORMATION

Broadband infrastructure and services are becoming key catalysts and enablers of economic transformation, for people to change what they make and how they make. It is necessary to have bandwidth and connectivity—generally, the more, the better—but it is not sufficient. Bandwidth determines how much code and data can be accessed and processed, and connectivity determines the number and types of sources and uses of code and data. None of this is possible without capabilities to create code and make sense of data. None of it is meaningful without purpose. The economic—and for that matter, *social*—purpose and workforce skills most drive the development of, or at least co-evolve with, broadband.

## CHAPTER 2: BROADBAND: WHAT IS IT, WHERE IT CAME FROM, WHERE IT'S GOING

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Broadband is essentially infrastructure, and has evolved as part of the general growth of infrastructure. It all started with trails. Trails led to roads. Roads led to rails. Rails set the network paths for telegraph. Along the way, wells and pumps remained the mainstay of the hinterlands as clean, potable water was pumped through metropolitan plumbing systems. Chamber pots and sanitation ditches slowly disappeared as wastewater utility systems developed. Public health became a practice rather than a privilege. Infrastructure saved lives and America kept growing. All the while, the roads kept coming. The neighborhood vehicle gave way to the family vehicle, the station wagon, the his-and-her-vehicles, and multi-vehicle families. When the roads couldn't get wider, they wrapped themselves around, over and under each other.

Infrastructure follows us as we seek, we discover, we populate, we create opportunity, jobs, education, wealth and community prosperity. If there is value, there will be demand. If there is demand, there will be scarcity followed quickly by new supplies. Scarce capacity incites invention of opportunities and possibilities as well as increased supply.

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### **Broadband**

...high-speed Internet access that is always on and faster than the traditional dial-up access. Includes several high-speed transmission technologies such as: digital subscriber line (DSL), cable modem, fiber, wireless, satellite, and broadband over powerlines (BPL).

<http://www.fcc.gov/general/glossary-telecommunications-terms>

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### **Bandwidth**

The capacity of a telecom line to carry signals. The necessary bandwidth is the amount of spectrum required to transmit the signal without distortion or loss of information.

<https://www.fcc.gov/general/glossary-telecommunications-terms>

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## BROADBAND BASICS

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Fast, reliable, and affordable Internet access affects nearly every business, home, and community anchor institutions, such as hospitals, fire stations, and libraries, within the community. Broadband can be a vital element for Stark County's current and future economic vitality—indeed, its effectively required! Broadband provides the digital infrastructure necessary to connect communities to the rest of the world. As more of Stark County's businesses, community anchor institutions, and residents utilize the Internet for critical services and enhanced lifestyle opportunities, the more reliant they become on fast, high quality, affordable broadband services. This, along with the explosion of more sophisticated online business applications, like telemedicine or interactive video advertising, is driving the need for consistently higher bandwidth.

## OVERVIEW OF INTERNET TECHNOLOGIES

### Advanced Telecommunications Capability

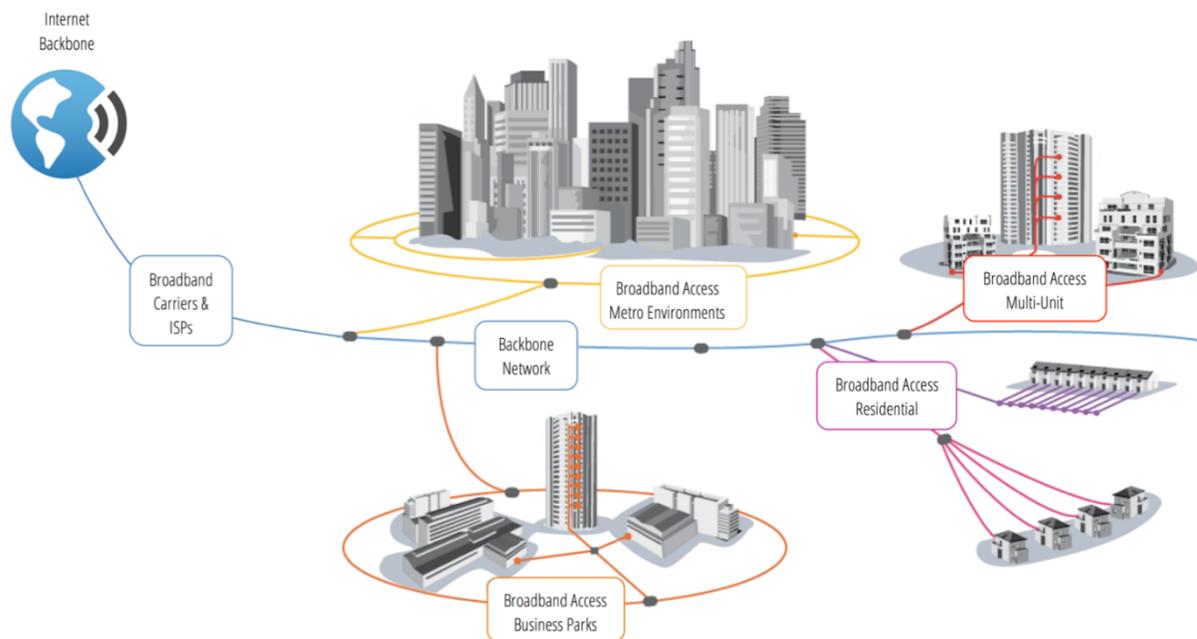
... high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology

<https://www.fcc.gov/general/glossary-telecommunications-term>

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 comes in many forms and from many locations across the world in the networks that connect the local community to the Internet backbone. Websites, television, streaming video, videoconferencing, cloud services, and even telephone service are just a few types of content that are delivered across local broadband networks.

Access to this content is made available through the type of infrastructure and selection of connections available in the local network. Robust local infrastructure results in faster, more reliable access to content. Conversely, local infrastructure that is aging and built on older technologies results in slower, less reliable access to content.

FIGURE 5: HOW FIBER-OPTIC NETWORKS CONNECT OUR COMMUNITIES



### DIAL-UP ACCESS

Though not defined as a broadband technology due to speed and bandwidth limitations, dial-up access still exists in many areas of the world, including Stark County, Ohio. 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.

## 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 may depend on the distance from your home or business to the closest telephone company facility.

The following are types of DSL transmission technologies:

- Asymmetrical Digital Subscriber Line – 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 – Used typically by businesses for services such as video conferencing, which need significant bandwidth both upstream and downstream.

## CABLE MODEM

Cable modem service enables cable operators to provide broadband using the same coaxial cables that deliver pictures and sound to televisions. Most cable modems are external devices that have two connections: one to the cable wall outlet, the other to a computer. They provide 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. You can still watch cable TV while using it. Transmission speeds vary depending on the type of cable modem, cable network, and traffic load.

## FIBER-OPTICS

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.

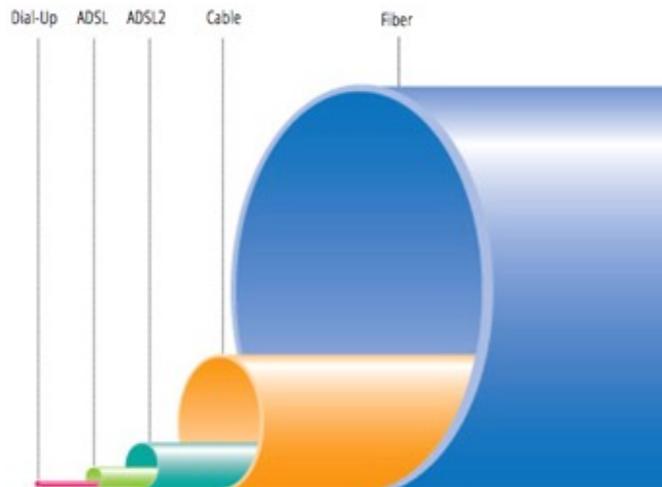
The actual speed you experience will vary depending on a variety of factors, such as how close to your computer the service provider brings the fiber and how the service provider configures the service, including the amount of bandwidth used. The same fiber providing your broadband can also simultaneously deliver voice over IP circuits (VoIP) and video services, including video-on-demand.

Variations of the technology 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) - Fiber to the Node technologies bring high-capacity fiber-optic cables to local service areas and then connect to existing DSL equipment. Rather than bringing fiber-optic cables to every home or business, the fiber is connected to the existing DSL network to increase its capacity. It allows these networks to carry more traffic; however, often times the copper-based "last mile" DSL network, connecting homes and businesses to the local nodes, is still a bottleneck and results in subscribers inability to access the true speeds of fiber-optic connections.
- Fiber to the Premise (FTTP) - Fiber to the Premise (FTTP), also referred to as Fiber To The Home (FTTH), is a technology for providing 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 most coaxial cable Internet connections, and generally needs to be serviced less. This technology is 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.

FIGURE 6: COMPARISON OF INTERNET CONNECTIONS

- Dial-Up – 56Kbps
  - Legacy Technology
  - Shared Technology
- ADSL – 10Mbps
  - First Generation of DSL
  - Shared Technology
- ADSL2 – 24Mbps
  - Second Generation DSL
  - Shared Technology
- Cable – 150Mbps
  - Data Over Cable Service Interface Specification (DOCSIS 3.0)
  - Shared Technology
- Next Generation Fiber – 1Gbps
  - Passive Optical Network (PON), Active Ethernet
  - Shared and Dedicated Technology



To illustrate the relative difference between common Internet connection methods, Figure 6 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.<sup>17</sup>

### 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 one 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. Generally, they provide relatively lower speeds, in the range of several hundred Kbps (e.g. 4GLTE).

With 5G deployment in the early stages, we can assume this technology will begin to be utilized in last-mile deployments – if the planned throughput can be achieved. However, it’s questionable whether or not 5G will

<sup>17</sup> Actual speed and quality of service will depend on the specific service contracted by the end user, whether using a traditional broadband service or a next-generation broadband service.

support residential deployments where multiple HD streams and dozens of devices could be connected to the Internet. In addition, while 5G is planned, the fiber providers are beginning to release 10Gb capable fiber to the home networks.

While future wireless technologies hold promise for much faster speeds, it's likely they will continue to lag fiber-optics. Many community anchors (schools and hospitals) do not consider wireless to be an option to support their long-term needs, however future wireless will be required as an overlay to a fiber-optic backbone. Remote connectivity and the numerous smart-city devices that are coming to market will necessitate ubiquitous high-speed wireless coverage, with next-generation fiber-optic backhaul. As an example, in Santa Monica CA, the city recently negotiated a small-cell DAS deployment using city owned street lights and fiber connectivity at each DAS placement. Fiber-optic backhaul will continue to drive wireless deployment through 5G and beyond.

## THE TRANSFORMATION OF COMMUNICATIONS

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The wired network that grew up along the railroads and highways, converted from carrying Morse code to voice to bits. Wireless technology was static after World War II but returned 30 years later as the "Beeper," then as the "Brick," then as the "Flip." Soon after, American ingenuity put the "I" on phone. It all part of the evolution of infrastructure.

Today, broadband is high-speed connectivity to the Internet offered to consumers in a variety of forms. Broadband subscribers across every user class are utilizing more online applications and particularly those that consume larger amounts of high-quality bandwidth. The technological agility available today that allows application developers to create and connect their software products to consumers is measured in minutes rather than months. Variety and uniqueness of application products have virtually no limits in terms of the number of subscribers or the geo-scope of the customer base.

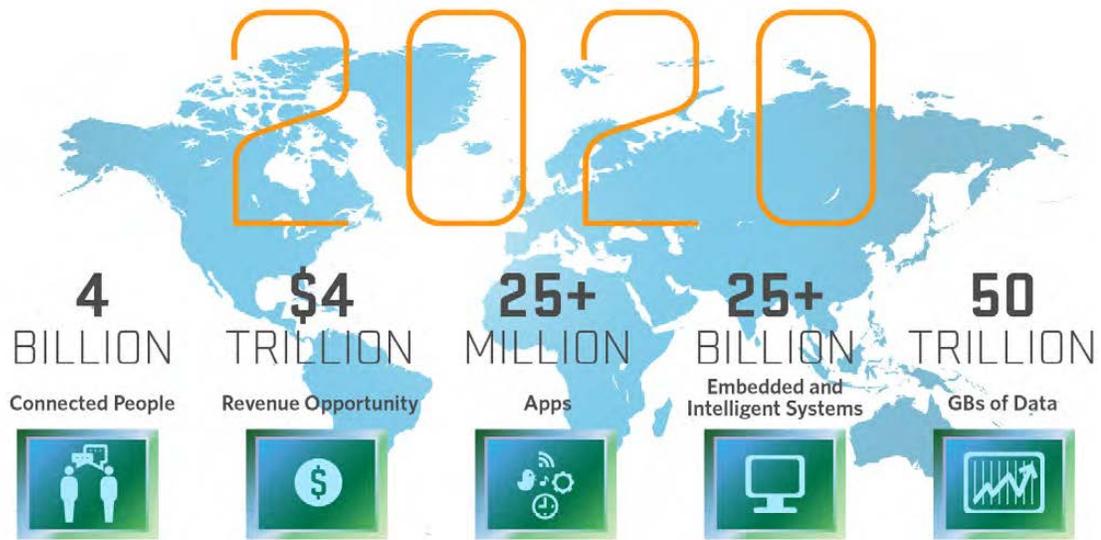
As the pace of the online revolution increases, regions equipped with high-speed, high-quality broadband networks will flourish in the digital world while others struggle to keep up. Government and civic entities across the country have realized the importance of broadband to their communities and are actively engaged with local stakeholders in the broadband development. In Stark County, we expect to find, most businesses subscribe to either DSL from the "telephone company" service provider or from no more than one cable provider. Though these service providers try to evolve to provide greater service levels and reliability to Stark County's consumers, the demand for bandwidth is quickly outpacing the supply simply because of inherent limitations in these traditional broadband technologies.

To resolve the increasing demand for more bandwidth, Fiber to the Premise (FTTP) broadband technologies are being deployed in metropolitan areas across the country to provide much greater speeds, reliability, and performance. Communities with next-generation broadband are well positioned to thrive and take full advantage of every opportunity the Internet and the digital content world have to offer. In essence, choosing next-generation technologies is revolutionary in that the consumers are driving the market. Traditionally, telecom offerings, as regulatory provisions, were built as a baseline infrastructure, that might as well have been advertised as. "Here it is – if you want to use it." Next-generation technologies are driven by communities of businesses, similar industries, and residential customers who have agreed, "We need it. We want it. We need to do more with it."

**BANDWIDTH TRENDS**

Broadband technologies have evolved to carry more and more data because of the advancements in online applications and the growth in the number of online devices. According to a new report by Gartner, “As it becomes cheaper to fit sensors to consumer products, the number of smart devices in a typical home in developed countries could grow to over 500 by 2022, .... smart devices, which make up the so-called Internet of Things (IoT), where wearables and sensors constantly exchange information, to be updated automatically with new features.”<sup>18</sup> While many of these devices have not made it mainstream, “tech geeks” and the wealthy are more likely to invest in and try out these options, where the everyday consumer may not have the knowledge or means to do so.

FIGURE 7: IDC PREDICTS HUGE GROWTH IN THE NUMBER OF GLOBAL CONNECTIONS

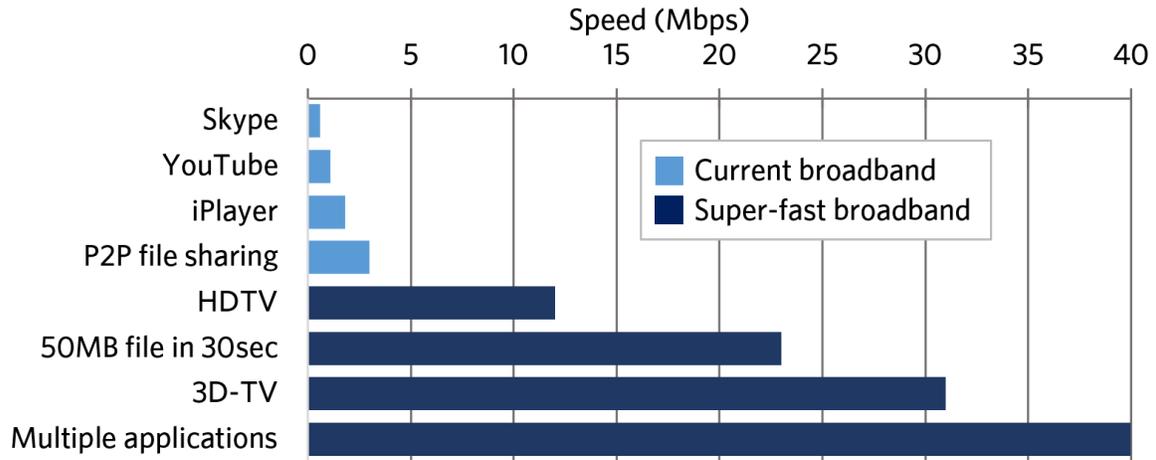


Source: Mario Morales, IDC

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 used by those applications. Figure 8 illustrates the bandwidth requirements of common applications and the impact of multiple applications running across a broadband connection.

<sup>18</sup> <http://www.techgoondu.com/2014/09/13/gartner-over-500-smart-devices-per-home-by-2022/>

FIGURE 8: BROADBAND APPLICATION SPEED REQUIREMENTS

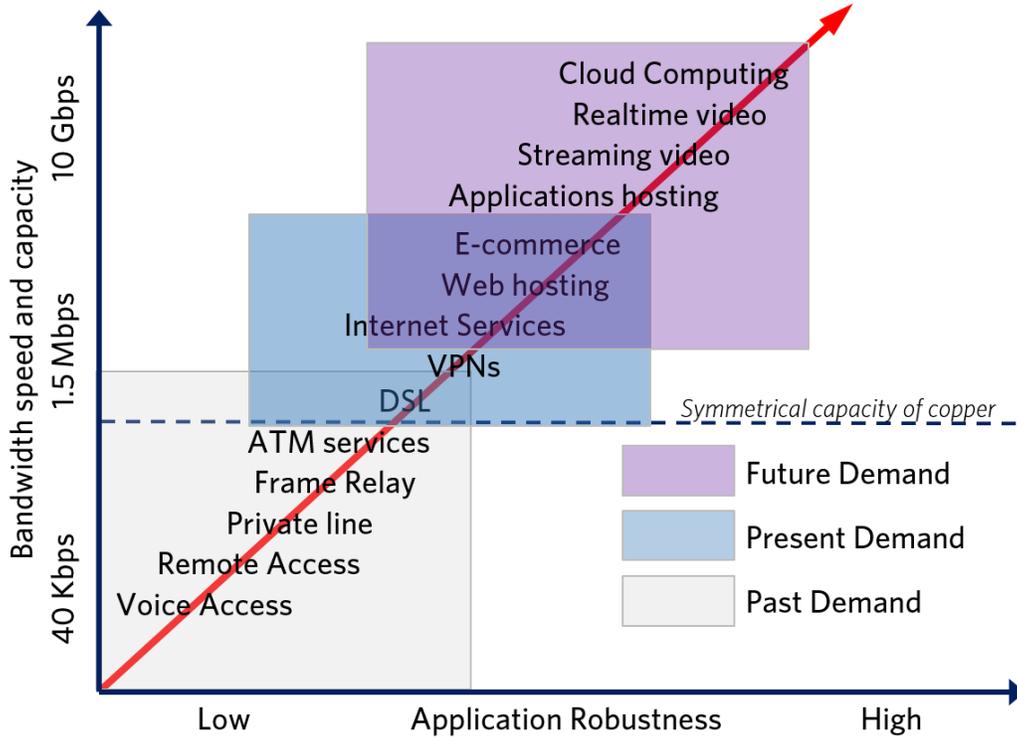


Today, broadband subscribers across every user class are utilizing more online applications, and particularly those that consume larger amounts of high-quality bandwidth. As the adoption of the Internet of Things (IoT) increases, these demands will escalate dramatically. Figure 8 illustrates broadband demand for applications today and the increases in broadband that are necessary to accommodate this demand. Broadband subscribers make heavy use of the core Internet functions of Internet browsing, web hosting, e-commerce, virtual private network connectivity, and voice services.

However, subscribers are consuming 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. In addition, the myriad of cloud services is driving the need for more symmetrical<sup>19</sup> broadband as real time and cloud applications require additional bandwidth, both in download speed and upload speed. As more of these applications are deployed, broadband connections will need to accommodate the increased bandwidth load. Many times these applications 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.

<sup>19</sup> Symmetrical broadband connections provide equal download and upload speeds, such as 10 Mbps down, 10 Mbps up, instead of traditional asymmetrical broadband services that provide unequal speeds, such as 10 Mbps down and 2 Mbps up.

FIGURE 9: GROWTH IN APPLICATION BANDWIDTH DEMAND



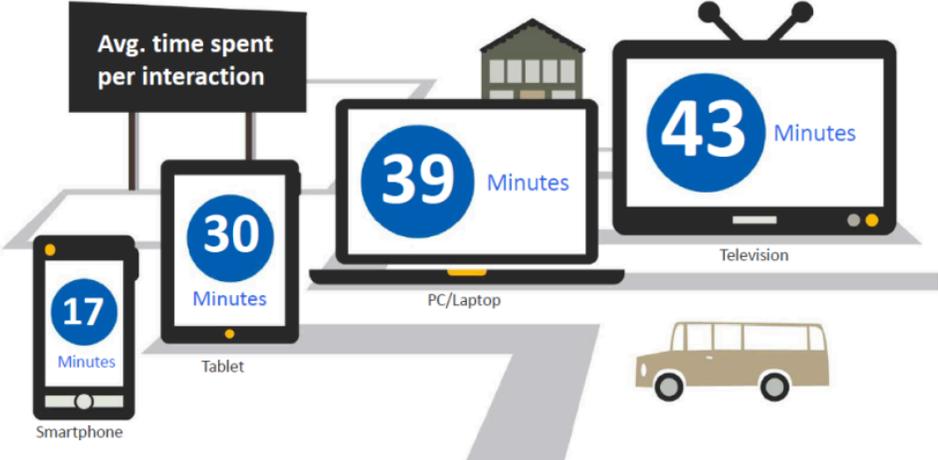
The proliferation of devices is also driving the need for more bandwidth as more devices in the home, businesses, and public places all access existing broadband connections. A report published in 2012 demonstrates the amount of time the average user spends with their devices across each type of device, and how users interact with multiple devices simultaneously. Although the study’s primary goals were to gain a deep understanding of consumer media behavior over a 24-hour period,<sup>20</sup> an important implied finding is that users are spending significantly more time with their devices, devices that all require broadband connections. As these devices all vie for bandwidth on a users’ broadband connections, the demand for more bandwidth to support more applications grow.

These demands also extend to many devices inside the home that are now being connected to the Internet and using our broadband connections. 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 home devices will lead to increased use of residential broadband connections, as “always-on” technologies are constantly connected to the Internet.

<sup>20</sup> *The New Multi-Screen World. Understanding Cross-Platform Consumer Behavior* Google 2012. [think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study\\_research-studies.pdf](http://think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study_research-studies.pdf)

FIGURE 10: THE PROLIFERATION OF BROADBAND-CONNECTED DEVICES

### Our time online is spread between 4 primary media devices



## SMART COMMUNITY TRENDS

As communities invest in fiber infrastructure, they are constructing foundational communications infrastructure required to support a multitude of technology based initiatives that require connectivity, illustrated in below. These initiatives can include broadband services, collaboration opportunities, public safety applications, and future energy and utility management functions and features as outlined below.



## EDUCATION BROADBAND TRENDS

Online applications used by educational organizations require high-bandwidth broadband, with services that meet strict quality and performance requirements to support real-time video and voice applications such as distance learning and teleconferencing. Today’s teaching resources incorporate multimedia—sound, graphics, video, and data, while the use of online textbooks is continuing to expand.

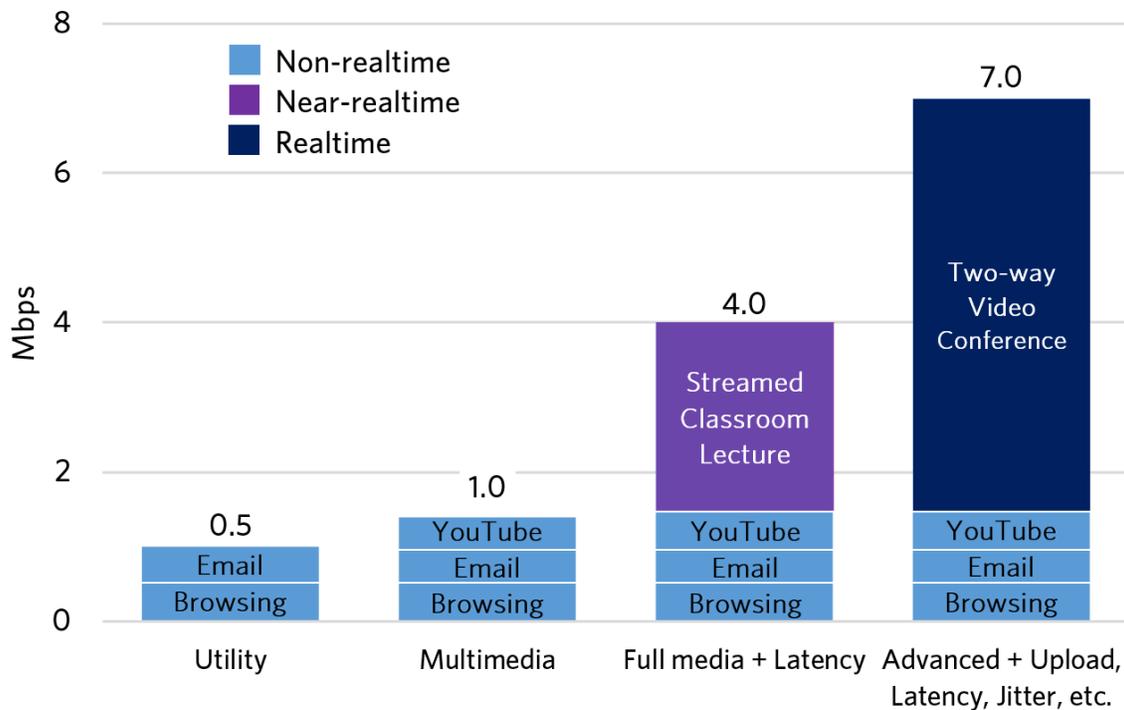
Table 6 lists the bandwidth requirements per student for common educational applications along with the quality and performance requirements of these applications. Basic educational tools, such as web browsing and YouTube, consume up to about 1 Mbps per student. However, moving up to more advanced educational technologies such as streamed classroom lectures and 2-way video teleconferences that use significantly more bandwidth per student, 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.

TABLE 6. RECOMMENDED BANDWIDTH PER USER<sup>21</sup>

Activity	Recommended Download speeds
Email and Web Browsing	500 Kbps
Download a 1 MB digital book in 5.3 seconds	1.5 Mbps
Online Learning	250 Kbps
HD-quality Video Streaming	4 Mbps
Skype Group-Video Session, 7+ people	8 Mbps
Download a 6,144 MB Movie in 8 minutes	100 Mbps
Current Generation Multiple Choice Assessments	64 Kbps/student

In response to increased demand, many states have instituted requirements for online testing, creating an even greater need for high-quality broadband services. Additionally, educational institutions are utilizing more online content to support their lesson plans, from streaming sources such as YouTube, TeacherTube, Vimeo, and Facebook. Figure 11 shows how these requirements multiply.

FIGURE 11: BANDWIDTH DEMANDS FOR EDUCATIONAL TECHNOLOGIES PER STUDENT



Jessica Rosenworcel, FCC Commissioner, recently stated during a panel discussion on Aspen Ideas<sup>22</sup> that seven in ten teachers assign homework that required broadband access to complete, however, one in three students live in households without access to high-speed broadband Internet. Access to high-speed Internet is becoming an

<sup>21</sup> State Educational Technology Directors Association (SETDA), “The Bandwidth Imperative,” page 21.

<sup>22</sup> Aspen Ideas Festival. Panel discussion. <http://www.aspenideas.org/session/closing-digital-divide>

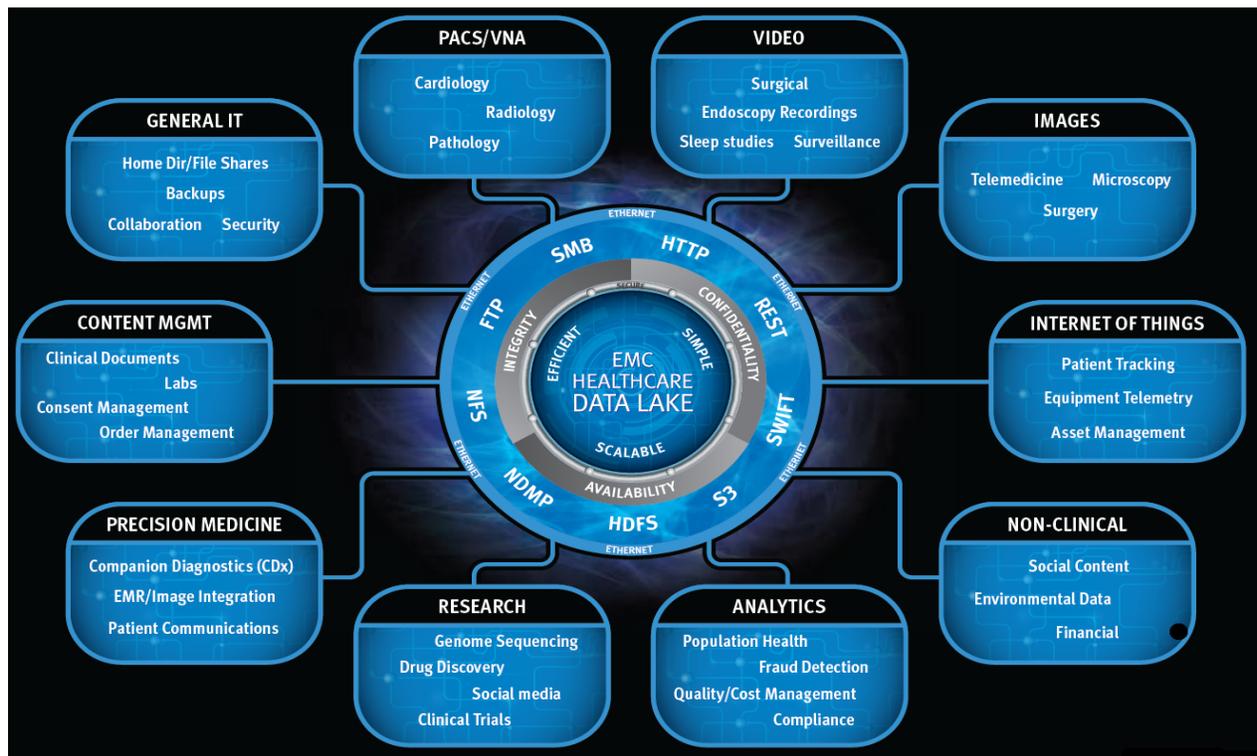
important component of education, inside the classroom and in the home. This integration of technology into learning is only going to increase over time, those students without access in the home may fall behind in their academic success further widening the social issue termed the “digital divide” or “homework gap.”

In addition to high-speed Internet needs of traditional brick and mortar schools, the residents of the Stark County area would see value in real time online educational platforms. Executives or retirees may engage in courses through online universities as students or professors. Creation of and participation in streamed online lectures require reliable, high-speed Internet access and significant bandwidth.

### HEALTHCARE BROADBAND TRENDS

Broadband is crucial for Stark County’s healthcare providers as they begin to leverage electronic medical records and other important capabilities of health IT, such as telehealth and electronic exchange of healthcare information. Stark County’s population is “older and poorer” and will experience vast improvements in healthcare over the coming years – in large part to technology and connectivity platforms. Healthcare applications require high performance broadband capability. Healthcare facilities currently maintain access to high-speed broadband services but beyond these organizations, the healthcare providers that have access to this type of service is unknown. Doctor’s offices, clinics, and imaging centers all have growing broadband needs to ensure they stay connected as their organizations transition to the digital healthcare environment. For these smaller organizations, high-speed broadband becomes a critical need to fulfill their mission and provide for long-term success. As more advancements are made in health technology, high-speed symmetrical speeds will be required in the home to provide access to the myriad of health devices that will be online. These advances will allow the healthcare community to provide real-time healthcare to those that require it, and will allow our family and friends to age in place – in the comforts of their homes.

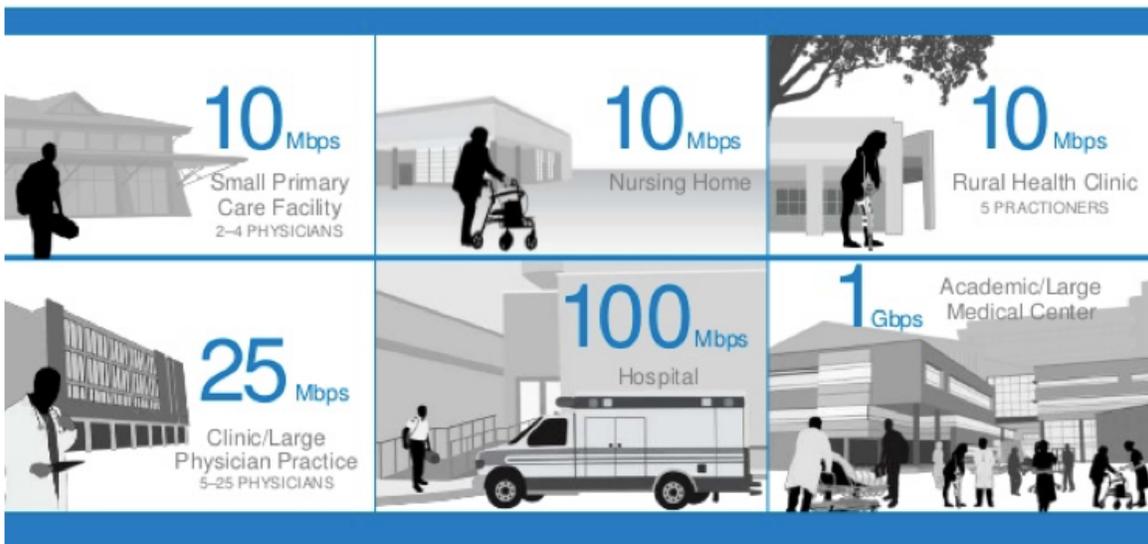
FIGURE 12. CONNECTED MEDICAL DEVICES ARE MORE AND MORE COMMON



As a guide, the FCC has released minimum recommended broadband speeds for healthcare organizations, as part of its Healthcare Connect program. These speeds identified by Healthcare Connections should be considered minimum requirements and Stark County’s healthcare organizations should have access to more bandwidth if needed.<sup>23</sup>

Future needs of healthcare providers in the County will continue to grow. As a guide, the FCC has released minimum recommended broadband speeds for healthcare organizations, as part of its Healthcare Connect program. These speeds identified by Healthcare Connect should be considered minimum requirements and Stark County’s healthcare organizations should have access to more bandwidth if needed. These recommendations were released in 2010; it is likely that these recommendations will be updated with higher bandwidths within the near future.

FIGURE 13. RECOMMENDED BANDWIDTH REQUIREMENTS: AS HEALTHCARE ORGANIZATIONS CONTINUE TO DIGITIZE PROCESSES, BANDWIDTH NEEDS SKYROCKET<sup>24</sup>



<sup>23</sup> <http://gcn.com/articles/2015/08/21/virginia-health-broadband.aspx>

<sup>24</sup> Time Warner Cable. Garnered from Google Images.

## NATIONAL BROADBAND POLICY TRENDS

The Federal Communications Commission (FCC) is tasked with the oversight responsibility relative to telecommunications standards and practices throughout the United States. The FCC is empowered to fulfill its obligations under the authority granted by the Telecommunications Act of 1996. Every year, as required by the Act, the FCC assesses the progress of the broadband industry and publishes its findings in its “Broadband Progress Report.” A key focus of the Report is to determine if, “advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.”<sup>25</sup>

TABLE 7. FCC BANDWIDTH BENCHMARKS – FIXED LOCATION

Year	Download Speeds	Net Increase	Upload Speeds	Net Increase
1996	<b>Telecommunications Act defined “advanced telecommunications capability” as fixed landline.</b>			
1999	200 Kbps <sup>26</sup>	-	200 Kbps	-
2010	4 Mbps	2,000%	1 Mbps	500%
2015	25 Mbps	600%	3 Mbps	300%
2020	TBD	TBD	TBD	TBD

Some of the most important outputs from the annual FCC study include recommendations for more precise measures of the industry’s progress. Such recommendations typically include new or revised performance benchmarks. Each benchmark is accompanied by a precise definition that explains the criteria by which the benchmarks will be measured and assessed. For example, the 2015 Report concluded that the existing benchmark standards for broadband transmission speeds were insufficient to keep pace with the current use and foreseeable demands by subscribers. “Subscribers” are individuals and businesses that contract for telecommunications services from federal and/or state-approved “service providers.”

As a result of the information collected during the course of the study, the FCC recommended that the benchmarks for bandwidth speed be increased, thereby redefining the national expectation of “advanced telecommunications capability”<sup>27</sup>. In addition, for the very first time the FCC sought comment on the adoption of a minimum speed benchmark for mobile broadband services and suggested industry benchmarks for mobile service offerings to be considered “broadband”. The intent for fixed broadband is to offer high-speed, high-capacity connections capable of supporting multiple, simultaneous users.

The recommendation to establish the wireless rate is important to note considering that a mobile broadband metric has not yet been formally adopted. In the absence of that standard and in consideration of the rapidly growing consumption of mobile data, the fixed broadband metric was suggested for both fixed and mobile communications.

<sup>25</sup> [http://www.connectednation.org/sites/default/files/bb\\_pp/policy\\_brief\\_on\\_new\\_fcc\\_broadband\\_definition\\_final.pdf](http://www.connectednation.org/sites/default/files/bb_pp/policy_brief_on_new_fcc_broadband_definition_final.pdf)

<sup>26</sup> [http://www.connectednation.org/sites/default/files/bb\\_pp/policy\\_brief\\_on\\_new\\_fcc\\_broadband\\_definition\\_final.pdf](http://www.connectednation.org/sites/default/files/bb_pp/policy_brief_on_new_fcc_broadband_definition_final.pdf)

<sup>27</sup> Telecommunications Act of 1996, Pub. L. No. 104-104, § 706(a), 110 Stat. 56, 153; SEC. 706. Advanced Telecommunications Incentives; (c) (1) Definitions

TABLE 8. FCC BANDWIDTH BENCHMARKS – MOBILE SERVICES

Year	Download Speeds	Net Increase	Upload Speeds	Net Increase
1996	<b>Telecommunications Act defined “advanced telecommunications capability” as fixed landline.</b>			
1999	Mobile n/a	-	Mobile n/a	-
2015	25 Mbps	-	3 Mbps	-
2020	TBD	TBD	TBD	TBD

Market observers, like Vox Media, know quite a bit about online usage. Through one of their web outlets in January 2015, they offered this observation following the release of the FCC Report.

*Changing the national broadband standards to 25Mbps down and 3Mbps up is a bold move for the FCC, which has faced opposition from cable providers which are staunchly against this measure, as it essentially removed DSL services from the broadband discussion.*

*While cable and fiber-optic services can easily meet the new standards, DSL — which is delivered over telephone lines — generally never reach the new download threshold.<sup>28</sup>*

Nonetheless, in reaction to growing consumer demand for bandwidth, network operators have continued to upgrade equipment and networks within capital budget limitations to make these lines 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.
- Service Providers understand that fiber-optic broadband delivers the only long-term solution to the ever-growing bandwidth needs of homes, businesses, and community anchors and that the actual speeds associated with fiber-optic connectivity are always dependent on the services provisioned by the provider who operates the system.

In summation, 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 comes in many forms and from many locations across the world in the networks that connect the local community to the Internet backbone. Websites, television, streaming video, videoconferencing, cloud services, and even telephone service are just a few types of content that are delivered across local broadband networks.

Every minute of every day, subscribers are consuming real time video and streaming applications at work, at home – and in between. More than ever, planners, regulators and consumers alike need to understand the roles of Accessibility, Bandwidth, and Continuity.

<sup>28</sup> <http://www.theverge.com/2015/1/29/7932653/fcc-changed-definition-broadband-25mbps>

## CURRENT BROADBAND REGULATIONS

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Broadband facilities and services have been essentially not regulated at the federal (Federal Communications Commission) or state (Ohio PUC) levels. The FCC in its application of federal law had generally treated broadband Internet access services as unregulated services and subjected them to fewer regulations than cable TV or telecommunications services. However, last year the FCC changed its approach to broadband services. Specifically, prior to 2015 the FCC had employed light-handed regulatory practices for Internet access under its “Title I”, Information Services authority. By its “Net Neutrality” order in February 2015, the FCC changed from classifying Internet access (and other services) as Title I “Information Services”, and reclassified those services to be regulated as “Title II” services.<sup>29</sup> At the federal level, this reclassification permits the FCC to use its full array of public utility-style regulatory practices, but very significantly, the FCC has indicated it will “forbear” from applying these practices, and in fact the FCC has very carefully avoided calling Internet access a “telecommunications service”.

FCC regulation of Internet services is intended by the FCC to remain light handed through this “forbearance”, with regulatory scrutiny focused mainly to ensure greater transparency, reasonable network management practices, authority to review interconnection practices, and to ban three practices: blocking access to legal content; throttling on the basis of content; or paid prioritization. So the decision to reclassify Internet services as “Title II” does not present concerns for infrastructure deployment for wholesale or retail broadband services.

The FCC assesses broadband progress annually in its Broadband Progress Report, as required by the Telecommunications Act of 1996. On January 29, 2016 the FCC issued its 2016 Broadband Progress Report<sup>30</sup> which adopted benchmarks and criteria to assess consumer broadband. In the 2015 Report, the FCC increased the speed benchmark for what constitutes “advanced telecommunications capability” that “enables users to originate and receive high-quality voice, data, graphics, and video communications using any technology” as required by Section 706 of the Telecommunications Act of 1996. The FCC found based on its analysis of consumer usage that the speed benchmark for fixed landline broadband is a minimum of 25 Mbps download speed, and 3 Mbps upload speed.<sup>31</sup> In 2015, the FCC also sought comment on the adoption of a minimum speed benchmark for mobile broadband services for the first time, suggesting a minimum speed benchmark of 10 Mbps download and 1 Mbps upload to be considered “broadband”. This benchmark was not adopted in 2015, and the FCC determined that information was insufficient to set a mobile speed benchmark in the 2016 Report.<sup>32</sup>

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<sup>29</sup> Report and Order on Remand, Declaratory Ruling, and Order; *In the Matter of Protecting and Promoting the Open Internet*; GN Docket No. 14-28; FCC 15-24; Adopted February 26, 2015 and Released March 12, 2015. [The “Net Neutrality Order”]

<sup>30</sup> *2016 Broadband Progress Report*; Before the Federal Communications Commission in the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act; GN Docket No. 15-191, released January 29, 2016. (“FCC 2016 Broadband Progress Report”)

<sup>31</sup> 2016 FCC Broadband Progress Report, at paragraph 14.

<sup>32</sup> 2016 FCC Broadband Progress Report, at paragraph 58.

Key finding of the 2016 Broadband Progress Report include:

- Approximately 34 million Americans still lack access to fixed broadband at the benchmark speeds of 25 Mbps download and 3 Mbps upload.
  - A persistent urban-rural divide has left 39 percent of the rural population without access to fixed broadband at the minimum speed, while only 4 percent of the urban population lacks such access;
  - However, this is an improvement over previous years (2012: 55%; 2013: 53%)
- Fixed and mobile broadband services offer distinct functions meeting both complementary and distinct needs;
  - Fixed broadband offers high speed, high capacity connections capable of supporting bandwidth-intensive uses, such as streaming video by multiple users;
  - Mobile devices provide broadband access on the go and especially useful for real-time two-way interactions, mapping applications, and social media. But consumers who rely solely on mobile broadband tend to perform a more limited range of tasks and are significantly more likely to incur additional usage fees or forgo use of the internet.

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### CONSUMER BROADBAND TRENDS

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A recent Pew Research Center report, “Home Broadband 2015”<sup>33</sup> reaches similar conclusions to the FCC’s 2016 report and additional insights:

- Home broadband adoption seems to have plateaued, at 67% of Americans, down slightly from 70% in 2013. It is unclear whether this statistically significant difference represents a “blip” or not. The decline in rural adoption is larger, from 60% in 2013 to 55%.
- This downturn takes place at the same time there is an increase in “smart-phone only” adults. Smart phone adoption is at parity with home broadband adoption (68% v. 67%).
- 15% of American adults are “cord cutters” – those that have abandoned pay cable or satellite TV. Cord cutters cite the availability of televised content from the internet as one factor.
- Those who are smartphone-dependent face distinct challenges as being more likely to run up against data-cap limits, cancel or suspend service due to financial constraints, and be challenged in key tasks such as filling out job applications and writing cover letters.
- “The monthly cost of broadband service is now cited by a plurality of non-adopters as the most important reason for not having a home broadband subscription.”<sup>34</sup>
- “69% of Americans indicate that not having a home high-speed internet connection would be a major disadvantage to finding a job, getting health information, or accessing other key information – up from 56% who said this in 2010.”<sup>35</sup>

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<sup>33</sup> Pew Research Center, December 21, 2015, “Home Broadband 2015”; Available at: <http://www.pewinternet.org/2015/12/21/2015/Home-Broadband-2015/>

<sup>34</sup> Id, at page 4.

<sup>35</sup> Id, at page 4.

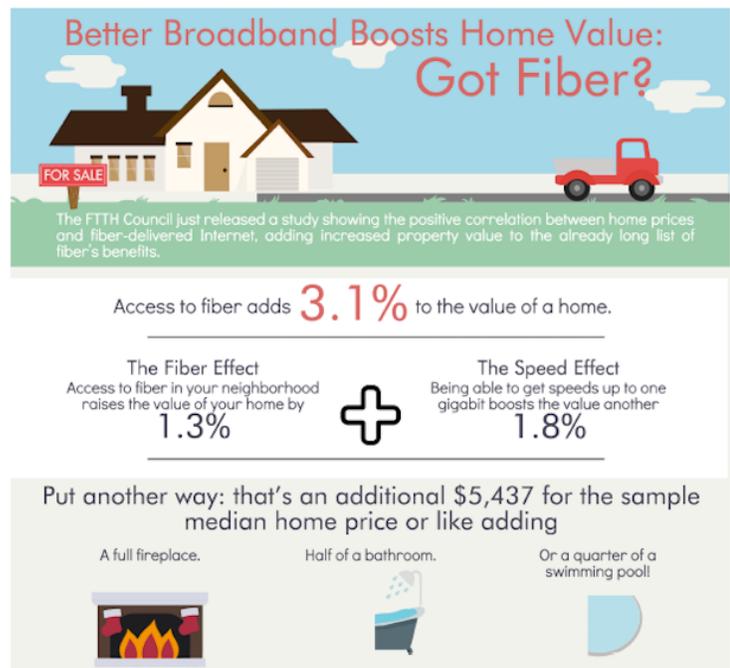
- “65% of non-adopters say that lacking home broadband service is a major disadvantage” when it comes to looking for job opportunities, accessing government information and services, following the news, learning new things, or getting health information. This is up from 48% who said so in 2010.<sup>36</sup>
- “Large numbers of non-broadband households have never had home high-speed service in the past, and few have interest in subscribing in the future.”
- “Among non-adopters, price sensitivity – where the monthly cost of service is the chief barrier to adoption – is the most prominent among those who have had service in the past, and/or are interested in getting it in the future.”<sup>37</sup>

## BROADBAND AND PROPERTY VALUES

Recent research has shown the impact of high speed broadband on property values. “In recent years, we’ve been hearing that high-speed broadband is good for home values – and conversely that a lack of broadband can depress home values and/or make homes harder to sell. But until now there has been little or no scientific research to back up those assertions.<sup>38</sup> “A 2015 white paper by the Fiber to the Home Council Americas goes even further, citing data from the University of Colorado at Boulder. Apparently, not only does a fiber connection add an average of 3.1 percent to a property’s value, but valuations are increased by an additional 1.8 percent when comparing areas with connectivity speeds of 100 Mbps with those that support 1 Gbps or more.”<sup>39</sup>

In the past, proximity to roads, buildings, and easy parking determined the value of property. In today’s business and real estate, proximity to viable and reliable Internet access, namely fiber, could increase property value in greater terms. “The evidence is mounting: investment in fiber improves the economic performance of a community as well as its quality of life,” said FTTH Council President and CEO Heather Burnett Gold. “Around the United States, leaders at the local level have started to think about how their community’s Internet infrastructure is a catalyst for economic, educational, and governmental innovation.”<sup>40</sup>

FIGURE 14: BROADBAND BOOSTS HOME VALUES



<sup>36</sup> d., at page 5.

<sup>37</sup> Id., at page 5.

<sup>38</sup> <http://www.telecompetitor.com/broadband-and-home-values-ftth-council-study-looks-at-fiber-impact/>

<sup>39</sup> <https://www.atlantech.net/blog/why-fiber-has-more-impact-on-real-estate-value-than-physical-location>

<sup>40</sup> <http://www.ftthannual.org/blog/study-shows-home-values-up-3.1-with-access-to-fiber>

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## BUSINESS BROADBAND TRENDS

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### ATTRACTING AND RETAINING INDUSTRY

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*... companies want to go where they can see the gig service.*

*- Marshall Ramsey, President of the Morristown, Tennessee Chamber of Commerce*

Morristown, TN, was able to bring a call center to the city because it was able to install the fiber for free because the city valued the future economic benefits the call center would bring to Morristown over the cost of the fiber installation. Pixel Magic, a visual effects producer, and Tapes Again, a media reproduction and processing company, both relocated offices to Lafayette, LA to gain access to the municipally-owned LUS Fiber in order to support the state's burgeoning film industry. For Chanute, KS, having a fiber-based network was instrumental in attracting Spirit Aerosystems to open up a new manufacturing facility creating 150 jobs that require high quality broadband Internet. Expedia, the online travel giant, created many hundreds of jobs in Springfield, MO in the form of a call center that relies heavily on the high bandwidth of Springfield's municipal network. In Cedar Falls, IA, where its industrial park went from having 27 businesses and \$5 million in taxable valuation to having 160 businesses and \$270 million in valuation in the twenty years since it connected to the city's municipal fiber network.

*Municipal broadband can be a powerful lever against the digital divide that condemns people to the isolation and reduced economic opportunities experienced by many ...*

*- Seattle City Councilmember*

The small Minnesota town of Windom was in crisis when Fortune Trucking, a local company that employed 47 people in a town of 4,600, announced that slow Internet speeds might force it to leave town. Although the company's headquarters were located a mile outside of the Windom's jurisdiction, community members successfully lobbied to bring municipal fiber to Fortune, saving those jobs and stabilizing the local economy. Alpha Natural Resources, a coal mining company, stayed in Bristol, VA, thanks to the BVU municipal fiber network. When the city of Princeton, IL, set up a municipal broadband network, it kept 300 jobs in the community with the global industrial machinery company, Ingersoll Rand.

## BOOSTING PRODUCTIVITY

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There is no solid data on the impact of broadband on private enterprises for the United States. But in Europe, as of 2008, broadband had increased labor productivity 5% on average for manufacturing and 10% for service industries, in spite of slow adoption of broadband value-added services especially by small and medium businesses (about 3% per year).<sup>41</sup> Katz points out “adoption does not automatically translate into growth but that it would require the accumulation of intangible capital, defined as the changes in business processes and firm culture that lead to assimilation of improved business processes.”<sup>42</sup> Digital development isn’t just about having technology; it’s really *using* it, which requires learning and takes time and money:

There appears to be a positive economic impact from expanded broadband deployment and adoption. However, various research challenges including methodological problems and access to sufficiently granular data have prevented the authors from drawing more definitive conclusions from the U.S. broadband experience. Another finding is the time lag for businesses to effectively exploit innovative broadband applications.<sup>43</sup>

These impacts really hit after broadband penetration reaches a “critical mass,” and it’s not clear exactly what that level is.<sup>44</sup> Efforts to boost adoption and utilization are important to reach this critical mass and reduce time to effective use.

## CREATING JOBS

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*You can't grow jobs with slow Internet.*

*- Stephanie Rawlings-Blake, Mayor of Baltimore*

Broadband deployment creates jobs in construction and telecom, and it leads to sustained employment gains in knowledge-intensive sectors such as financial services, education, and healthcare.<sup>45</sup> Investments by broadband service providers created an estimated 265,800 jobs between 2003 and 2009 in the United States, with over a million more projected jobs by 2015. We don’t have actual data on broadband job creation in the United States, but an analysis of employment in Europe published in 2008 concluded that 440,000 jobs per year were created in broadband-related industries. Broadband led to the creation of another 549,000 knowledge- and technology-intensive jobs per year in other European sectors. While it eliminated some 725,000 low-skill, low-tech jobs per

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<sup>41</sup> Fornefeld, et al., 2008.

<sup>42</sup> Katz, pg. 17.

<sup>43</sup> Holt, Lynne; Jamison, Mark. (2009). Broadband and contributions to economic growth: Lessons from the US experience. *Telecommunications Policy*, 33: 10-11, pp. 575-581. doi:10.1016/j.telpol.2009.08.008. From the abstract.

<sup>44</sup> Multiple studies come to this conclusion. For a detailed discussion of this and other results, see Minges, Michael. (2015). *Exploring the Relationship Between Broadband and Economic Growth*. Background paper for World Development Report 2016: Digital Dividends. <http://pubdocs.worldbank.org/en/391452529895999/WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf>

<sup>45</sup> Katz, Raul. (2012). *The Impact of Broadband on the Economy: Research to Date and Policy Issues*. Columbia Institute for Tele-Information (CITI), BDT Regulatory and Market Environment Division (RME), International Telecommunications Union. April 2012. [http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports\\_Impact-of-Broadband-on-the-Economy.pdf](http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf)

year, there was a net gain of 105,000 jobs due to broadband across Europe.<sup>46</sup> By 2012, smartphone apps had created 466,000 jobs, up from zero in 2007 before the introduction of the iPhone, including jobs at app-only companies, software companies with app versions, infrastructure providers, and spill-overs to other sectors.<sup>47</sup>

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## IMPROVING HEALTHCARE AND EDUCATION

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*We are embarking on new initiatives with our local school district and regional colleges and universities to leverage broadband and to facilitate discussion between schools and the business community to strengthen, retain, and attract a quality workforce.*

*- Dana McDaniel, Deputy City Manager of Dublin, Ohio*

In Danville, VA, their municipal broadband has long served the Danville Regional Medical Center, one of the city's largest employers. Medical companies, Ohio Health and Cardinal Health, and numerous educational facilities use Dublin, OH, municipally-owned fiber network for their healthcare, education, and research needs. Lakeland, FL, invested in a dark fiber community infrastructure, and has since reaped the rewards; the Florida Polytechnic University and Lakeland Regional Health medical center. Both rely on the network for their critical operations.

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## INCREASING INCOMES

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Economically, speed matters: an increase in broadband speeds of 4 Mbps translates into an extra \$2,100 per year in household income, and upgrading from 0.5 Mbps to 4 Mbps increase income about \$322 per month.<sup>48</sup> This is due to increased personal productivity and more flexible work arrangements, including home-based businesses complementing or replacing a regular job, and better information, education, and cultural enrichment, leading to faster career advancement. Defense contractor, Northrup Grumman, and IT consultant company, CGI, chose Lebanon, VA for its high-speed fiber network with the goal of creating 700 jobs paying twice the median wage.

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## MAKING WORK FLEXIBLE

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The US Census Bureau reported that in 2010 13.4 million people, or 9.5% of all workers, worked from home or other remote location—"telework"—at least one day a week, an increase of 41% over a decade.<sup>49</sup> Median earnings for persons who telecommuted was \$96,300 a year. Home-based workers earned \$74,000 a year, whereas onsite workers earned \$65,600. This trend seems to be continuing. Global Workplace Analytics<sup>50</sup> estimates that 20% to 25% of workers work remotely regularly, 50% of the workforce has jobs that are compatible with telework, workers spend 50% to 60% of their time away from their desks, and 80% to 90% of workers would like to telework two or three days a week. Growth in teleworking is four times greater than growth in employment.

According to HR Daily Advisor in 2015, telecommuting continues to grow year after year. In fact, some analysts predict that 30% of workers in industrialized countries will be telecommuting within just a few years. It's already

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<sup>46</sup> Ibid.

<sup>47</sup> Mandel, Michael. (2012). *Where the Jobs Are: The App Economy*. South Mountain Economics, LLC. TechNet. February 7, 2012. <http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf>

<sup>48</sup> *Socioeconomic Effects of Broadband Speed* (2013).

<sup>49</sup> See <https://www.census.gov/newsroom/releases/archives/employmentoccupations/cb12-188.html>.

<sup>50</sup> See <http://globalworkplaceanalytics.com/telecommuting-statistics>.

higher than that in some industries and regions. When allowing telecommuting, employers benefit by saving money and by increasing productivity. The benefits of working from home are plentiful, but telecommuters need high quality next generation broadband in order to take full advantage of this arrangement.

In 2010, DirecTV announced the creation of a virtual call center, allowing 100 residents in southwestern Virginia to work from home, relying solely upon municipal broadband access. 150 home-based English teachers in Powell, WY were connected to students in South Korea by the Korean venture capital firm, Skylake Incuvest; this unorthodox pairing was made possible by Powell's investment in FTTH. Policymakers in Ashland, OR, hope to use their city's fiber network, Ashland Fiber Net, to incentivize and support Internet-based home businesses.

Broadband in enabling the "gig economy" in which organizations draw on "contingent workers" for short-term engagements. Gigs can pay really well, and give individuals the flexibility and freedom of working for themselves.<sup>51</sup> There's been huge growth of 9.4 million "gigs" in the last five years. Co-work spaces are another aspect of the virtualization of work, which also supports entrepreneurship and innovation:

*[Co-working] offers the opportunity to be working amidst a variety of like-minded people in an environment that inspires innovation and nurtures creativity. ... These communal hubs are creating an entrepreneurial "ecosystem" that is part of a milieu where the whole is greater than the sum of its parts.*<sup>52</sup>

Remote workers need to be collaborators and skilled communicators, special efforts are required to engage and manage them, and it all needs executive level buy-in; but it can have huge benefits.<sup>53</sup> It increases productivity and employee retention, reduces office space costs, helps attract highly qualified talent, and cuts down on commuting, congestion, and pollution. While building and managing distributed teams, it can have a transformative impact on culture and ability of team members to really get things done. The key is to fully capitalize on technology.<sup>54</sup>

## SUPPORTING ENTREPRENEURS AND HOME-BASED BUSINESSES

According to the U.S. Small Business Administration there are 28 million small businesses in the United States.<sup>55</sup> They generated 54% of all sales, 55% of all jobs, and 66% of net new jobs in the country. Over the last quarter century, while big business eliminated 4 million jobs, small businesses created 8 million. Over two-thirds of small businesses start as home-based businesses, 55% of new businesses operate from home, and so do 59% of established businesses do, many of which have employees.<sup>56</sup>

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<sup>51</sup> Compare the views in <http://nypost.com/2016/06/04/this-new-gig-economy-isnt-helping-anyone/> and in <http://www.bloomberg.com/news/articles/2016-06-02/gigonomics-the-dismal-science-behind-today-s-on-demand-jobs>.

<sup>52</sup> <http://www.areadevelopment.com/workplace-trends/Q4-2015/Co-Working-Spaces-New-Emerging-Urban-Landscapes-789900.shtml>

<sup>53</sup> See <http://fortune.com/2015/02/12/lessons-learned-from-3-companies-that-have-long-embraced-remote-work/>.

<sup>54</sup> See <http://tech.co/distributed-teams-2013-08>.

<sup>55</sup> <https://www.sba.gov/managing-business/running-business/energy-efficiency/sustainable-business-practices/small-business-trends>

<sup>56</sup> Kelley, Donna J.; Ali, Abdul; Brush, Candida; Corbett, Andrew C.; Majbouri, Mahdi; Rogoff, Edward G. (2012). *Global Entrepreneurship Monitor 2012 United States Report: National Entrepreneurial Assessment for the United States of America*. Babson College and Baruch College. <http://www.babson.edu/Academics/centers/blank-center/global-research/gem/Documents/GEM%20US%202012%20Report%20FINAL.pdf>

*There is an even broader belief that using broadband to make home-based entrepreneurs a major economic development force, with 52% of respondents saying this is a likely outcome and another 25% who have had personal experience in this area.*

*-- International Economic Development Council*

Home-based businesses can grow in to major enterprises. Let's look at a few examples. PewDiePie is a Swedish comedian who produces videos of himself and friends playing video games. Over 40 million people subscribe to his YouTube channel, and he earns approximately \$12 million a year (yes, for videos of him playing video games). He is the biggest, but just one of the numerous, high-grossing gamers and video bloggers who have become celebrities in their own right. Here's a another example: Unable to get her paranormal fiction published the old-fashioned way, author Amanda Hocking made \$2.5 million dollars and sold 150,000 books via Amazon.com before a traditional publisher wised up and offered her a multi-million-dollar contract. Or, consider Sophia Amoruso who evolved her business selling vintage clothing on eBay into "Nasty Gal" an online fashion powerhouse with over \$100 million in annual sales. It is important to understand that these internet sensations did not arise in isolation: They tapped networks of experts and supporters, and tapped huge networks of consumers via YouTube, Amazon.com, and eBay.

Just for good measure think about eBay, Facebook, and Google, which were started in a living room, dorm room, and garage, respectively, by just a few people. Together these companies have huge market value but *sell no physical products*. How much time and money did people in the Stark County area spend on these and similar products in the last year? All of those products are *imports* and all of that time and money were capital—human and social as well as financial—flowing out of the area. The economic opportunity is to develop local digital products—intellectual and virtual rather than physical products—that can be exported from Stark County to the world.

## ENABLING INNOVATION

*The ultimate answer is innovation: The creation of new goods and services that spur the growth of new industries capable of employing tens or hundreds of thousands of workers.*<sup>57</sup>

Innovative products emerge when local culture and individual personalities connect with global markets, a phenomenon referred to as *glocalization*.<sup>58</sup> Digital technology makes this practical: anyone with a good idea can easily produce and sell it everywhere no matter where they may be. In the same way, digital products can be easily adapted to local interests. This requires new knowledge and skills, which means educational institutions have an important role to play in digital development. New capabilities are necessary to launch and run technology-enabled organizations. These enterprises require new digital infrastructure for their people, their partners, and their products. Skilled young workers demand good broadband.<sup>59</sup>

Programs that promote entrepreneurship, innovation, and *new* economic activities can greatly benefit from broadband. Business incubators are the modern classic example: their success depends upon their programs and

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<sup>57</sup> Mandel, pg. 1.

<sup>58</sup> See Barry Wellman, "Little Boxes, Glocalization, and Networked Individualism." Pp. 11-25 in *Digital Cities II*, edited by Makoto Tanabe, Peter van den Besselaar, and Toru Ishida. Berlin: Springer-Verlag, 2002.

<sup>59</sup> See <http://www.forbes.com/sites/markhughes/2015/03/21/the-millennial-trends-that-are-killing-cable/#2fe0c3b74f8f> and <http://www.millennialmarketing.com/2013/06/millennial-marketing-trends-by-the-numbers/>

services rather than just providing low-cost facilities.<sup>60</sup> Makerspaces, another example, provide a range of tools for individuals to build things, but it's classes, meetups, and workshops for those individuals to interact that make makerspaces thrive.<sup>61</sup> While many people associate "hacking" with criminal activities, it is actually a central element of software development, and developers regularly participate in "hackathons." Hackathons are becoming part of new economic development practices in places such as San Diego, Fairbanks, Washington DC, and Lee County, Florida. Facilities make interaction possible, but it's programming that draws in talent, drives the connections, generates solutions to important problems, and leads to new enterprises with highly valuable and innovative products.

With broadband, innovation can occur anywhere that is able to get creative, knowledgeable people working together on important problems. For example, Battelle Memorial Institute, a non-profit that relies on quantum computing to encrypt information uses Dublin, OH, municipal network to support its innovations. The imperative is to deploy new and different infrastructure—networks, but also spaces and systems—and to enable collaboration and promote creative problem-solving. This new approach to economic development is quite practical thanks to new digital technologies, including social media, collaboration tools, high-performance computing, and powerful new digital devices, all enabled via ultra-fast broadband.

*The speed of broadband development is not neutral with regards to economic impact: the successful development of innovative activities, which constitutes a large share of the positive impact of broadband, requires remaining at the forefront of worldwide development.*<sup>62</sup>

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<sup>60</sup> The *Incubating Success* report (2011) provides a comprehensive consideration of incubation practices. <https://www.inbia.org/docs/default-source/research/download-report.pdf>

<sup>61</sup> For a great discussion of this, see "How Makerspaces Help Local Economies" at <http://www.theatlantic.com/technology/archive/2015/04/makerspaces-are-remaking-local-economies/390807/>

<sup>62</sup> Fornefeld., pg. 6.

## CHAPTER 3: COMMUNITY BENCHMARKING AND LESSONS LEARNED

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Stark County can learn from other cities, counties, and communities instituting fiber based broadband projects across the state of Ohio. Each utilizes different strategies and business models and studying these projects can assist the Stark County Broadband Authority (SCBA) in making decisions regarding building and implementing the SCBN. A selection of the projects in the Ohio region are reviewed below.

### **City of Hudson, Ohio**

Similar to other communities that have recently decided to invest in municipal networks, Hudson's focus is only on Internet access and voice. The gigabit network will be deployed incrementally by Hudson Public Power focusing on downtown and areas of high demand. Through the reinvestment of service fees from customers, the city plans to grow the network as a self-sustaining venture.

Hudson's municipal network is marketed under the name Velocity Broadband, and is one of the first cities in the Midwest to offer gigabit connectivity and is signing on business customers while the network is being deployed. While the City is offering business services only at this point, they have received a Ohio based grant to study residential FTTH deployment.

The City initially deployed Internet and voice services in key business areas of Hudson, using a phased strategic approach. The Velocity network launched Labor Day 2015 and has over 65 businesses online, with over 50% taking voice services. Hudson has over 100 additional business that have expressed interest and are planned to be connected as the City expands into these new areas of the community.

The City of Hudson is operating Hudson as a municipal enterprise fund, with staffing and resources internal to Velocity, and resources from Hudson Public Power, the City's municipal electric utility.

### **City of Fairlawn, Ohio**

In 2015, the City of Fairlawn established the following broadband project objective: To offer Internet connectivity via 1 Gigabit fiber to the home (FTTH) and a carrier-grade Wi-Fi services citywide. This fiber broadband project will provide Internet, voice, and television to homes, businesses, and community organizations. "Financing the construction of the network with private money will allow us to build the network much more quickly than we could on our own," Fairlawn's Mayor William Roth, a key project supporter, said in a news release earlier this year.<sup>63</sup>

Based upon the positive response, the City's next step was to secure a project-engineer-designed contract which would determine the overall cost and to position the project for construction within the following six months. The City had sufficient revenue to cover the estimated cost of the build-out. As a result, there was no need for an assessment or tax hike to produce the required funding.

Fairlawn's plan does not include owning and operating the network as a municipally owned broadband network. Their plan is to forge a public-private partnership with a provider that would provide the retail services to the customers. The city has entered into a revenue sharing agreement with Extra Mile Fiber, another Ohio based company to operate the last mile network. While Extra Mile Fiber does build and operate fiber networks, the City

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<sup>63</sup> November 30, 2015. Fairlawn, Ohio Pursues Design Plan for Muni Broadband Utility. Institute for Local Self Reliance (ILSR). Community Broadband Networks. <https://muninetworks.org/content/fairlawn-ohio-pursuing-design-plan-muni-broadband-utility-0>

of Fairlawn decided to hire Fujitsu, a global organization which manufactures fiber network equipment as well as provides installation.

### City of Dublin, Ohio

“Dublin residents fed up with slow internet connections are asking the city to add broadband service as another public utility, but the city isn't planning to compete with private telecommunications companies – yet.” This was the attention-getting opening to a column posted by Carrie Ghose in the Columbus Business First. The article reported multiple “standing-room-only” work sessions attended by City hall representatives and “frustrated citizens” in a formal session scheduled late April 2016. The incumbent Internet Service Providers were requested to provide maps of the residential areas they served, notated with the service speeds being provided.

The request, or perhaps challenge, was for the purpose of learning as a community just when and how the incumbent providers were planning to meet the growing needs of businesses, civic organizations, and residents. The improved service for residents was among the most demanded due the rising number of home-based businesses and telecommuters within the community. As Ms. Ghose pointed out, “More people are working or even running businesses from home, uploading large files to international clients or running statistical simulations in the cloud. Business networks typically are 1 Gigabit per second both ways, 10 times faster than 100 Mbps.”

Columbus Business First’s staff reporter Evan Weese, had earlier written that the City was “speeding up its 125-mile fiber-optic cable network, up to 100 Gigabits per second, and last year started leasing access to unused fiber to small and medium businesses.” He also pointed out that “Dublin-based health care giant Cardinal Health Inc. had recently leased fibers on the network, which the City has been using as an economic development attraction to induce and retain new business, more jobs, greater growth.

With regard to the potential issue of competition with the providers by the city, Ms. Ghose quoted Doug McCollough, the City's chief information officer, “The carriers would look on that as an act of war,” “That’s a long road to travel and we’re nowhere close to that just yet.” Mr. McCullough emphasized the city’s role, “We are a city and should not be competing against telecom carriers, (but) the patience for that message is running out,” McCollough said. “Our residents want broadband service in their home for a reasonable price – now.”

### City of Columbus, Ohio

When Chattanooga, TN, set out to create the fastest municipal broadband service in the country: Telecommunications firms got angry and sued the city. Four times. That was many years ago, but cities in Ohio have found out more recently that when a government entity wants to set up a high-speed network, dealing with telecommunications firms is still a tricky business. “Access rights and all that, those we can overcome because we have the right of way, we have permits, we can do all kinds of things,” recalled Moez Chaabouni, former deputy chief information officer for the City of Columbus, Ohio. “Probably the biggest hurdle we faced was organizations like AT&T, Verizon, and Sprint. And I only mention these guys because they’re great at what they do, but they were incredibly opposed to us putting up anything in the downtown area, or anywhere for that matter, that was going to compete with their business.” But Columbus found a way around the problem, and government entities around the state have followed suit.

#### 1. BUILD IT, THEN HAND IT OFF

Instead of trying to sell connectivity directly to businesses and residents, Chaabouni decided to pursue a new strategy. He went to Connected Nation Exchange, the for-profit arm of the Internet development advocate Connected Nation, and asked them to take the network off the city’s hands. We cannot go out and compete with the AT&Ts of the world, that’s not our business. Our business is fiber, dark fiber, infrastructure, getting to places

where organizations cannot go in and drill and have conduit. We have the conduit, we have the fiber, it's dark, it's there, it's ready to be developed, it's high quality, go ahead and market it," Chaabouni said during the roundtable.

## 2. USE IT FOR GOVERNMENT — AS MUCH AS POSSIBLE

When Columbus handed off its fiber network, it made sure there was an asterisk in the agreement. "All we [asked] in return is the ability to connect our schools, our libraries, our communities and our [services]," Chaabouni said. Having such speedy Internet is extremely handy for public uses, for a number of reasons. With so many services becoming digitized, higher speeds allow many things to function better. Cities that have laid down fiber can then use the networks cooperatively to achieve efficiencies, and ultimately, cost savings. That's what Gahanna, another suburb of Columbus, did with its own network.

## 3. EMPHASIZE ECONOMIC DEVELOPMENT

The ultimate benefit to the city may also be the most roundabout one. Most of the roundtable participants described broadband as an economic development tool: By offering high-speed Internet, the city empowers existing businesses to do more and draws new businesses in. Those companies pay taxes, and they pay employees who also pay taxes. So at the end of the day, if broadband is indeed functioning as an economy booster, the city should see more revenue. High-speed Internet can also serve as a convincing pitch for businesses the city wants to draw in. "What happens is you create a center of gravity," McCollough said. "And when one company is able to do R&D with the supercomputer, three technology companies come in to serve them. And they may be consulting and contractors, but when they come in, two telecommunications companies come in to serve them." Transformation or otherwise, Ohio State CIO Stu Davis said high-speed Internet is a public service. "It's all about the public good at the end of the day, and if we can stimulate that activity then that's really what the state is trying to do," he said.

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## SECTION 2: STARK COUNTY BROADBAND NEEDS, GAPS, & ISSUES

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### CHAPTER 4: STATE OF BROADBAND IN STARK COUNTY

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As part of this Study, Magellan performed a market analysis for the Stark County region. This includes an analysis of enterprise, residential, and small business services. This analysis included identifying what service providers are advertising as being available in the area, and what is actually available through a random sampling of locations across the County. The goal of this process is to identify what is being advertised vs. what is actually provided.

In many cases, there is a vast disparity between what is advertised vs. actually available. As is documented in this section, it is evident that many advertisements are misleading. This analysis is meant to provide an overview of available services, but it does not identify areas served by any given provider or service.

Enterprise services include dark fiber and lit service offerings<sup>64</sup>. For other users, cable and DSL or fiber offerings are identified as well. Pricing for fiber services is usually priced by Individual Case Basis (ICB), however some pricing has been made available for this Study. In addition, fiber is normally priced at “what the market will bear,” and in areas where there is lack of competition amongst fiber providers, costs can be prohibitive for many.

Stark County has a wealth of railroads passing through the area, and in turn, has many major network backbone routes and providers operating throughout the County. These routes have been buried along the railroad and are typically utilized for long-haul transport purposes – connecting city to city and state to state. While these routes are valuable assets to the Stark County community, they rarely have an “on ramp” allowing metro access to these routes. In turn, these fiber segments don’t add much value to the last-mile deployment issue. Consequently, these backbone fiber routes are not considered in the retail service provider analysis, as pricing and availability is difficult to determine.

Stark County does have a local carrier-neutral data center located in the heart of the County, which interconnects the aerial Internet backbone fiber routes of many Tier 1 and regional competitive providers. This facility is a privately run facility, however management is supportive of the project and opportunities for partnership should be explored. The data center would be a major asset to any Stark County broadband project as it currently houses many potential partners, including functioning as Stark’s data center/CO. This facility also has transport capacity available to nearby metro markets including Cleveland, where more robust telecommunications and Internet services are available such as Internet peering<sup>65</sup> at cheaper rates.

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#### CURRENT MARKET, PROVIDERS, & PRICING

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During development of this Study and multiple trips in Stark County, we interviewed seven different service providers located within Stark County. In addition, numerous long haul providers, including Level 3 and Zayo maintain routes through the region. Dedicated, enterprise grade services are available in speeds ranging from 1 Mbps to 100 Gbps. Providers will generally customize these services to business customers’ specific needs and types of service such as transport, Internet Protocol (IP) and Multi-Protocol Label Switching (MPLS). The Stark County local exchange carrier map and provider maps are located in Appendix E, under a separate cover.

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<sup>64</sup> Dark fiber refers to fiber strands that are being used, i.e. not connected to equipment to provide services. Lit fiber refers to fiber strands that are connected to equipment and power, essentially ready for service or being used for service.

<sup>65</sup> Internet peering is a route optimization method where parties can exchange some of their traffic without incurring transit fees.

FIGURE 15: SAMPLE PORTFOLIO OF SERVICES FROM BROADBAND SERVICE PROVIDERS

 Professional Services	 Security	 Data Networks	 Voice	 Content Distribution
<ul style="list-style-type: none"> <li>· Professional Services</li> <li>· Managed Network Services</li> <li>· Managed IT and Hosting</li> </ul>	<ul style="list-style-type: none"> <li>· Secure Access Services</li> <li>· Email/Web Defense</li> <li>· Security Consulting</li> <li>· DDoS Mitigation</li> <li>· Threat Intelligence</li> <li>· Managed Security Services</li> </ul>	<ul style="list-style-type: none"> <li>· Managed Dedicated Fiber</li> <li>· MPLS/IP VPN</li> <li>· Secure Internet Services</li> <li>· Converged Services</li> <li>· Wavelengths</li> <li>· Ethernet</li> <li>· Private Line</li> <li>· Virtual Private LANs</li> </ul>	<ul style="list-style-type: none"> <li>· Wholesale Voice</li> <li>· Contact Centers</li> <li>· Collaboration Services</li> <li>· Voice Complete</li> </ul>	<ul style="list-style-type: none"> <li>· Channel Origination</li> <li>· Content Delivery Network</li> <li>· VenueNet</li> <li>· Cloud Content Exchange</li> <li>· Vyvx Solutions</li> </ul>

\*\*Please refer to the Glossary of Terms for definitions

### CURRENT BROADBAND PROVIDERS

**TWC/NEW CHARTER:** Time Warner Cable is one of two predominant cable TV companies serving Stark County (MCTV is the other). Stakeholder meetings and survey data indicate broad levels of dissatisfaction with the speed, price and availability of Time Warner’s broadband service offerings.

Time Warner recently merged with another of the largest cable companies in the US – Charter Communications. The Time Warner/Charter merger was recently approved by the Federal Communications Commission, with certain conditions. Since the FCC found that “the transaction as proposed would likely cause significant public interest harms but may also produce modest public interest benefits”,<sup>66</sup> it imposed remedial conditions. The primary conditions imposed by the FCC’s Order are:

- Prohibition of data caps or usage-based prices for residential broadband Internet access service;
- Requirement for settlement-free interconnection;
- Continuation of commitment to purchase, distribute, and service CableCARDS<sup>67</sup> so that subscribers continue to have alternatives to leasing equipment;
- Prohibition for seven years of entering or enforcing contractual terms that inhibit distribution of online content;
- Residential build-out commitment for residential broadband Internet access service, such that the New Charter will extend the network to two million additional customers;

<sup>66</sup> *Memorandum Opinion and Order*; Before the Federal Communications Commission, In the Matter of Applications of Charter Communications Inc. and Time Warner Cable Inc., and Advance/Newhouse Partnership For Consent to Assign or Transfer Control of Licenses and Authorizations; MB Docket No. 15-149; released May 10, 2016, at paragraph 455. (“Time Warner/Charter Merger Order”)

<sup>67</sup> A television, set-top box, or device that connects to a personal computer that can be plugged directly into a cable system to receive cable channels without having to lease a set-top box from a cable operator.

- Offer an affordable, low-price standalone broadband service to low-income consumers;
- Report its plan to manage cybersecurity risks during the transition period; and,
- Retain an internal company compliance officer and an independent external compliance officer to report and monitor the New Charter's compliance with the terms of the Commission's Order.<sup>68</sup>

On May 18, 2016 Charter Communications completed the transaction.<sup>69</sup> The merger results in New Charter being the third largest cable provider behind AT&T/DirecTV and Comcast. The New Charter will operate under the brand name of Spectrum.

Stark County has an urgent interest in availability of high-speed broadband services to business and residences which meets accelerated speed requirements. Magellan Advisors recommends that Stark County seek information from Time Warner to know with specificity when and where New Charter plans to meet each one of these conditions within the County, with regular updates.

**AT&T:** AT&T is the incumbent local exchange carrier (ILEC) serving most of the exchanges throughout the Stark County area. AT&T is one of the world's largest providers of IP-based communications services for businesses, including Virtual Private Network (VPN) and Voice over IP (VoIP), and is very well known for its wireless network.<sup>70</sup> AT&T has recently acquired DirecTV, and the FCC conditioned its approval of the transaction on AT&T extending fiber connections to additional locations as well as offering gigabit connections to E-rate eligible schools and libraries.<sup>71</sup>

**Frontier:** Frontier Communications is the other incumbent local exchange company serving Stark County. It serves the Paris and Minerva exchanges in Southeast Stark County, and the Brewster and Beach City exchanges in Southwest Stark County. Frontier Communications provides wireline retail and wholesale services in 28 states, including former Verizon operations in many states.<sup>72</sup> Frontier Communications has a business model that emphasizes expansion of broadband availability, using Federal Communications Commission Connect America Funds.

**Everstream:** Everstream, formerly the non-profit OneCommunity, operates fiber networks throughout Michigan and Northeast Ohio. Everstream used ARRA funds to construct an intercounty middle mile network through Northeast Ohio, before being spun off as a for network provider. Everstream provides managed network services for businesses, with customer-specific solutions.<sup>73</sup> During discussions with Everstream, they noted previous conversations with specific community leaders and would still like to come to the table to partner where opportunities present themselves.

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<sup>68</sup> Time Warner/Charter Merger Order, at paragraphs 456-463.

<sup>69</sup> <http://finance.yahoo.com/news/charter-completes-merger-bright-house-120106014.html>

<sup>70</sup> <http://www.att.com/gen/investor-relations?pid=5711>

<sup>71</sup> In the Matter of Applications of AT&T Inc. and DIRECTV For Consent to Assign or Transfer Control of Licenses and Authorizations; MB Docket No. 14-90; Memorandum Opinion and Order; FCC 15-94, Released July 28, 2015, at page 148.

<sup>72</sup> <http://investor.frontier.com>

<sup>73</sup> <http://everstream.net/network/>

They provide end-user retail service and in some cases function as carrier's carrier. They serve community anchors, enterprise customers, and the SMB market. Everstream maintains colocation in many of the regional and state colocation facilities throughout Ohio and specifically in Stark County.

**MCTV:** MCTV originated as Massillon Cable TV, and provides cable TV and telecommunications services in five counties including Stark County. MCTV serves more than 47,000 customers in western Stark County.<sup>74</sup> MCTV provides digital TV, high-speed internet access, residential and commercial telephone, TV advertising, dedicated fiber-optic connections and security systems.<sup>75</sup> MCTV offers residential Internet access at speeds up to 50 Mbps down and 3 Mbps upload.

**Agile Networks:** Agile states it has deployed a network that unifies existing tower and fiber assets into one network. It is a hybrid fiber/wireless network, with backhaul capable of 1 Gbps speeds. Agile Networks has initially focused on public safety applications. This network is intended to enhance public safety communications, extend the reach of existing fiber assets for government and education, provide cost competitive telecommunications for state and local government and serve as a catalyst for economic development and rural broadband in previously underserved markets.<sup>76</sup> The network also provides residential Internet connectivity regionally. Agile Networks of Canton, Ohio is the exclusive franchise lessee and operator of the State of Ohio's Multi-Agency Radio Communication System (MARCS) towers and other infrastructure, and now operates the State of Indiana's system.

**LightSpeed Technologies:** LightSpeed is local to the Canton area, and uses fixed wireless technologies to provide Internet access services, emphasizing unserved areas in an effort to close the "digital divide". LightSpeed advertises faster Internet access and faster downloads, along with upload speeds that exceed to what DSL/Cable can offer.<sup>77</sup>

**OARnet:** The Ohio Academic Resources Network (OARnet) was created in 1987 by the Ohio Board of Regents, to provide connectivity for colleges and universities, K-12 schools, public broadcasting stations, academic medical centers, government agencies, and partnering research organizations. OARnet has recently been merged with the Ohio Supercomputer Center to form the Ohio technology consortium – OH-TECH. OARnet operates a fiber-optic backbone network that was launched in November 2004.<sup>78</sup> It currently has six major rings across the state of Ohio. OARnet interconnects with other academic/research Regional Optical Networks, and also provides global reach through its interconnection to Internet2 – the nation's most advanced nationwide research and education network.<sup>79</sup> Backbone connections between rings operate at 100 Gbps using Dense Wavelength Division Multiplexing transport technology, and remaining network connections operate at 10 Gbps.

**Level 3:** Level 3 Communications is a global communications provider, supplying communications services to enterprise, government, and carrier customers. Anchored by extensive fiber networks on three continents connected by undersea facilities, Level 3's global services platform features deep metro assets reaching more than

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<sup>74</sup> "MCTV ... more than just television service"; CantonRep.com, August 25, 2014.

<sup>75</sup> <http://www.mctvohio.com/about-us>

<sup>76</sup> <http://agilenetworks.com/history/>

<sup>77</sup> <http://www.lsti.net/services/>

<sup>78</sup> <https://www.oar.net/network/design>

<sup>79</sup> Id.

500 markets in over 60 countries. Level 3 maintains extensive fiber routes through Ohio including metro fiber in larger cities. Level 3 offers a portfolio of connectivity services including Internet, voice, transport, dark fiber, and other complementary service offerings. Level 3 provides this depiction<sup>80</sup> of its network in Ohio, where the red dot indicates on-network cities with metropolitan networking. Level 3's buried and aerial backbones route between Akron, Canton, and Alliance.

**Zayo:** Zayo provides bandwidth infrastructure services, including fiber and bandwidth connectivity, colocation, and cloud services to wireless and wireline carriers, media and content companies and finance, healthcare, and other large enterprises. Zayo states its 87,000-mile network in the US and Europe includes extensive metro connectivity to thousands of buildings and data centers. In addition to high-capacity dark fiber, wavelength, Ethernet and other connectivity solutions, Zayo offers colocation and cloud services in its carrier-neutral data centers.

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## RESIDENTIAL BROADBAND MARKET ANALYSIS

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Through analysis of the market, Magellan identified a number of residential sites by address, selected randomly in various sections of Stark County. Magellan's team contacted each telecommunications 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 vary.

The following residential site locations were utilized:

- Residential Site #1 – 13537 Indiana Street Northeast, Alliance, OH 44601
- Residential Site #2 – 5131 Beechwood Avenue, Alliance, OH 44601
- Residential Site #3 – 754 East 1st Street, Minerva, OH 44657
- Residential Site #4 – 8050 Locust Avenue, Louisville, OH 44641
- Residential Site #5 – 4635 Hudson Drive Southwest, East Sparta, OH 44626
- Residential Site #6 – 12610 Lawnfield Street Southwest, Beach City, OH 44608
- Residential Site #7 – 14478 Barrs Street Southwest, Massillon, OH 44647
- Residential Site #8 - 13311 Carla Avenue Northwest, Uniontown, OH 44685
- Residential Site #9 - 6920 Hahn Street, Louisville, OH 44641
- Residential Site #10 - 7251 Minerva Road Southeast, Waynesburg, OH 44688
- Residential Site #11 - 14836 Warwick Drive Northwest Canal, Fulton, OH 44614
- Residential Site #12 - 5874 Ballyshannon Circle Northwest, Canton, OH 44718
- Residential Site #13 - 612 Market Avenue, South Canton, OH 44702

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<sup>80</sup> <http://www.level3.com/~media/files/maps/en-network-services-level-3-network-map.pdf>

FIGURE 16: SPATIAL DISTRIBUTION OF RESIDENTIAL MARKET ANALYSIS SITES

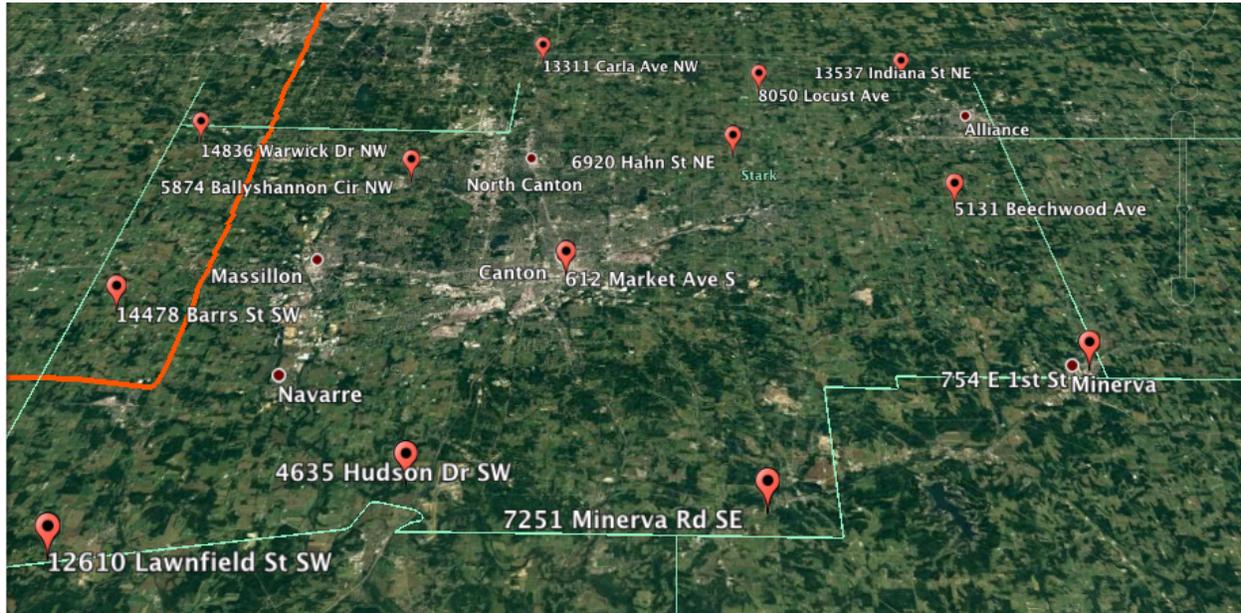


FIGURE 17: RESIDENTIAL BROADBAND MARKET ANALYSIS – RESIDENTIAL SITES 1 – 13

Provider	Type of Service	Cost
<b>Residential Site #1 – 13537 Indiana Street Northeast, Alliance, OH 44601</b>		
Frontier	DSL up to 6Mbps/1Mbps	\$34.99/month**
Time Warner	Cable up to 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #2 – 5131 Beechwood Avenue, Alliance, OH 44601</b>		
Frontier	DSL up to 6Mbps/1Mbps	\$34.99/month**
Time Warner	Cable 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #3 – 754 East 1st Street, Minerva, OH 44657</b>		
Frontier	DSL 24Mbps	\$55/month**
Time Warner	Cable up to 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #4 – 8050 Locust Avenue, Louisville, OH 44641</b>		
Time Warner	Cable up to 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #5 – 4635 Hudson Drive Southwest, East Sparta, OH 44626</b>		
Frontier	DSL 6Mbps	\$34.99/month
Time Warner	Cable up to 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #6 – 12610 Lawnfield Street Southwest, Beach City, OH 44608</b>		

<b>Frontier</b>	DSL 1.6Mbps	\$34.99/month
<b>Residential Site #7 – 14478 Barrs Rd Southwest, Massillon, OH 44647</b>		
<b>MCTV</b>	Cable 50/3Mbps	\$89.95/month
<b>Residential Site #8 – 13311 Carla Avenue Northwest, Uniontown, OH 44685</b>		
<b>AT&amp;T</b>	DSL 24Mbps/ 3Mbps - Data Restrictions - 1TB a month before overages	\$50/month*
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month
<b>Residential Site #9 – 6920 Hahn Street, Louisville, OH 44641</b>		
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #10 – 7251 Minerva Road Southeast, Waynesburg, OH 44</b>		
<b>AT&amp;T</b>	DSL 12Mbps/ 1Mbps - Data Restrictions - 1TB a month before overages	\$50/month*
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #11 – 14836 Warwick Drive Northwest, Canal Fulton, OH 44614</b>		
<b>AT&amp;T</b>	DSL 768Kbps - Data Restrictions - 1TB a month before overages	\$30/month*
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month*
<b>Residential Site #12 – 5874 Ballyshannon Circle Northwest, Canton, OH 4471</b>		
<b>AT&amp;T</b>	DSL 45Mbps/5Mbps - Data Restrictions - 1TB a month before overages	\$60/month*
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month*
<b>MCTV</b>	Cable 50/3Mbps	\$89.95/month
<b>Residential Site #13 – 612 Market Avenue, South Canton, OH 44702</b>		
<b>AT&amp;T</b>	DSL 12Mbps/1Mbps - Data Restrictions - 1TB a month before overages	\$50/month*
<b>Time Warner</b>	Cable 50Mbps/5Mbps	\$64.99/month*

\*pricing is subject to a 12-month introductory period.

## COMMERCIAL BROADBAND MARKET ANALYSIS

Through analysis of the market, Magellan identified a number of commercial sites by address, selected randomly in various sections of Stark County. Magellan’s team contacted each telecommunications 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.

The following commercial site locations were utilized:

- Commercial Site #1 – 14008 Union Ave NE, Alliance, OH 44601
- Commercial Site #2 – 14738 Ravenna Ave Northeast, Hartsville, OH 44632
- Commercial Site #3 – 12992 Cleveland Ave NW, Uniontown, OH 44685
- Commercial Site #4 – 9277 Cleveland Ave NW, North Canton, OH 44720
- Commercial Site #5 - 7390 Middlebranch Ave NE, Canton, OH 44721
- Commercial Site #6 – 2017 Union Ave, Minerva, OH 44657
- Commercial Site #7 – 231 N Market St, Minerva, OH 44657
- Commercial Site #8 - 123 6th St SW, Canton, OH 44702
- Commercial Site #9 - 212 Federal Ave NW, Massillon, OH 44647
- Commercial Site #10 - 120 Wabash Ave S, Brewster, OH 44613

FIGURE 18: SPATIAL DISTRIBUTION OF COMMERCIAL MARKET ANALYSIS SITES

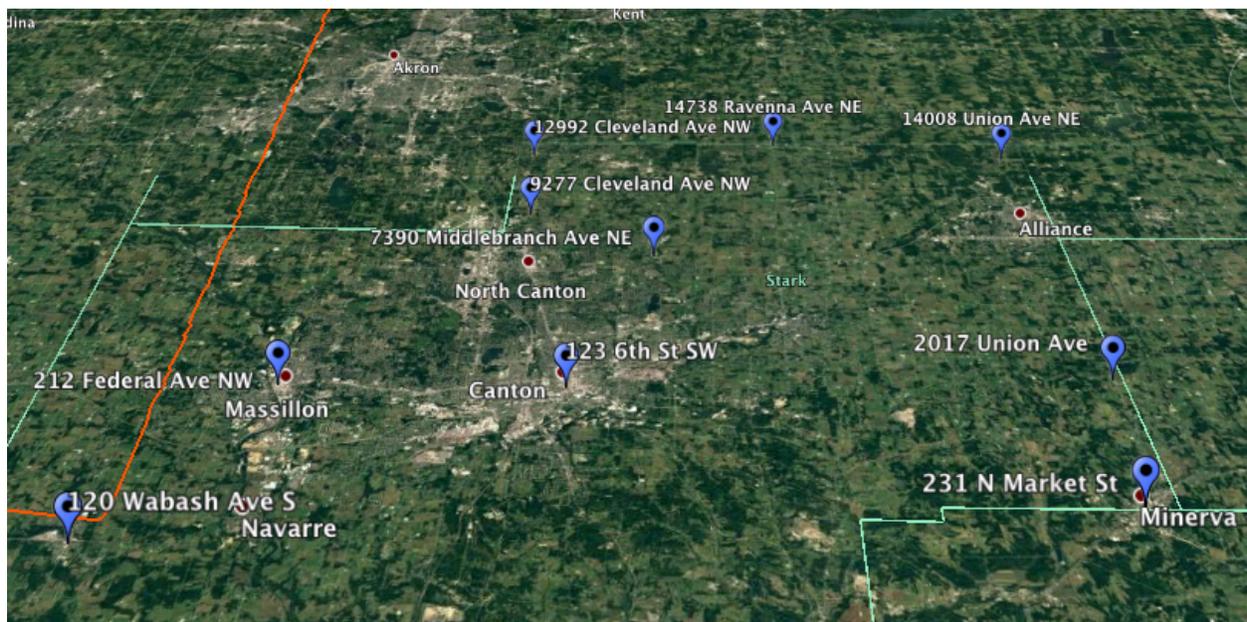


FIGURE 19: COMMERCIAL BROADBAND MARKET ANALYSIS – COMMERCIAL SITES 1 - 10

Provider	Type of Service	Cost
<b>Commercial Site #1 – 14008 Union Ave NE, Alliance, OH 44601</b>		
Time Warner	Cable up to 50Mbps/5Mbps	\$219/month
<b>Commercial Site #2 – 14738 Ravenna Avenue Northeast, Hartville, OH 44632</b>		
Time Warner	Cable up to 50Mbps/5Mbps	\$219/month
<b>Commercial Site #3 – 12992 Cleveland Ave NW, Uniontown, OH 44685</b>		
AT&T	DSL- Uverse MaxTurbo 24Mbps/3Mbps	\$90/month*
<b>Commercial Site #4 – 9277 Cleveland Ave NW, North Canton, OH 44720</b>		
AT&T	DSL Uverse MaxTurbo 45Mbps/6Mbps	\$110/month*
Time Warner	Cable 50Mbps/5Mbps – 2 months, 10/10 fiber \$700	\$219/month
<b>Commercial Site #5 - 7390 Middlebranch Ave NE, Canton, OH 44721</b>		
AT&T	DSL Uverse Elite 6Mbps/786Kbps	\$50/month*
Time Warner	Cable 50Mbps/5Mbps	\$219/month
<b>Commercial Site #6 – 9061 2017 Union Ave, Minerva, OH 44657</b>		
Time Warner	Cable 50Mbps/5Mbps	\$219/month
<b>Commercial Site #7 – 231 N Market St, Minerva, OH 44657</b>		
Time Warner	Cable 50Mbps/5Mbps	\$219/month
<b>Commercial Site #8 – 123 6th St SW, Canton, OH 44702</b>		
AT&T	DSL Uverse MaxPlus 18Mbps/1.5Mbps	\$80/month*
Time Warner	Cable 50Mbps/5Mbps	\$219/month
<b>Commercial Site #9 – 212 Federal Ave NW, Massillon, OH 44647</b>		
AT&T	DSL Uverse MaxPlus 18Mbps/1.5Mbps	\$80/month*
MCTV	Up to 20 Mbps/3 Mbps Coax over Cable	\$159.95/ month
<b>Commercial Site #10 – 120 Wabash Ave S., Brewster, OH 44613</b>		
AT&T	DSL Uverse MaxPlus 18Mbps/1.5Mbps	\$80/month*
MCTV	Up to 20 Mbps/3 Mbps Coax over Cable	\$159.95/ month

\*pricing is subject to a 12-month introductory period.

### REGIONAL DATA CENTER FACILITIES

Data center facilities are an important asset to any community. They connect the region to the greater national and international Internet backbones. Data center facilities come in several different names, however the function is very similar – centers for high-end computing/telecommunications services. In Stark County, there are several central offices (CO) managed by the incumbent LEC, headends operated by the cable providers, and carrier neutral facilities such as the Secure Data 365 facility. Interconnection to the Secure Data 365 data center will place Stark

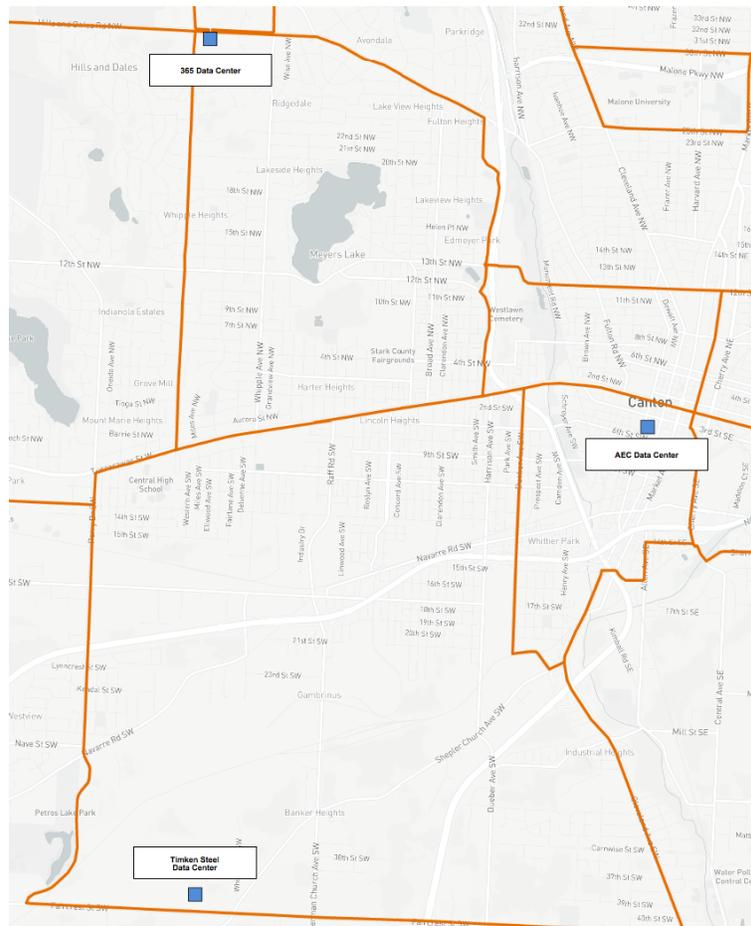
County assets on the regional/state telecommunications backbone, and will provide for future interconnect to one or many of the carriers located in the facility or the sister facility located in Cleveland.

**Secure Data 365** is a privately owned data center featuring interconnect capability to Level 3, Zayo, T1 Co., TWC, Everstream, FirstCommunications, Lightspeed Technologies, and AT&T. In addition, the data center has full colocations facilities with floor and rack space available. Secure Data 365 is a facility located near the center of the Stark County urban core and would prove to be an excellent facility to interconnect and establish a presence. The data center includes direct long-haul fiber connections into Cleveland providing additional services and providers to work with.

In addition to the Secure 365 Data Center, there are two additional private data center facilities which could service purpose for the SCBN network if made available. They include the TimkenSteel shared corporate data center and the AEC data center located in downtown Canton.

Further data center analysis has been provided in Section 3 under Key Initiatives.

FIGURE 20: STARK REGION DATA CENTER FACILITIES



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## BROADBAND GAPS AND ISSUES (SWOT ANALYSIS)

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As outlined above, Stark County is predominantly served by AT&T, Time Warner Cable (now New Charter), and Massillon Cable TV (MCTV). While there are numerous providers in the market, the types of services and costs for services are highly disparate when compared with more densely populated urban areas or key metro markets such as Cleveland, Los Angeles, or New York. More so, due to major M&A activity in the US telecom industry, it is likely that most residents and businesses in Stark County only have a choice of a single provider when the FCC definition of broadband (25Mbps Down/3Mbps Up) is brought into the equation. To support this comment, AT&T currently advertises “up to” 6 Mbps DSL services in most areas of Canton, where comparably priced services in a major metro can approach 300 Mbps – 50x the speed for a minor increase in monthly cost.

### Lack of Feeder/Distribution Fiber Infrastructure

Through analysis of the available broadband infrastructure in Stark County and through discussions with regional service providers, Stark County is lacking in fiber feeder/distribution infrastructure which would deliver Fiber to the Premise (FTTP) services to commercial and residential properties. It is important to note that MCTV is deploying FTTP services to select areas of the County using a GPON platform. Fiber distribution technology such as Gigabit Passive Optical Networks (GPON) is used to deliver a lower cost fiber connection than is available in a dedicated fiber service offering. GPON is a fiber based alternative to deploying copper last-mile. While GPON systems still utilize the concept of shared capacity, the overall amount of bandwidth that can be delivered to any group of subscribers is much greater than legacy DSL and cable networks found throughout the County.

Small to medium business (less than 20 employees) contribute significantly to the County’s GDP, and these businesses are experiencing issues accessing the necessary services and bandwidth capabilities to support their operations. As the County and its communities begin to determine last-mile deployment options, FTTP technologies such as GPON should be evaluated as an offering for residential and the small to medium business market.

### Fiber Availability

While there are vast amounts of fiber infrastructure throughout Stark County, the direct use of the infrastructure by businesses and community anchors is limited. Fiber infrastructure is not typically installed by providers in advance of revenue opportunities, and therefore puts the County at risk when executing its economic development efforts. During stakeholder interviews, we learned of specific instances where companies had difficulty contracting for the required level of services to support their operation. Without additional fiber availability, the County will continue to experience issues when recruiting bandwidth intensive industries to the area.

In many cases, business looking to locate in Stark County could potentially face the need to spend significant amounts of money to build out the provider’s network infrastructure to receive service. Placing the County’s economic future in the hands of broadband providers can have a negative effect on the County’s recruiting efforts, and can become a major obstacle to closing these deals. Again, we heard direct quotes during stakeholder interviews where companies were quoted up to \$30,000 to connect to a dedicated fiber service.

The County and its communities have the ability to require broadband infrastructure to be constructed when other underground utilities are placed. Installing conduit when the ground is open for other purposes would save future trenching and labor costs. A “dig once” policy, as this is known, would allow the communities to take a proactive position on providing technology infrastructure in areas where it may be too cost prohibitive otherwise.

## CHAPTER 5: STARK COUNTY NEEDS ASSESSMENT

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A needs assessment is a process through which various areas of a situation are analyzed to determine gaps, deficiencies, or issues. In relation to broadband in Stark County, conducting this needs assessment required investigation of the areas of education, healthcare, public safety, business, and residential sectors of the marketplace to determine how high-speed broadband is currently being used, how it benefits these sectors, and the broadband needs of these sectors into the future. Magellan Advisors gathered this information through on-site interviews in Stark County with the Stark County Area Broadband Task Team (SCABBTT), examination of the results from the SCABBTT Broadband Survey, and consultant research activities.

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### EDUCATION

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Stark County encompasses 17 school districts, totaling 105 schools. Canton City School District is by far the largest in the County with 24 schools. Canton City School District was the only school district to participate in interviews with Magellan Advisors, and will be the major focus within this needs assessment. The Magellan team also had the opportunity to speak with the IT Director for the Stark Portage Area Computer Consortium, also known as SPARCC.

There are 9,600 students in the Canton City School District, grades K-12. Within the district, there is one high school, one early college high school, one alternative high school, seven Pre-K – 2 buildings, seven 3 – 5 buildings, five 6-8 buildings, and one K - 8 building. The Canton City School District employs 1,100 staff, 750 being instructional positions. The school district free and reduced lunch statistics show 80% of the students are enrolled in free and reduced lunch, which according to the district, translates to 100%. The digital divide is a real social issue for Canton City Schools, and Stark County as a whole. Students in Canton City Schools struggle with home-based Internet, although approximately 80% state that they can access the Internet “in some way” in their homes.

It is unclear to school officials whether these students are simply accessing the Internet through mobile devices, whereas mobile phone connectivity is not sufficient for connecting their iPads or devices for completion of school assignments. While the educators and administrators “try to be cognizant of what they ask students to do online,” the school district is serious about preparing their students for college and career, by way of preparation for the next generation of the workforce. It is necessary for students to have access to and experience with technological devices in order to be successful in almost any field upon graduation. Whether you work in McDonald’s or on Wall Street, it will be necessary for the student to be familiar with various technologies to be a productive member of society.

Canton City School District officials stated during meetings that grants, E-rate funding, and general fund dollars have been used to purchase and implement various technologies, ranging from iPads for one-to-one device programs for freshman, to wireless access points to ensure online testing is achieved effectively and efficiently. State and federal governments require that mandated testing is conducted online in K-12 education. If the school districts do not conduct online testing for the mandated tests, they can risk losing funding. In addition, the school district is following a growing trend of moving infrastructure to the Cloud. In this manner, the organization can save costs of hardware and management in order to reallocate funds to other technology.

FIGURE 21: STARK COUNTY SCHOOL DISTRICTS

School District	Street Address	Number of Schools
Alliance City School District	200 Glamorgan St., Alliance	7
Canton City School District	305 McKinley Ave., NW, Canton	24
Canton Local School District	4526 Ridge Ave. SE, Canton	3
Fairless Local School District	11885 Navarre Rd. SW, Navarre	3
Jackson Local School District	7602 Fulton Dr., Massillon	6
Lake Local School District	436 King Church Ave. SW, Uniontown	5
Louisville City School District	407 East Main St., Louisville	4
Marlington Local School District	10320 Moulin Ave., Alliance	6
Massillon City School District	930 17th St NE, Massillon	6
Minerva Local School District	406 East St., Minerva	3
North Canton City School District	525 7th St NE, North Canton	7
Northwest Local School District	2309 Locust St. S, Canal Fulton	4
Osnaburg Local School District	310 Browning Ct., East Canton	3
Perry Local School District	4201 13th Street SW, Massillon	9
Plain Local School District	901 44th Street NW, Canton	9
Sandy Valley Local School District	5362 State Route 183 NE, Magnolia	3
Tuslaw Local School District	1835 Manchester Ave NW, Massillon	3

Clearly, and understandably, the prevailing concern on the minds of school leaders is related to the State of Ohio 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.

***“Students in Stark struggle with Internet access at home. The digital divide is real here.”***  
*–Canton City School District*

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, TeacherTube, Vimeo, and Facebook.

As stated previously, the freshman class is being provided with iPads through a one-to-one device learning program. 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.

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

To provide some relief for households in the county without Internet access that have school age children, several libraries and schools specifically provide Wi-Fi to the outside areas around the facility, such as the parking lots, playgrounds and covered outdoor areas. This is a great service that the libraries and schools can provide the community that often goes unnoticed, and for the most part is free. The schools' and libraries' Internet services and supporting components are dormant after hours for the most part – providing Wi-Fi access after-hours is an excellent way to use this unused capacity for the benefit of the surrounding communities.

Most school districts, with the exception of Canton, connect into the Stark Portage Area Computer Consortium (SPARCC) for Internet connectivity. SPARCC contracts for a 5Gb Internet circuit through OarNet, which is then used to provide Internet services to the districts themselves. SPARCC manages circuits that connect each district and in many cases provides the necessary supporting infrastructure for WAN and Internet connectivity. SPARCC provided data that documented the connectivity currently in place today. They report that TWC provides connectivity for approximately 60% of schools, followed by MCTV at 20%, and 20% are connected by district owned fiber.

In discussions with the SPARCC IT Director, we learned that SPARCC had previously commissioned a study to develop a plan to build and connect all school sites to a district owned fiber-optic network, but at that time, the cost was determined to be too much to take on. SPARCC pays approximately \$250,000 annually - before E-Rate - to interconnect the 100+ school sites on its network.

#### STARK COUNTY SCHOOLS E-RATE

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. The Education Networks of America (ENA) maintains the E-Rate contract for the school districts through 2017.

The E-Rate subsidies for Stark County Schools vary greatly depending on the school district in question. A complete E-rate listing of requests and discounts is provided in the Appendix under a separate cover. School districts receive discounts on Internet access based on their free and reduced lunch statistics. For instance, in a school district such as Canton City School District, for a free and reduced lunch statistic of 90%, the federal government would help fund 90% of the school district's Internet connectivity costs and 50% of its voice systems costs. The school district must pay the remaining 10% and 50%, respectively, through its own internal cost allocation. It is important to note that traditional voice services are being phased out and will no longer be supported through the program over the next couple years – this is following suit with the migration to IP based services.

TABLE 9: STARK COUNTY SCHOOL DISTRICTS E-RATE FUNDING & DISCOUNTS

School District	2015 E-Rate Request	2015 E-Rate Commitment	Telecom/Internet Discount
Alliance City	\$146,006.31	\$140,427.81	90%
Canton City	\$456,844.40	\$456,196.51	90%
Canton Local	\$94,188.07	\$92,223.05	80%
Fairless Local	\$119,886.23	\$118,437.49	70%
Jackson Local	\$180,708.08	\$124,474.61	40%
Lake Local	\$224,113.46	\$151,624.22	40%
Louisville City	\$110,109.22	\$110,109.22	60%
Marlington	\$55,590.15	\$57,846.88	70%
Massillion City	\$77,590.76	\$77,475.56	80%
Minerva Local	\$60,376.47	\$20,931.50	70%
North Canton City	\$67,738.33	\$67,738.33	50%
Northwest Local	\$15,975.72	\$15,975.72	60%
Osnaburg Local	\$15,266.09	\$15,266.09	60%
Perry	No E-rate filing	No E-rate filing	NA
Plain Local	\$87,006.32	\$81,675.89	60%
Sandy Valley	\$25,776.33	\$25,776.33	80%
Tuslaw Local	\$17,036.37	\$17,036.37	60%
<b>Total County Funding</b>	<b>\$1,754,212.32</b>	<b>\$1,573,215.58</b>	

Clearly, the current E-Rate program offers a significant amount of money to Stark County schools annually. E-rate has the ability to benefit any Stark area broadband program including construction and implementation of the Stark Community Broadband Network. Any organization that is formed to own, operate, and maintain the SCBN has the ability to become an approved E-rate service provider by applying for and receiving a Service Provider Identification Number (SPIN). This will allow the federal E-rate subsidy dollars to be collected and utilized to provide fiber based services to the local schools. For 2015, the total funding requested was over \$1.75 million, and over \$1.5 million was committed by USAC for Stark County schools. The SCBA should position itself to maximize the potential funds that could be applied locally through the E-Rate program.

## STARK AREA LIBRARY SYSTEMS

Many residents use libraries for more than checking out books. Libraries are hubs for research, computer usage, learning, and community events. If people do not have Internet access in their home, many will seek out their local library to log on, conduct research, send emails, apply for or attend college, and to conduct job searches. These community anchor institutions are vital the low socio-economic population in staying connected and employed.



There are seven separate library systems in Stark County.

- Stark County District Library
- North Canton Public Library
- Massillon Public Library
- Rodman Public Library
- Canal Fulton Public Library
- Minerva Public Library
- Louisville Public Library

**The Stark District Library** system is the largest system in the County, with 10 physical locations, which services a population of 240,000 residents. In addition, the library has six mobile units with wireless capabilities. The library system states that they have 1.4 million visitors per year, 800,000 visits to the virtual library, and 260,000 annual sessions in the computing center. All libraries have Internet access and WiFi, including outside areas of the building allowing residents to access the WiFi after hours, if needed. This outside WiFi can be an important tool for students at local schools to utilize after the library is closed. As stated previously, the digital divide is real in Stark County, and options for students to access WiFi to conduct research or complete assignments on devices outside of school helps to bridge that divide. The library has 50 MiFi hot spots on hand for check out. MiFi devices are devices the size of a cell phone that can be used to bring Internet into a home and create a hot spot for the home's devices. Many can connect up to 10 devices at one time, so a student can conduct research while his/her mother searches for a job or reads the news. While 65% of Stark County residents have smart phones a large percentage may not have WiFi in the home, which is problematic for data usage through the cell phone carrier. The MiFi hotspots can provide needed WiFi in the home to assist in minimizing data overages.

**The North Canton Library** consists of one physical location. This system is primarily driven by school district initiatives and the Ohio Public Library Information Network (OPLIN). Funding for the library system comes from grants, E-rate, and the state. A representative from the North Canton Library reported that their network is serviced by AT&T. The computing centers within the libraries are bustling, 1,600- 1,800 people utilize the computer services daily with an additional 10,000 log-ins to their wireless network. They also see a demand for their printing services, they have 10 stations that are in use approximately 50% of the time the library is open for business. In addition to printing, the library also offers free faxing services. North Canton Library stated during interviews that "remote workers are a big part of the future workforce." The library system supports this growing population of remote workers with machines, wireless Internet, printing, and faxing.

**The Massillon Library** system has three physical locations, which services a population of 33,407 residents. In addition the library has one mobile unit. The library has 319,436 visitors per year and 27,976 annual computer sessions. All libraries have Internet access and WiFi.

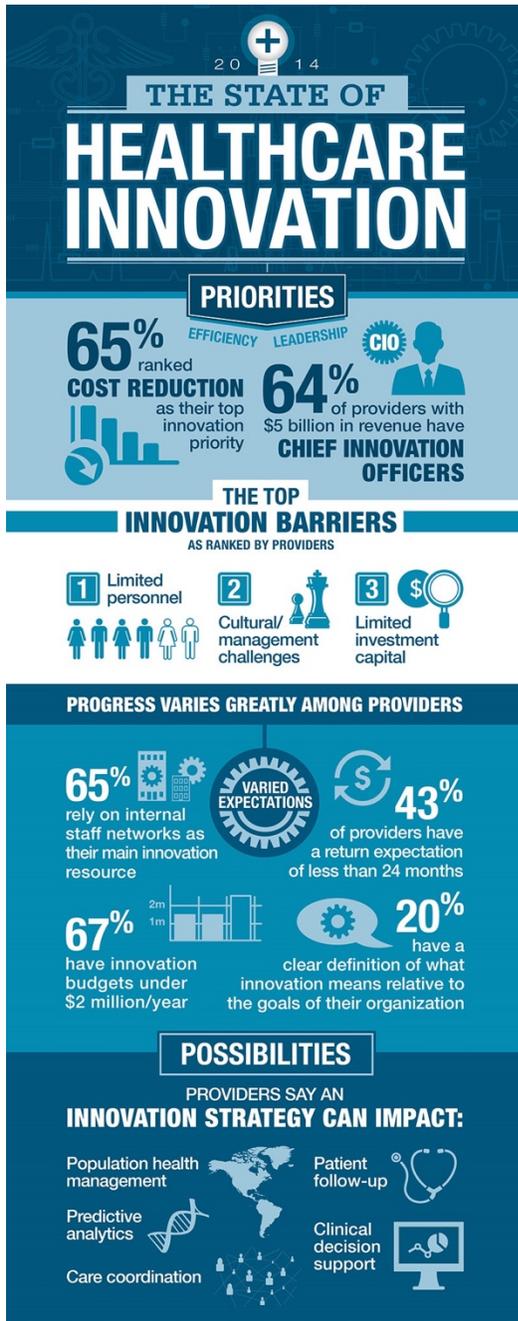
**The Rodman Library** system has two physical locations, which services a population of 37,478 residents. In addition the library has one mobile unit. The library has 250,536 visitors per year and 36,036 annual computer sessions. All libraries have Internet access and WiFi.

**The Canal Fulton Library** system has one physical location, which services a population of 13,248 residents. The library has 94,224 visitors per year and 7,904 annual computer sessions. The library has Internet access and WiFi. Throughout the years the library received national attention for its diverse services and cutting edge collection that features items not usually found in other libraries. The library was an early adopter of both computer and video services years before they became mainstream in public libraries. Continuing that leading edge collection and service philosophy, the library has recently added e-readers, tablets, and zinio, a service that provides e-magazines to its circulating collection. The library continues to have strong community support and strong leadership that have allowed it to grow and become an integral part of historic Canal Fulton.

**The Minerva Library** system has one physical location, which services a population of 12,055 residents. The library has 98,228 visitors per year and 14,404 annual computer sessions. The library has Internet access and WiFi.

**The Louisville Library** system has one physical location, which services a population of 18,769 residents. The library has 124,644 visitors per year and 7,800 annual computer sessions. The library has Internet access and WiFi. The past four decades have brought many changes to the Louisville Public Library, including the addition of DVDs, CDs, national newspapers, magazines, audiobooks, eBooks, and other digital services. The library also has computers for public use, free WiFi, and even conducts computer training through the Connect Ohio Project.

HEALTHCARE<sup>81</sup>



Broadband is expected to transform healthcare, simultaneously enabling better outcomes and lowering costs, both on the internal operations of the 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 \$700 billion over 15-25 years.<sup>82</sup>

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 AMA created guiding principles for ensuring the appropriate coverage of telehealth services that state:<sup>83</sup>

- 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 example, in the Stark County service area, Aultman Hospital is adopting a “Population Health” strategy that will center around the use of patient data to help anticipate and minimize future health issues. Population Health is a sea change in how hospitals currently interact with their communities, with an emphasis on proactively engaging patients and helping them arrive at the best outcome for their future, chronic or acute conditions. For this strategy to be successful, patient data and health metrics need to seamlessly and effortlessly flow from patient, to physician, to diagnostician across a constellation of facilities both local and regional.

<sup>81</sup> Avia. 2014.

<sup>82</sup> <http://www.broadband.gov/issues/healthcare.html>

<sup>83</sup> <https://download.ama-assn.org/resources/doc/hod/x-pub/a14-cms-report-7.pdf>

Aultman’s Population Health strategy is an additional dimension to telehealth. Rather than just facilitating communication and messaging between patient and provider, this in its realized form, will harness big data to mine best outcomes for patients as they transition through life.

Aultman Hospital anticipates an array of benefits from the Population Health strategy 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



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.

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.

While Aultman currently contracts with traditional telecommunications providers for Internet and wide-area network connections, it also is seeing huge increases in the amount of bandwidth required to support the organization. Aultman has played a leadership role in the SCABBTT discussion for the last several years and believes community ownership in potential network assets could prove very useful for Aultman, its services and the community it serves.

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**THE EMERGING MISSION OF HEALTHCARE, “IS NOT JUST ABOUT HEALTH, BUT ABOUT ALL THE DIMENSIONS OF WELLNESS.” – DR. SUPPEN**

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Canton Mercy Hospital, owned by Sisters of Charity, is a growing healthcare organization that includes 240 staffed beds, five urgent care centers, and 11 off-site physician offices. All physician offices are connected to the hospital, typically at 10 Mbps through Time Warner. The healthcare system also utilizes AT&T, Massillon Cable, and LightSpeed Technologies. The representative from Canton Mercy states that they will be receiving Internet through Everstream in the future.

Canton Mercy states that only six percent of their population currently uses the functions on their online portal, with the greatest number of log-ins occurring with post-birth FAQs. However, telemedicine and electronic medical record keeping is the “next big thing” affecting their industry. Currently, they have a partnership with an outsourced company for homecare technologies. Telemedicine will continue to be of great interest to the healthcare system.

In summary, the rise of the Internet of Things, telemedicine, electronic medical records, and health information technology will continue to have significant effects for the field of healthcare. These organizations will continue to require more and more bandwidth connected within and between their facilities, as well as within their patients' homes - bandwidth that can only be accomplished by and "future-proofed" through fiber-optic broadband technologies.

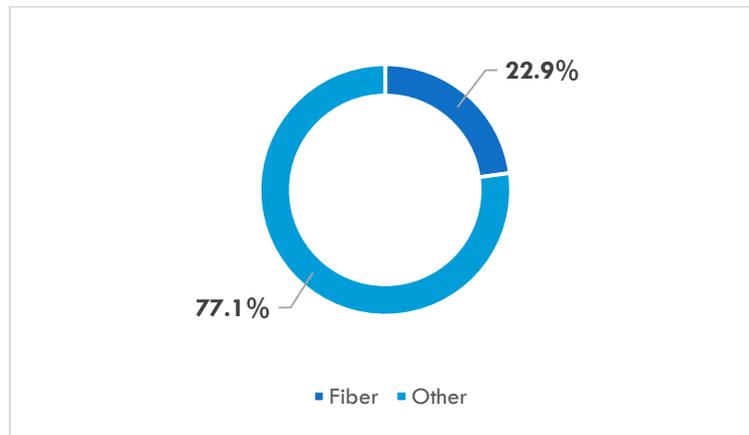
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## ECONOMIC DEVELOPMENT

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Stark County must compete daily for companies looking for areas to locate, and next-generation broadband services are becoming a very important part of the equation. Communities that do not have readily available, affordable Internet will not be successful in attracting new industry. In Stark County's case, the lack of available, affordable broadband is pushing startups to nearby communities such as Akron. In one case, we interviewed a local company, founded by a third-generation Stark County resident, who started his company in Akron at the tech incubator where high-speed Internet is readily available. The gentlemen commented "I wanted to open my business in Stark, I'm from Stark – I live in Stark, but, I was unable to find an affordable fiber offering." This point is at the root of the issue in Stark County. Tremendous amounts of fiber capacity runs through Stark County mostly aerially and others buried along certain railroad rights of way. Within the communities, the incumbent providers will state "fiber is readily available to anyone that wants it"; however, the question should be at what cost. There is little doubt that enterprise businesses, and community anchors have fiber service at prices the market will bear. In Stark County, 95% of businesses are classified as small to medium having less than 20 employees. The business surveys depict a vast disparity between the businesses that claim to have fiber service vs. those that do not. See Figure 22 below:

FIGURE 22: FIBER VS OTHER SERVICES



This disparity represents the lack of access to affordable fiber based services – services both incumbents are making available in other markets across the US.

In other markets, like the large NFL cities, greater return of investment is provided to the national carriers. This return on investment incentivizes providers to build high-speed networks. Stark County upgrades are likely coming, but when and in what increments? Without more control the community will continue to be held hostage, allowing a foreign entity to determine the County's future.

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## GOVERNMENT

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Fiber-optic networks provide a public infrastructure that can be used for an assortment of public benefits, including enhanced municipal utilities and improved collaboration and infrastructure sharing programs, as well as improved public safety and first response. When local government and public service organizations use broadband, the fiber then provides a platform for long-term adoption and what's known as "smart community" innovation.

Smart communities use technology and data and communication in every way possible to do things better, whether to save money and time, to better allocate resources and staff, or to offer more convenience and quality of life public services. Instead of a smart home that manages lighting and sprinkler systems around the house, a smart community might cut energy consumption through better street lighting, or better manage the flow of rush hour traffic, or allow recycle bins to decide when it's time to be emptied.

As we look to the future, local governments and public sector organizations must operate as a business, and strive to work smarter through technology. Each department and its staff should be able to access information and have a process to do their jobs as efficiently as possible. Technology today is capable of sending and receiving bandwidth-intensive information, and can help all local departments share workflow documents, detailed maps and blueprints, high resolution photographs and other documents and forms of unified communications. A willingness to improve established process is usually the first barrier to overcome.

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## STARK COUNTY GOVERNMENT

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On the minds of most local government leaders is the positive impact that broadband can have on quality of life aspects. For all residents to have access to affordable broadband would alleviate many issues of communications of public policies or passing along frequently asked questions. So many times people call on the phone or stand in line for an office in the courthouse to ask a question, or to pay a bill, or to request forms or information that could have otherwise been accomplished across the Internet. This is an inconvenience for residents and causes additional work for staff.

Broadband use and applications being used in local government appears limited to task specific operations. Outside of email and traditional office software, most departmental computers and staff work with state or federal agency reporting and filing software. With no overall county-level broadband provider contracts, government departments have autonomy to select the service provider that will perform best for their needs.

Magellan Advisors had the opportunity to meet with representatives from Massillon, Canton, and the Stark County Auditor's office. Massillon states that MCTV, the home town provider, has a hold on the market. MCTV is an established organization of 50 years and seems to meet the needs of the city and the residents. MCTV builds infrastructure to support the needs of the City of Massillon; however, there is a lack of competition in the city enabling a monopolistic broadband Internet environment for their residents.

The City of Canton consists of 17 locations, including fire stations, and several locations are campus style facilities. The city has 42 departments, 32 of which are under the city manager or mayor's office. The City of Canton Council is comprised of 13 members, three at large, and one council president. When Magellan Advisors inquired about broadband friendly policies, specifically dig once policies, the city affirmed that they do not currently have any initiatives in place. The city has 800 employees, 100-150 of those employees are part-time status. The representatives from the City of Canton advised that their provider is AT&T and their monthly expense to AT&T is \$6,500 per month.

The Stark County Auditor’s office provided that the County has 16 sites, seven of which are connected via County fiber. Currently, AT&T is the primary ASE provider for Internet and transport. AT&T connects remote facilities back to the data center with 10 Mbps, 100 Mbps, and 1 Gbps connections. Stark County utilizes space at the Secure Data 365 Data Center, costing the county \$1,100 per month for the rack space and additional costs for power. The voice systems have 132 channels and run using IP Flex. The County fiber utilizes (2) 4” conduits with 4 inner ducts, which is the County’s standard. While they have never been approached for dark fiber or conduit leasing, the representatives state that they have a “handshake” agreement with the City of Canton to enter into a partnership for dark fiber and conduit. Like Canton, Stark County does not currently have broadband friendly policies, such as a dig once policy.

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## PUBLIC SAFETY

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### POLICE AND FIRE DEPARTMENTS

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Regardless of what community broadband model chosen, these fiber optic lines are, indeed, critical infrastructure. Their significance grows commensurate with

*“Connectivity is a major issue for Public Safety.”  
– Jackson Township*

technological advance mentioned throughout all sectors of our lives. Given emergency response our communities have come to expect from our first responders, healthcare providers, transportation and utility crews in times of cold weather extremes and worse, natural disasters such as hurricanes Sandy and Katrina, and to a lesser extent tornados and even earthquakes, these fiber networks significance and demands for service will only increase.

Jackson Township officials provided feedback and information regarding the state of broadband affecting police and fire departments throughout the Stark County area. At this point in time all departments handle their own connectivity and purchasing needs, without cost sharing or benefits of economies of scale. Throughout the Stark County area there are 22 police departments, 33 fire departments, and five major dispatch centers in operation. Canton Police Department is the largest in size, with Stark County being the second largest. A 911 regionalized broadband committee has been established in the County and their focus is on mobile wireless.

911 Dispatch Centers and PSAP’s are vital communication networks necessary to alert, communicate and provide situational awareness to our first responders including police, fire and paramedics. These networks also form the means for receiving their constituents’ emergency calls for service including future NG911 (next generation) 911 calls initiated via text and including geo-location and other situational awareness information. FCC Chairman Wheeler recently read from a prepared statement, “Industry and many states, counties, and cities are working hard to address transition risk and achieve NG911 capabilities. Nearly 20% of counties now support text-to-911. Many jurisdictions are building out their Emergency Services IP Networks – the basic backbone for NG911 in their communities. But these islands of progress are the exception, not the rule. Unless we find a way to help the nation’s PSAPs overcome the funding, planning, and operational challenges they face as commercial communications networks evolve, NG911 will remain beyond the reach for much of the nation. Let me be clear on this point: 911 service quality will not stay where it is today, it will degrade if we don’t invest in NG911.”<sup>84</sup>

It’s obvious we can ill afford a repeat of Stark County’s past experience with any backhaul network 911 outage issues. A community broadband network routed through a local carrier hotel, such as Secure Data 365, would greatly enhance our viability, redundancy and ability to handle the demands of data, voice or video as well as future NG911 demands tomorrow and far into the future.

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<sup>84</sup> Wheeler on Hill: Next-Gen 911 & Cybersecurity Are Priorities

Jackson Township reports that connectivity is a major issue in their township, specifically, redundancy is needed as they currently experience six outages per day resulting in lost time, lost service, incomplete information in reporting, and an unnecessary dependency on their dispatch department. Further, due to the slow network, their GIS systems become extremely problematic resulting in service issues. The wireless connectivity, provided by Verizon Air Cards, is not reliable. The 22 cruisers in Jackson Township utilize MiFi devices and the network becomes exceptionally bogged down and Air Cards become ineffective during large events such as the Hall of Fame events, festivals, or carnivals. These inefficiencies become a public safety concern for the departments.

Fire and police have some exposure to technology to assist with the reporting, administrative, and "paperwork" side of their work as all departments currently utilize iPads for communication and documentation. Although, challenges have been realized as CAD programs do not run on iPads. In-vehicle cameras are currently installed and used, and many departments are implementing body cameras as well. License plate recognition (LPR) is used sparingly throughout the County, but Jackson Township reports that there are a few units deployed there. Through a fiber-based network these devices along with gunshot sensors and cameras could become more commonplace. The City of Canton already has cameras deployed in "tough areas" of the city with gunshot capability. Jackson Township maintains that some of the cameras in Canton are temporary while the rest are permanent allowing for some flexibility of transport, when necessary.

As stated previously, departments make their own decisions regarding technology and do not have the same carriers for Internet or mobile wireless. Jackson Township believes that there is a sincere need for a county-wide secure WiFi network. Verizon is the wireless carrier and MCTV provides Internet for the police department in Jackson Township, while AT&T provides DSL service for the Canton Municipal Court. Fire stations use MCTV and Time Warner, however Jackson Township states that they have not been satisfied with Time Warner's services. The Canton Municipal Court inquired about fiber from AT&T, but deployment was cost prohibitive. The Criminal Justice Information System (CJIS) recommends a common platform for all departments and believes that Ohio's position on adopting FirstNet should be assessed. FirstNet was signed into law in 2012 and is working to "build, operate and maintain the first high-speed, nationwide wireless broadband network dedicated to public safety."<sup>85</sup> This network will increase the ability of different public safety departments to communicate and transfer information, especially important during hectic, dangerous, and complicated situations.

Fiber connectivity is used to connect the Multi-Agency Radio Communication System (MARCS) towers throughout the region, and there are 18 towers currently connected. Jackson Township states that they had opportunities to install some fiber for themselves in abandoned conduit and would like to build more. VPN service is used in many departments for Amazon Web Services, providing virtual server technology and a hosting environment on a subscription basis. This aids the departments in saving on hardware and management expenses.

Connectivity for telemedicine is a difficulty for paramedics. They need connectivity to the hospitals to transmit electronic medical records and data regarding patients, such as transmittal of vitals from first responders to the hospital or physician. The first responders also feel that distance learning systems would be helpful; however, these have not been deployed in the past.

The CJIS has great connectivity needs now and moving forward into the future. CJIS has 1,800 users per day and their storage is in the Amazon Cloud. Their system monitors the jail, manages data, and the LPR systems. Moving forward, needs for at home monitoring will increase greatly. The jails in the area are over-crowded and the justice system is needing to use home arrest more frequently. At this point, they use the inmate's home phone service

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<sup>85</sup> [www.firstnet.gov](http://www.firstnet.gov)

for the monitoring; however, an Internet based network could be beneficial. Additionally, a Uniform Traffic Ticket program is coming soon which may add more data to their system as well.

In summary, a fiber infrastructure for the first responders of the County would provide a foundation for future applications of technology. The sentiment from departmental staff is anything that will keep responders in the field and ready to respond instead of dealing with the paperwork and communications inefficiencies encountered today is a welcome improvement. In addition, more collaboration and bulk purchasing agreements should be explored.

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## BUSINESS

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Businesses in the communities of the Stark County service area compete in a state and region heavily entrenched in the commercial retail, transportation, agriculture, manufacturing, and tourism industries. The area does not compete with other theme parks and outlet malls, but rather pursues sport special interest sightseers due to the HoF and athletic events held at their stadium and the adjacent facilities. The area surrounding the HoF comprises a condensed area of restaurants and accommodations, far greater than any other portion of the County.

Just as the Stark County service area communities rely on the state highways and the Interstates and other public infrastructure to drive the economy by bringing in visitors and shipping out manufactured goods, broadband that is accessible, affordable, and reliable is an important economic driver. However, through several examples that are provided in the section, the bandwidth demanded by local businesses today outpaces the service levels that commercial Internet service providers are willing to deliver to the community. To attract, retain, and grow technology and data-driven businesses in the area, communities will require a competitive edge that fiber can provide.

Through on-site interviews and focus groups, Magellan Advisors was able to learn more about the needs of businesses in the Stark County area. Some major participants were TimkenSteel, Squirrels, Brewster Cheese, Huntington Bank, Seifert Technologies, a number of the local Chambers of Commerce, along with SMB focus groups. These organizations supported the survey results, discussed later, that a majority of the companies and organizations in the area are SMB businesses. The North Canton group of interviewed businesses attested that “there are no longer any cluster industries in the area and it will be important to build infrastructure to invite new businesses to the area and support their growth.” Canton recently lost a good company due to a lack of bandwidth to support their organization. These community members provided a wealth of anecdotal information that is worthy of attention by the community at large and organizations involved in strategic planning for the SCBN.

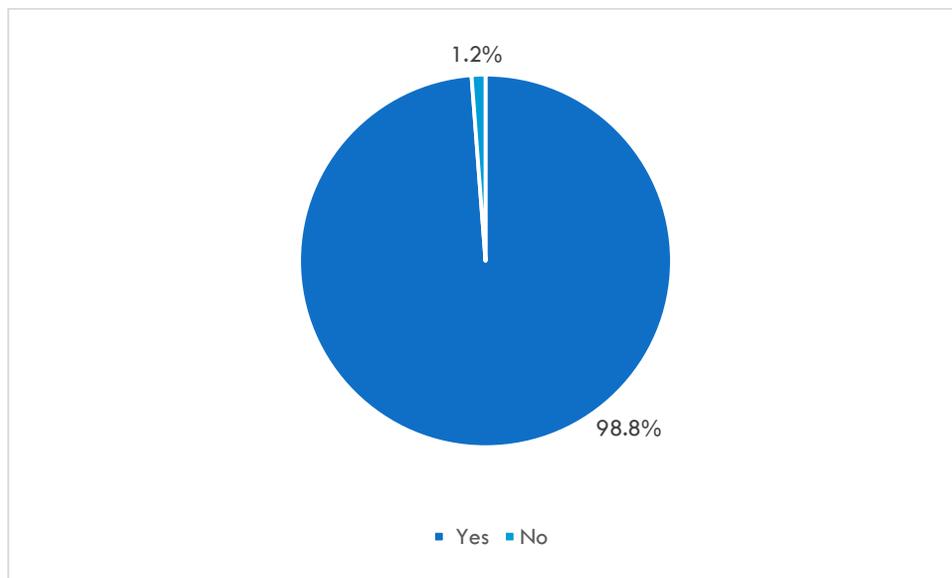
As demonstrated through the market analysis, AT&T is the dominant provider for businesses in the Stark County area. The interviews and focus groups sustained this, as organizations in the focus groups stated AT&T is widely used and TimkenSteel uses AT&T MPLS with bonded T-1 service. However, Seifert Technologies stated that AT&T’s services were not effective for the organization and they have used MCTV with great success. While many are concerned with “the monopolistic environment MCTV operates within,” companies also stated that the services met their needs, although the prices are “quite expensive.” Squirrels, an educational software developer with a staff of 35, uses Everstream for fiber connectivity that provides 100 Mbps with bursts to 1 Gbps. In the past, Squirrels contracted with Time Warner; however, the reliability was not adequate for their organization. Although, Time Warner is also used by other SMBs in the Stark County area, and a business owner stated that they have been happy with their service. While many organizations felt satisfied with services, there is a definitive lack of competition in the area to increase speed and reduce price.

Local Chambers of Commerce, SMBs, along with TimkenSteel, were concerned with bandwidth needs when contemplating converting to cloud based computing, storage, and management. SMB businesses stated that the cloud and network speed are out of sync in terms of speed and cloud utilization. Huntington Bank, one of the

largest small business lenders in the area, stated that online access seems to fail or slow down regularly. These slow network speeds, averaging 14 Mbps in Canton, may not be conducive of supporting cloud computing and future needs of businesses in the Stark County service area. TimkenSteel stated that cloud issues will drive capacity needs and options for solutions. These solutions will be best met through fiber based broadband, future-proofing the Stark area for businesses to develop, grow, and succeed.

To gather a better understanding of broadband related issues faced by businesses in Stark County, a business survey was conducted that included questions related to broadband access and its use in the operation of 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 businesses that completed either the printed or online version of the survey, 98.8% subscribe to Internet services at their business.

FIGURE 23: "DOES YOUR BUSINESS SUBSCRIBE TO INTERNET SERVICES?"



From a business recruitment standpoint, broadband can be a true competitive differentiator for Stark County communities. Through promotion of the community's fiber-optic broadband services, prospective businesses can be assured that they could locate in the Stark region and have robust access to the Internet and 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 expectation for attracting and retaining desirable businesses and facilities.

However, when broadband services cannot fulfill business needs, businesses lose productivity and efficiency, which together affects their bottom line and makes them less competitive as compared with businesses in communities that have more widely deployed and affordable broadband services. Over the long term, 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.

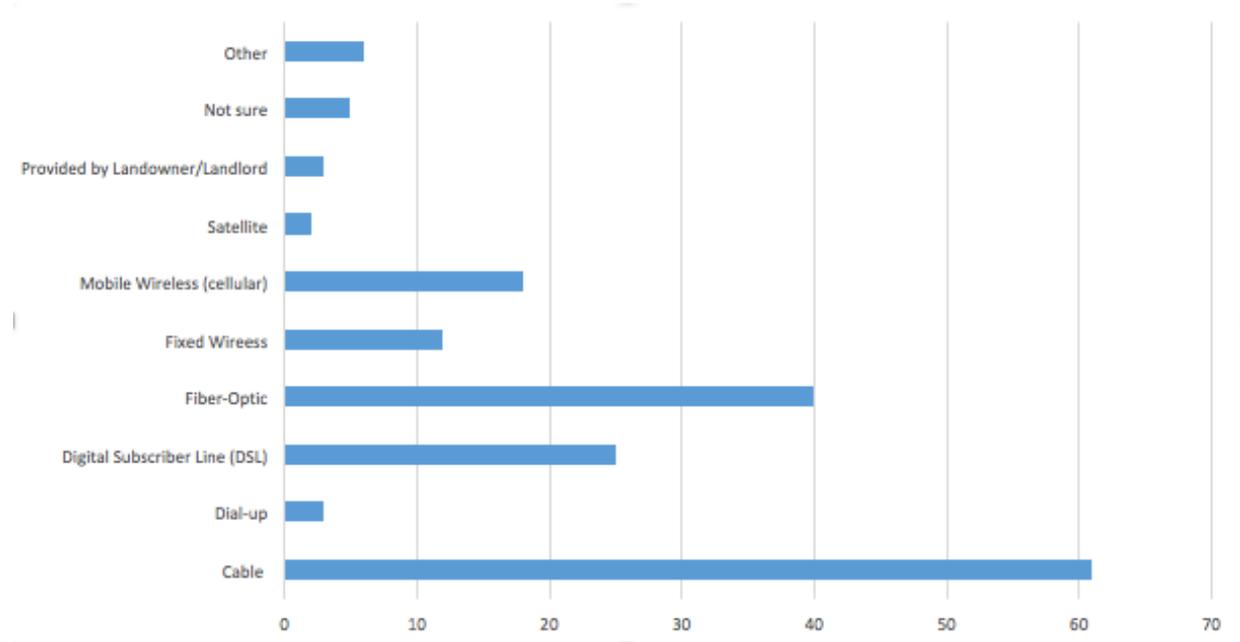
## STARK COUNTY SURVEY RESULTS

As part of the research performed for this broadband assessment, a survey of Stark County area businesses was conducted to understand the business community’s broadband uses and needs. The responses were a representative sample of businesses in the Stark County service area with 168 local businesses responding to the online survey. The survey data provides a snapshot of how broadband is shaping the way small businesses operate in Stark County.

The business market in the Stark service area is predominately made up of small- and medium-sized businesses, with many in the manufacturing, healthcare, and professional services sector. A majority of survey respondents were small businesses (38%) with 10 or fewer employees, while 32% were businesses with over 50 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 the Stark County communities.

As seen in Figure 24, the majority of Stark County service area businesses (46.2%) subscribe to Internet services via cable, with DSL accounting for less than half of cable at 18.9%. Approximately 30% of Stark County businesses connect to the Internet via fiber, which likely serves larger employers or businesses that are part of larger national or international companies requiring high-speed service.

FIGURE 24: HOW STARK SERVICE AREA BUSINESSES CONNECT TO THE INTERNET



Making up the remaining 23% of Stark County businesses include wireless types of connectivity, including mobile and fixed wireless, and satellite. These types of connectivity are perhaps a reflection of the geographic terrain and rural nature of the Stark service area where more traditional broadband providers have limited physical infrastructure.

All over the county and the world, fiber Internet access is now recognized as a fundamental infrastructure that businesses require. In fact, the data from this survey suggests that to support large employers, fiber is the best possible solution. The lack of fiber infrastructure can be a major competitive obstacle to growing businesses and closing site selection opportunities.

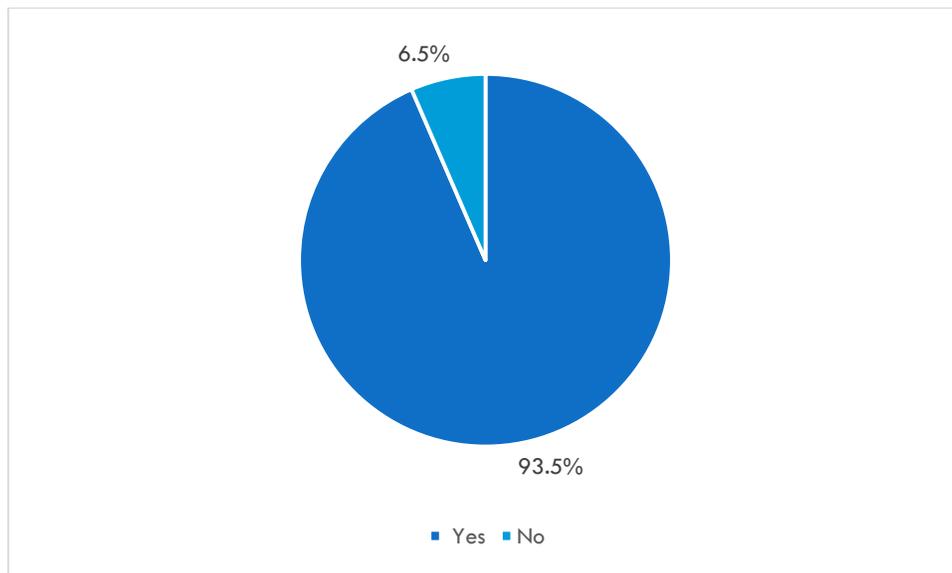
Many of the small businesses surveyed that are settling with the connectivity they have available to them could be stifling their business efficiency, growth and innovation opportunities. With fiber, a community can incubate home-grown businesses, grow small businesses into large employers, and be a magnet for relocating or expanding employers and entrepreneurs. During SMB focus groups, a business owner stated that he lives in Stark County but operates his business in Summit, utilizing a business incubator that is providing his company with 100 Mbps down.

Therefore, it is critical that community leaders are able to promote the availability and affordability of fiber-optic broadband in all business and industry recruitment efforts just as it promotes the access to transportation corridors or the availability and affordability of water and electric utilities.

To gauge the perception of the importance of broadband infrastructure from Stark County businesses, the question was asked if broadband is considered a utility. As seen in

Figure 25, businesses overwhelmingly (93.5%) consider broadband to be the “fourth utility,” on par with electricity, water and sewer, as something that should be universally available and affordable.

FIGURE 25: “DO YOU CONSIDER BROADBAND TO BE A UTILITY?”



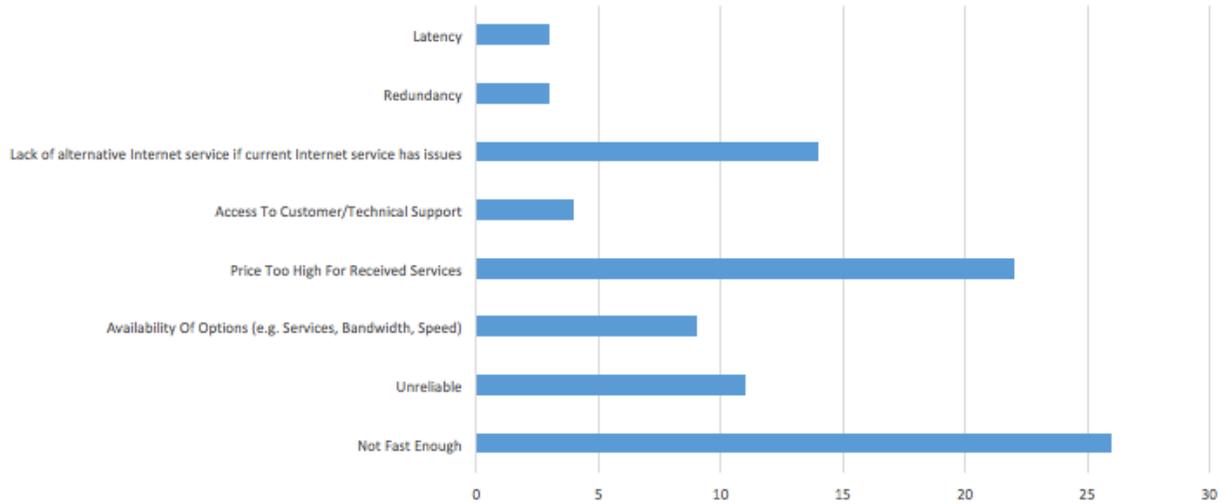
As seen with the above findings, broadband is considered a fundamental infrastructure that businesses require to maintain connectedness to the world, its customers, and its employees. For businesses to recognize broadband as a public infrastructure as other traditional utilities mean that businesses are perhaps more open and receptive to a local provider or government offering telecommunications services.

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 Stark County and their partner communities expand and promote the availability of affordable and reliable broadband services, especially to support business and industry recruitment efforts.

Of course, 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 Stark communities.

In thinking of Internet services that are capable of supporting local business, when asked if their provider was meeting their needs only 61% of all responding businesses reported that current Internet services are fulfilling their business needs, while 22% of businesses that believed that their current provider is not meeting their business needs. As we’ve seen elsewhere, wireless forms of connectivity represent the lowest ratings, with mobile wireless and satellite scoring almost identically low ratings.

FIGURE 26: IN WHAT WAY IS YOUR INTERNET INSUFFICIENT?



Because of the array of connection types subscribed to by Stark County 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 Stark area businesses. Of the businesses that said their Internet provider is not fulfilling their business needs, the top response at 70.3% was that the speed was “not fast enough,” with 59.5% saying their “price was too high,” while 37.8% said that there is a “lack of alternative Internet service if current Internet service has issues.”

FIGURE 27: SATISFACTION WITH CURRENT INTERNET SERVICES AMONG STARK SERVICE AREA BUSINESSES

	Not Satisfied ----- Completely Satisfied					Trend
	Poor	Fair	Good	Very Good	Excellent	
Internet Services Only	8.60%	22.58%	25.81%	29.03%	13.98%	
Other Products/Services	6.10%	20.73%	40.24%	20.73%	12.20%	
Customer/Technical Support	8.79%	29.67%	26.37%	23.08%	12.09%	
Price	16.67%	38.89%	25.56%	13.33%	5.56%	
Reliability	8.60%	20.43%	30.11%	26.88%	13.98%	
Speed	21.74%	17.39%	31.52%	17.39%	11.96%	

Figure 27 shows that most businesses are generally satisfied with their services, in fact some of the most positive business survey results were from this question, and important patterns emerge. First, echoing earlier findings, price and speed stand out as areas of least satisfaction as businesses report higher levels of dissatisfaction in those areas, with very few responses in the “completely satisfied” side of each category.

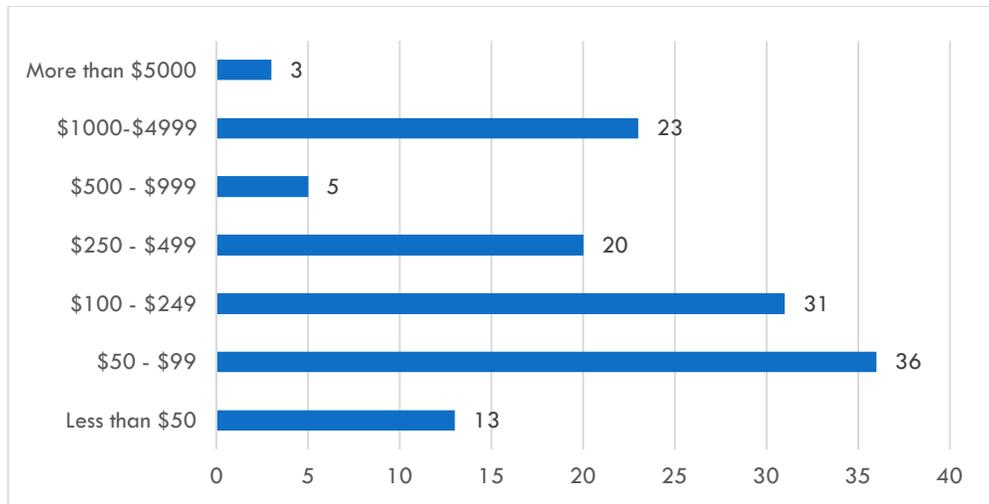
Internet Services Only, Customer/Technical Support, and Reliability show the healthiest trend among the six categories. What one looks for in a healthy trend line is a bell shaped curve, and ideally a bell shape with a higher right side than left side, which would indicate relatively higher levels of satisfaction. Of the six categories measured, Internet Services Only has the most ideal trend line, while better than expected responses on the satisfied side support relatively decent levels of satisfaction across all categories. Customer/Technical Support (39%), Price (55%), and Speed (39%) both indicate low levels of satisfaction by observing the trend line and percentage of poor and fair responses.

If there is any other information from this question, it would be the fact that of the 93 responses to this question, and out of the 558 individual opportunities to respond “completely satisfied” to one of the categories in this question, only 63 times was “completely satisfied” selected across any of the six aspects of Internet satisfaction. Service providers in the Stark service area are not overwhelming their customers by going the extra mile, but seem to be doing a fine job of meeting tempered expectations.

When asked why their business hasn’t upgraded Internet services to greater speeds and service levels, 45.9% said that “price for needed services too high or not competitive.” The second and third most responses were that they “don’t know who else can provide service in my area” (43.2%), and that “needed services are not available” (29.7%) in their area. The three responses speak directly to the heart of the broadband issues in the Stark service area, price and competition. 29.51% of businesses pay between \$50 and \$99 per month, with the second most common price range at \$100 to \$249 per month, which is paid by 25.41% of Stark County 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 satellite, mobile wireless, and fiber services. All told, 40% of Stark businesses pay under \$100 per month, while 42% of businesses pay over \$250 per month. Many are paying

several thousands of dollars per month, and could likely realize significant savings if a more competitive environment were present.

FIGURE 28: STARK COUNTY MONTHLY INTERNET COST



Striving to learn more about the needs of Stark County businesses, during interviews with several business owners 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 Stark service area 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. One business respondent offered that “their affected times are completely random, but very often. Every day we experience a lag at various times and at least three times a week we completely lose Internet service, to the point we cannot even process credit card sales.” This person went on to explain that they contact their provider weekly, but the service continues to have issues.

Regardless of business size, it is becoming more evident that businesses need a fiber-based broadband service, yet are hampered by the legacy wireless and copper connections currently offered by commercial service providers in the Stark County service area. While some fiber is being used in the area, there is a definitive lack of competition driving up prices and causing issues with availability and affordability.

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

The lack of service provider competition limits the improvement of services throughout the Stark 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 connection directly to an individual business that requests the advanced services, but the cost is clearly prohibitive to all but the largest businesses and employers.

As stated elsewhere, broadband is a fundamental utility that these types of businesses require to maintain their daily operations and ensure their competitiveness.

Therefore, it is critical that the Stark County community leaders promote the availability and affordability of broadband services in industrial recruitment and retention efforts as they execute their economic and workforce development strategies.

To the point of business attraction and retention, the survey asked businesses, “if contemplating whether to relocate to an area or expand your current business, how important is having high speed Internet?” The results showed that an impressive 76% view high-speed Internet as “Extremely Important” or “Very Important.”

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## THE CHANGING FACE OF WORK

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As we transition to the residential section of the needs assessment, now is a good time to look at the overlap of home and work. Home broadband can lead to many opportunities to generate income by working from home through a home-based business, or by working from home by occasionally teleworking. An impressive 17.1% of Stark County households that completed the survey reported having a home-based business, and another 30.7% reported having someone who telecommutes, or occasionally works from home for an outside employer.

For comparison, the most recent findings from the US Small Business Association says there were 14.56 million home-based businesses in 2013, representing 12.4% of US households,<sup>86</sup> so Stark County households are above

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<sup>86</sup> [https://www.sba.gov/sites/default/files/FAQ\\_Sept\\_2012.pdf](https://www.sba.gov/sites/default/files/FAQ_Sept_2012.pdf)



For Stark County businesses, there is very little *choice* in Internet providers. In fact, nowhere in the Stark service area did research identify an address where AT&T, Frontier, Time Warner, and MCTV compete for the same customers.



national average by over 5%. Additionally, a 2015 survey from Gallup Analytics<sup>87</sup> found that 37% of US workers have telecommuted within the previous year, which is on par with the Stark County household average of 30.7%. Teleworkers in the US 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, the Stark County percentages exceed national averages, which leads one to speculate that if residential broadband was better and more affordable, the Stark 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 is 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, 100% of Stark County households that report having a home-based business also subscribe to Internet services. This shows that one, small businesses in the Stark service area depend on Internet from local service providers, and two, there is potential for business growth with use of better broadband from existing users. Additionally, of those 55 respondents that report operating home based businesses, an overwhelming 86% state that the availability of high-speed Internet is extremely or very important when choosing a community or neighborhood. When asked to rank speed, support, price, reliability, and service options, speed (71%) and reliability (63%) topped the charts as being extremely or very important when choosing an ISP. Alternatively, service options were selected by 87% of respondents as not important when making a choice. Clearly, broader access and affordability of broadband would certainly enhance the prospects of growing existing small businesses, giving existing businesses access to new resources and opportunities, just as it will enhance the prospects of entrepreneurship and home-grown business start-ups.

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## RESIDENTIAL

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To understand broadband related issues faced by Stark County households, a survey of 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 Stark County, 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 residential section we will gain a better understanding of how Stark County households access and use the Internet. Of the 756 Stark households that completed the survey, 93.5% report subscribing to Internet services at their home. This potentially means that 6.5% of Stark County 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 reasons why households do not subscribe to Internet services.



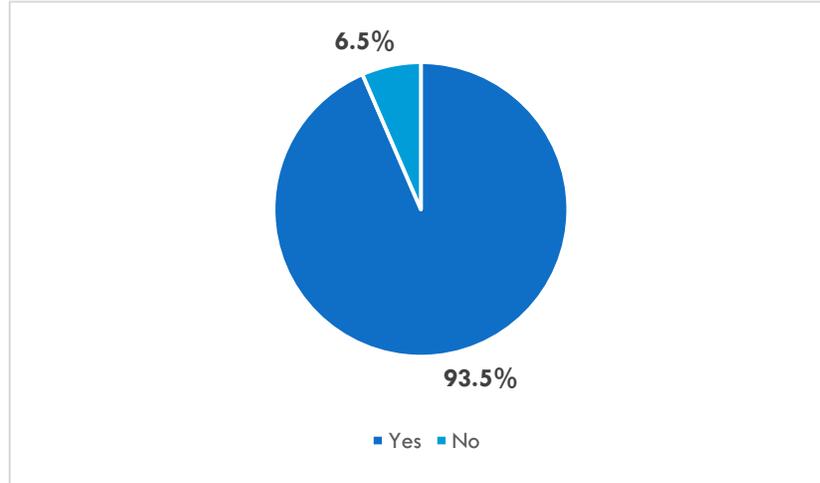
**100%**  
**of home-based  
businesses in  
the Stark County  
service area  
subscribe to  
Internet services.**

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<sup>87</sup> <http://www.gallup.com/poll/184649/telecommuting-work-climbs.aspx>

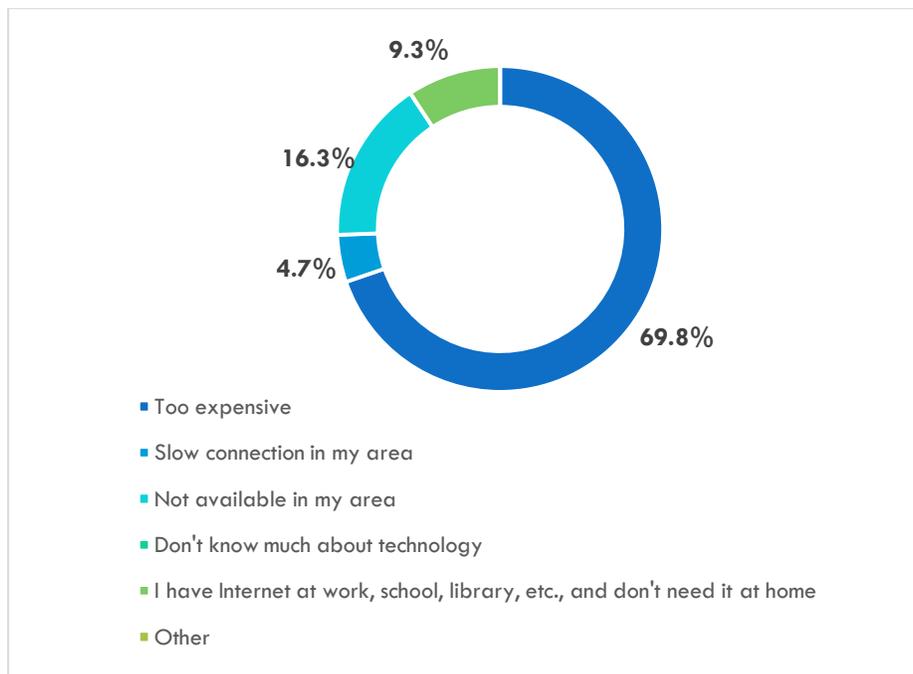
FIGURE 29: "DO YOU HAVE INTERNET SERVICE AT HOME?"



Of the 6.5% of surveyed Stark households that do not subscribe to Internet services, we asked them the single-most reason they do not subscribe to service at home, to understand whether it was their choice or if non-subscribership 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 and use.

As illustrated in Figure 30, more than half of the non-subscribing Stark households (69.8%) reported they did not subscribe to services because broadband is "too expensive", and another 16.3% said "services are not available in my area."

FIGURE 30: "WHY DO YOU NOT HAVE INTERNET AT HOME?"



Looking beyond primary indicators of broadband subscribership, when Stark households are given the ability to list multiple reasons why Internet services aren't subscribed to, affordability also emerges as a legitimate barrier. While services "not available" increases to at 16.3%, "too expensive" jumps to 69.8%, with "connections too slow" being low at 4.7%.

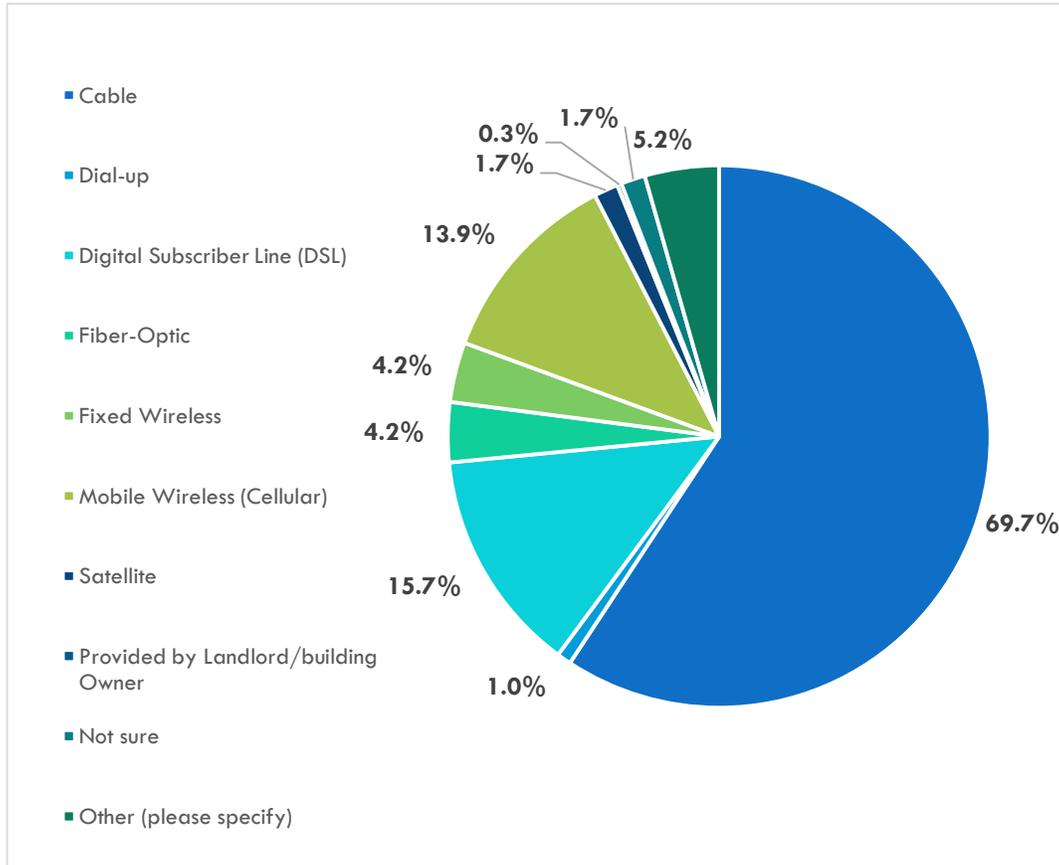
Also emerging as a necessary substitute for home Internet access, 9.3% of Stark households report regularly accessing the Internet outside the home, possibly at work, school, or a public place such as a library or a restaurant. Alternatively, as we'll see in later sections, smartphones and other mobile devices are increasing their role in connecting homes without access, and could also be represented in that response as accessing the Internet elsewhere.

Taken together, the survey data from non-subscribing households clearly indicates that very few Stark households have no interest or no need for broadband services. In fact, more than three of four Stark households recognize the importance of the Internet to their household and would likely adopt services if available at an affordable price. In short, a lot of non-subscribing homes in Stark County want broadband, but they simply can't afford the current prices.

Moving to the 93.5% of households in the Stark service area that subscribe to Internet services, we'll first look at the connection method chosen by households and then move into the details around their services. Of course in many cases households don't really have a true choice in their Internet connection method, but instead must subscribe to what is available to their home. But for many Stark County homes, the choice is between AT&T or Frontier DSL, Time Warner or MCTV Cable, or nothing.

As illustrated in Figure 31, a majority of Stark households subscribe to cable at 69.7%, with DSL the second most method at 15.7%. Other connection methods used in the Stark service area include mobile wireless (13.9%), fiber-optic (4.2%) and fixed wireless (4.2%).

FIGURE 31: STARK HOUSEHOLDS INTERNET CONNECTION METHOD



Over half of respondents subscribe to cable, demonstrating that Time Warner and other cable providers make up the majority of the Internet provider market in the Stark County area. The fact that 4.2% of the respondents' state that their Internet is delivered through fiber is promising; however, the inference can be made that many residents may not subscribe to fiber based on high pricing or its lack of availability.

Approximately 15% of households use satellite and their mobile phone as the 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.

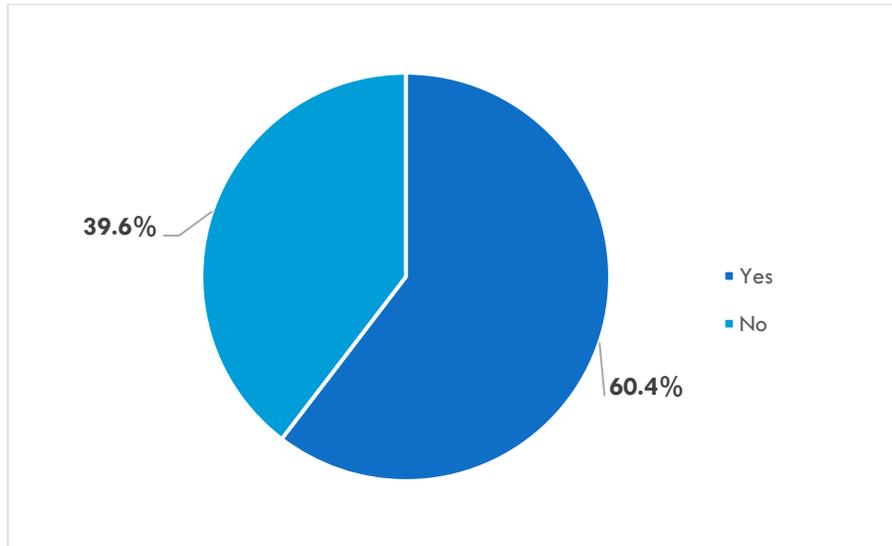
For example, a work or school file or job application can't easily be created or navigated on a phone, nor can any type of video interactivity be performed across a satellite connection due to the latency in satellite communication.

Also important to consider is that today's mobile wireless and satellite Internet platforms place limits on the amount of data that can be transmitted each month, with overage penalties that include bandwidth restrictions and inflated per-byte fees. These connection methods must be considered a last resort for any household, and clearly, some households in Stark County service area are settling for – and paying for – the last resort.

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

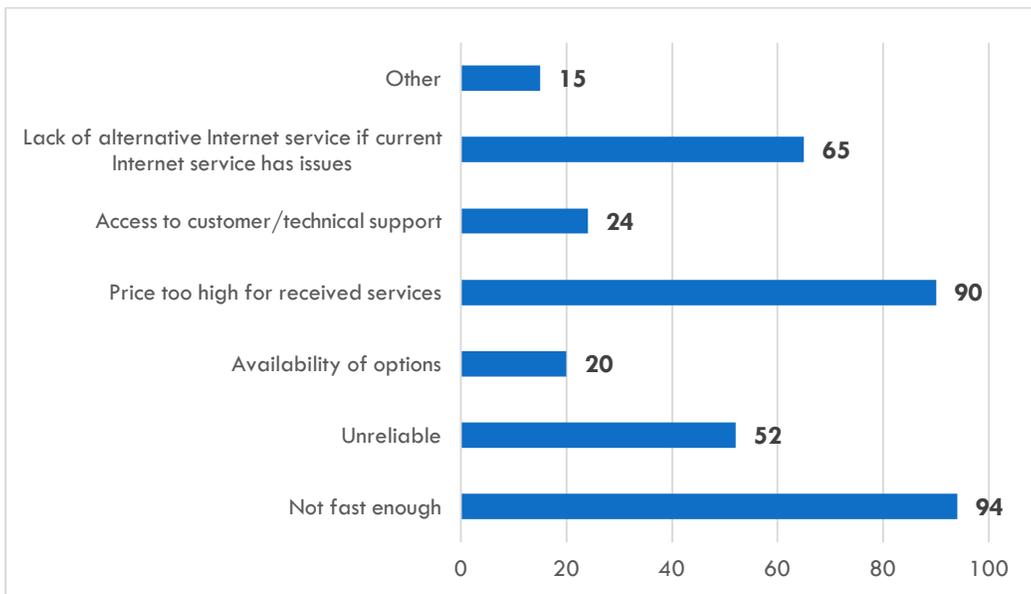
needs of their household. Residents' feelings regarding how needs are being met, 60.4% state that their Internet is sufficient and 39.6% indicate their Internet is insufficient.

FIGURE 32: IS YOUR CURRENT INTERNET SERVICE SUFFICIENT?



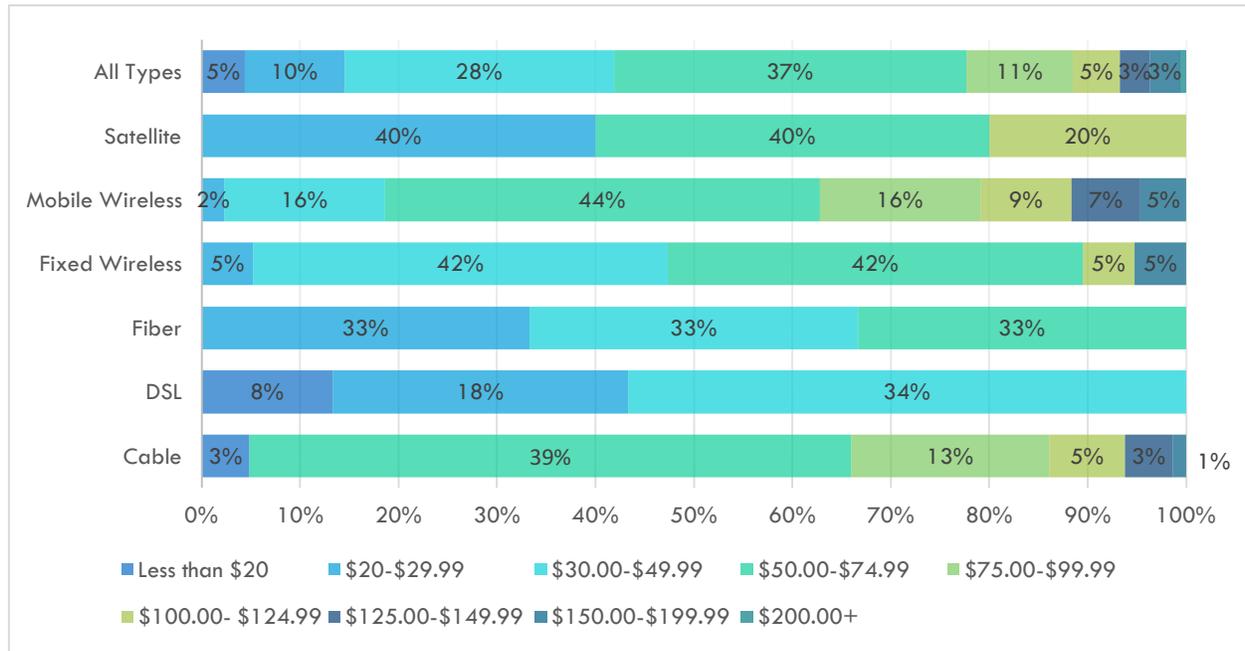
For those residents that felt their Internet is insufficient, we inquired as to the ways that the providers were failing the customers. Over 80% of respondents indicated that the service is slow and expensive, while approximately 50% were unhappy with the reliability and lack of alternatives in the marketplace. Again, through the market analysis it was discovered that there are rarely two or more options for Internet providers throughout the Stark County area, resulting in a monopolistic or duopolistic environment.

FIGURE 33: IN WHAT WAY IS YOUR INTERNET INSUFFICIENT? (CHECK ALL THAT APPLY)



Regarding price, survey data shows that a majority of Stark households (37%) pay between \$50 and \$75 each month for their home Internet services, with 28% paying \$30 to \$49.99 each month. The percentages across the Stark service area shown in Figure 34 are for all types of stand-alone or “unbundled” Internet services. On the costlier side of the spectrum, 11% of Stark households pay over \$100 each month, while on the opposite side, 43% pay less than \$50 per month, while 15% of Stark households pay less than \$30 each month for Internet service.

FIGURE 34: STARK HOUSEHOLD MONTHLY COST BY INTERNET CONNECTION TYPE



Digging deeper into the numbers we see a breakdown of average residential cost across all the types of Internet services subscribed to in the Stark service area. As discussed earlier, cable is the most common Internet connection in the Stark area (see Figure 31) with 39% of subscribers paying between \$50 and \$74 a month, with 13% paying in the \$75-99 range. The next most common connection type is DSL, with a majority of DSL households (39%) paying between \$30-49 each month for Internet service.

A majority of DSL subscribers (34%) fall in the \$30-\$49 range, while 18% report paying in the \$20-29 range. While that is quite a wide range for similar DSL services, the price variability is likely due to DSL customers that bundle their Internet service with voice or TV service to achieve slightly higher DSL speeds (18 Mbps vs 24 Mbps), with the actual cost of Internet service discounted in the bundled package. Also of note is that some subscribers may be within an introductory period, where the monthly cost is discounted during the first several months of a longer contract period.

Of added importance in Figure 34, we see local data that supports the position that mobile wireless and satellite are the most expensive forms of Internet service available to consumers. While the graph helps visualize the connection types relative to each other, not as visible is that 20% of satellite households and 21% of mobile wireless households pay over \$100 each month. In sum, 11% of all Stark households pay over \$100 each month for Internet service, and all of those are either satellite, mobile wireless, fixed wireless, or cable subscribers.

Especially for rural, cash-strapped households of Ohio, it is important for a community to have affordable broadband options. No household wants to pay \$100 a month or more for Internet, just as no household should rely on their mobile phone as their primary Internet connection. Not only can better broadband options improve

quality of life and help extend household budgets, it offers more opportunities for productivity, creativity, and interactivity.

While on the topic of affordability, as shown in Figure 35, price and speed show relatively low levels of satisfaction reflecting tremendous need for pricing improvement as residents overwhelmingly feel they are paying more than they should for the level of services they receive. Again, this could be a reflection of the monopolistic market for Internet in the Stark service area. Dissatisfaction with speed appears to be the next concern, indicating the desire of residents for next-generation fiber based connectivity.

FIGURE 35: LEVELS OF SATISFACTION WITH CURRENT INTERNET SERVICES AMONG STARK HOUSEHOLDS

	Poor	Fair	Good	Very Good	Excellent	Trend
Internet service only	6.67%	19.65%	33.33%	24.56%	15.79%	
Other products/services	6.00%	22.40%	37.60%	20.00%	14.00%	
Customer/Technical Support	14.08%	20.58%	31.77%	18.41%	15.16%	
Price	32.86%	34.63%	16.96%	6.36%	9.19%	
Reliability	7.77%	23.32%	27.56%	22.61%	18.73%	
Speed	13.83%	25.53%	30.85%	16.67%	13.12%	

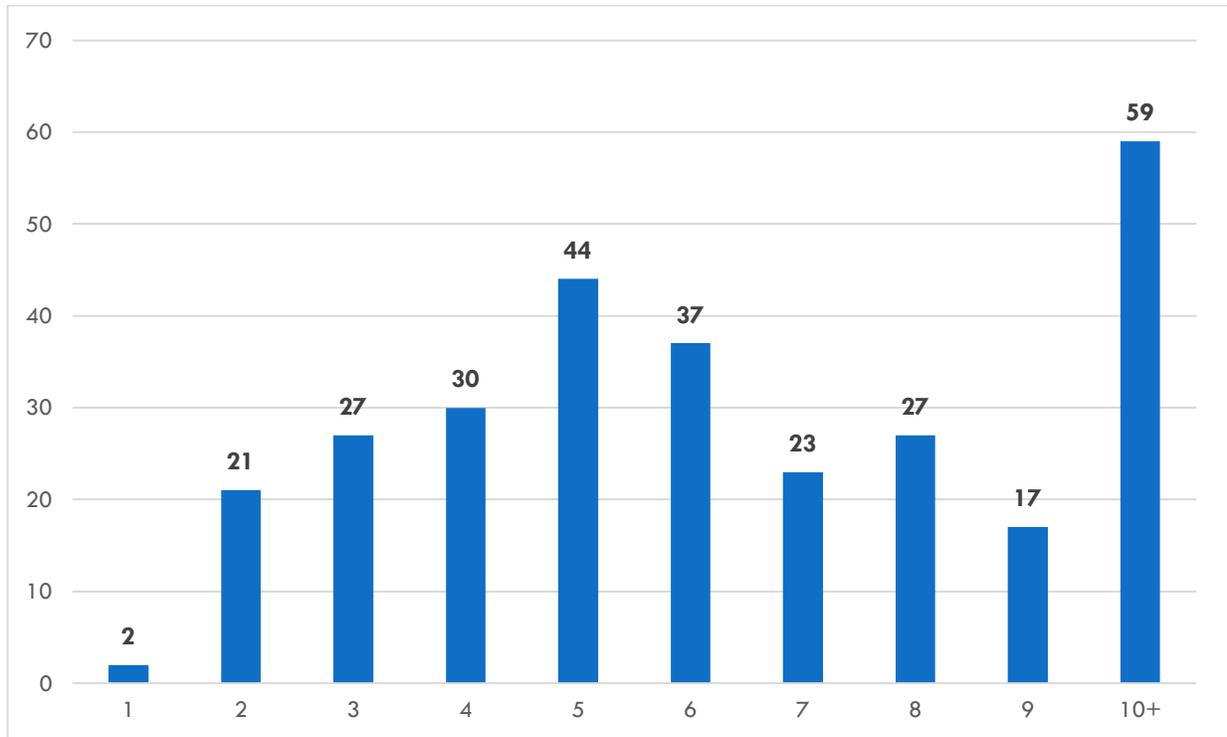
What one looks for in a healthy trend line is a bell shaped curve, and ideally a bell shape with a higher right side than left side, which would indicate relatively higher levels of satisfaction. Residents appear to be generally satisfied with their Internet provider in terms of Internet service, products/services, customer/technical support, and speed with these categories showing the healthiest aggregate responses and trend among all of the categories.

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 living in the unincorporated areas of the County wanted faster service, they would need to move. Again, affordable access appears to be a legitimate dividing issue for Stark households, particularly outside the more populated areas of the Stark service area.

## DEMAND INDICATORS – INDIVIDUAL DEVICES

In an attempt to understand how Stark households utilize the Internet today and identify indicators of Internet demand growth, we asked about the number of Internet-enabled devices that members of their household connect to the Internet. Somewhat surprisingly, an overwhelming 72.3% connect five or more devices to the internet and 20.56% connect over 10 devices. Comparing Stark households with national averages,<sup>88</sup> it turns out that 90% of U.S. households have three or more Internet-connected devices.

FIGURE 36: INTERNET-ENABLED DEVICES IN STARK HOUSEHOLDS



These findings suggest that once Stark households get a taste of online devices – after they get the first connected devices and realize the benefits, the desire for more devices increases. These results bode well for future broadband service demand in the Stark County service area. In looking at the average number of Internet-connected devices per household, Stark residents have a healthy appetite for technology and devices that connect to the Internet. In fact, survey respondents claim an average of 6.3 Internet-connected devices per household. Comparing Stark with recent national averages we see the number of connected devices per US household is 5.2. On par with national averages, demand appears to be strong in the Stark service area, with such numbers understandably expected to climb as more devices and services come to market.

A recent national study<sup>89</sup> demonstrated the amount of time the average user spends with their devices across each type of device. Over a 24-hour period users are spending significantly more time with their devices, on devices that

<sup>88</sup> <http://www.ericsson.com/res/docs/2014/emr-november2014-regional-appendices-rnam.pdf>

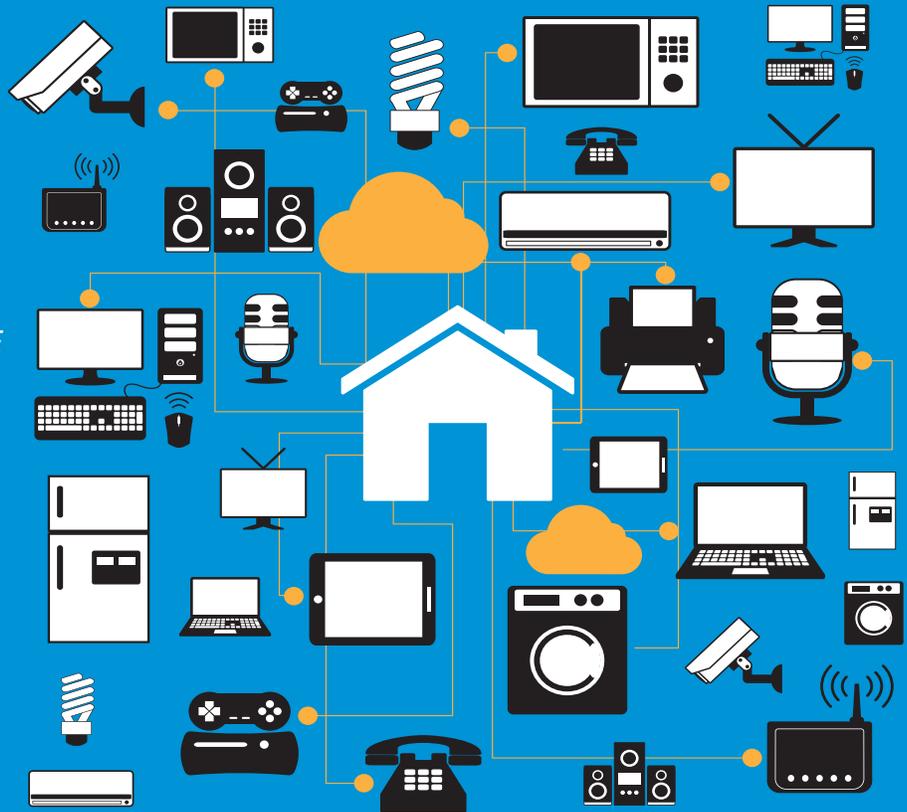
<sup>89</sup> "The New Multi-Screen World. Understanding Cross-Platform Consumer Behavior" [think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study\\_research-studies.pdf](http://think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study_research-studies.pdf)

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.

As Stark County plans for broadband deployment, it should keep in mind that the bandwidth needs of next year and the next five or ten years will be exponentially higher than the bandwidth needs of today. Planning for the future is key, and certainly fiber-optic networks will allow for this exponential growth well into the future.

*OVER 20% OF STARK HOMES CONNECT 10 OR MORE DEVICES TO THE INTERNET. ALMOST 70% OF STARK HOMES CONNECT 5 OR MORE DEVICES, WELL ABOVE THE NATIONAL AVERAGE OF 47%.*

*THE NUMBER OF CONNECTED DEVICES PER STARK HOME IS 6.3, SLIGHTLY ABOVE THE NATIONAL AVERAGE OF 5.2 CONNECTED DEVICES PER HOUSEHOLD.*



While the national survey did not ask for specific devices inside the home that connect to the Internet, the most current US research<sup>90</sup> 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.

<sup>90</sup> Delivering on the Promise of Connected Homes: [http://www.mckinsey.com/spContent/connected\\_homes/index.html](http://www.mckinsey.com/spContent/connected_homes/index.html)





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## COMMUNITY SUPPORT ORGANIZATIONS

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In order for a community to succeed and grow, community and social support organizations must thrive as well. 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 organizations must have the tools and resources for people and the special interests of the community to be represented and served.

Community institutions such as local Chambers of Commerce, the Edgewood Community Center (pictured to the left), the Massillon Recreational

Center, all the churches in the county, the environmental-focused, cause-based, and social services organizations each help support the people in the community and connect them to services.

The survey presented to residential respondents inquired “If you use wireless devices, how important is having wireless services available in the Stark County area?” Overwhelmingly, the answer was “Extremely Important” (62.8%) indicating that residents are interested in communities, cities, towns, and organizations providing WiFi for residents and consumers. Zero respondents answered that this was “Not Important” in the least.

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 where local government doesn't have the resources or authority to help. 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.

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.

## SECTION 3: ROADMAP & ACTION PLAN

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Magellan has worked extensively with the Stark County Area Broadband Task Team and many community stakeholders to understand the connectivity needs of the area. Those needs, documented at a high-level in this Study, along with accepted broadband and technology trends from across the United States have shaped our recommendations and more specifically this roadmap and action plan. This roadmap is meant to provide a high-level understanding of the potential programs, projects, and tasks that the County and its partners should undertake to begin investing in specific infrastructure projects, and to develop a long-term infrastructure program which will have a meaningful impact on the Stark community. This roadmap and action plan is broken down into a multi-year program and will define the action plan and required investments.

The roadmap and action plan begin with low cost/no cost tasks such as adopting broadband friendly public policies at all levels of government throughout the County. These policies will allow the County, cities, and townships the ability to work with area providers and utilities on joint trenching or dig once opportunities. Communities that utilize broadband friendly public policies to influence broadband investments have found the ability to construct these assets at significant savings over more traditional construction methods.

It is recommended that Stark County and its communities invest in a community owned middle-mile network, coined the Stark Community Broadband Network (SCBN) for purposes of this Study. This middle-mile network should interconnect local and regional data centers with Stark community anchor institutions. Many of the current Stark County anchors contract for Internet and local connectivity, and realize their data needs are ever increasing, as do their telecommunications bills.

***Middle-Mile: a term used most often referring to the network connection between the last-mile and the greater Internet. For instance, in a rural area, the middle mile would likely connect the town's network to a larger metropolitan area where it interconnects with major carriers.***

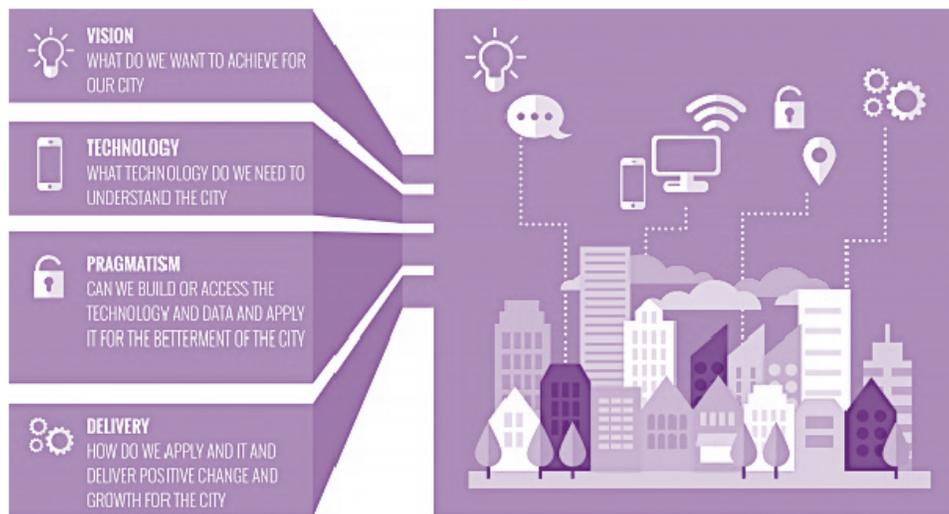
Today, Stark County's middle-mile networks are owned, maintained, and controlled by many incumbent and national carriers. Under this traditional ownership method, minimal, if any, decision making or influence happens at the local level. Development of the SCBN will allow local leaders to make direct investment decisions on when and where the network is expanded, while providing the individual cities and townships with world-class broadband assets which can help spur last-mile investments. The SCBN would be designed and constructed to first serve the region's community anchors, connecting them to data center facilities and multiple national telecommunications providers, while providing a new community owned network capable of serving businesses and residents in the very near future.

## CHAPTER 6: COMMUNITY VISION AND BROADBAND INVESTMENT PRINCIPLES

Stark County understands the importance of broadband infrastructure to the long-term sustainability of the region and understands its role in the transformation of the local economy. Broadband investments are investments in Stark County's future and should be deemed "critical infrastructure" as it supports nearly every facet of today's communities, including governmental, business and residential communications requirements. The SCABBTT and the greater community believe broadband infrastructure is the 4<sup>th</sup> Utility, a belief echoed by an overwhelming majority of today's citizens and by the Federal Government, with the FCC's action to reclassify broadband as a utility. As a next-generation utility, broadband infrastructure development should be treated as a community program, supporting long-term investments, vs. one time capital projects.

To support the vision of Gigabit Internet to every business and resident, we believe a clear vision and set of principles must be adopted by Stark County, its municipalities, and community leaders to ensure investments in broadband infrastructure continue to grow, providing residents and businesses with every opportunity that next-generation broadband can provide.

### BROADBAND IS AN INVESTMENT IN STARK COUNTY'S FUTURE



Regions across the country are investing in broadband infrastructure to support their growing demands for technology and community needs. Instead of leasing expensive connections from providers, governmental agencies and community anchors are building their own networks to reduce and control costs, and maintain ownership and control of a long-term asset that can be used for a variety of other purposes. Thousands of cities and communities across the US already own significant broadband (fiber/wireless) networks that they utilize for supporting their internal operations, connectivity to anchor organizations, and enhancing broadband services in their communities.

For Stark County, investments in broadband infrastructure are an investment into the local community. These assets will accommodate smart and connected technologies that will support the region as it evolves and transforms. Smart City technologies and the Internet of Things are growing trends that will continue to transform the way communities function. Devices, sensors, and people are being connected more than ever before – a trend not likely to slow down, as Gartner has predicted that the average household will have over 500 network enabled devices by 2022. A next-generation broadband network will keep Stark County at the leading edge of innovation while supporting a range of community technologies.

Broadband investments will assist in providing a platform that can enhance Stark County's ability to transform its economy and workforce into a 21<sup>st</sup> century economy, fostering the development of local ideas, innovations, and entrepreneurship. In addition, it will ensure that broadband investments are made using a “Community First” approach – focusing in on the direct needs of the area’s constituents and making local decisions. CMTC just recently released the Top 5 Manufacturing Trends of 2016 and they are listed as 1: E-Commerce, 2: Advanced Analytics, 3: Robotics, 4: Cybersecurity, 5: Industry 4.0.<sup>91</sup> Each of these trends are extremely dependent on high-speed fiber-optic services to function much less compete.

## 2016 is an exciting time in manufacturing.

### Technologies that recently seemed like ideas fresh out of a science-fiction novel have become a reality and are giving industry leaders a competitive edge.

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#### BROADBAND IS CRITICAL INFRASTRUCTURE

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Across the United States, telecommunications infrastructure is considered critical infrastructure. In the year 2016, fiber-optic technology has become the standard sought after by communities and government organizations. Today, Stark County governments, schools, and other community anchors rely on incumbent providers to provide Internet and local transport connectivity at rates equivalent to "what the market will bear." Investment in broadband infrastructure will enable the connection of Stark County’s governmental sites, schools, public safety agencies, libraries, and will support future Smart City/IoT initiatives. All of these needs will be aggregated to a single community owned broadband infrastructure, the SCBN, allowing the current telecom spend to be redirected to local community based investments.



<sup>91</sup> CMTC Consulting Solutions. (2016). Top Five Manufacturing Trends Report.

Stark County and its partners should treat fiber similar to other infrastructure/utility resources, i.e. a **long-term asset that serves the communities' basic needs**. Fiber maintains an economic life of 20 – 30 years; however, some municipal fiber networks have been in operation for more than 40 years. The County should view fiber as an infrastructure asset that will continue to drive value, cost reductions, and new capabilities throughout the Stark community.

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### BROADBAND DEVELOPMENT IS A LONG-TERM PROGRAM

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This Broadband Study must provide an investment and organizational roadmap for Stark County and its communities. As broadband investments begin to be made, we should expect that the network will continue to grow organically, connecting more facilities, community organizations, and businesses as opportunities present themselves. In addition, the SCBN would support future Smart City integrations such as utilities, traffic management, surveillance, and other community based programs.

Stark County and its communities should approach broadband infrastructure as a program rather than an individual project. Just as roads are extended and widened periodically to support more traffic, the broadband network will be expanded to support more users in and around the Stark community. Processes and procedures should be developed to plan, manage, and expand the network to ensure that the network continues to meet the needs of its users.

**Best Practice**

### Seminole County, FL

Seminole County developed its initial fiber-optic network to connect hundreds of city and county traffic signals in the mid-90s. As the network grew organically, the County began expanding the network to local schools, community colleges, city offices, sheriff's stations, state agencies and DOT facilities. Today, the network connects over 300 facilities and saves the County and its stakeholders millions of dollars per year.

**Benefits:**

- Cost reductions across all agencies participating in the network
- Unlimited capacity for future growth
- Integrated communications amongst all stakeholders



## CHAPTER 7: GOVERNANCE, CHARTERED OVERSIGHT, OPERATIONAL REQUIREMENTS

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The proposed middle-mile network, envisioned as a county-wide asset, requires administrative oversight by individuals who have no personal obligations in the day-to-day operations of the network. As such, an appropriate governance structure must be formed and empowered to oversee this very important program. Magellan Advisors defines governance as,

*A consistent and disciplined set of enterprise policies and transparent business processes that include oversight responsibilities, control, and the use of pre-defined decision criteria through a chartered collaborative effort by an executive team that measures and communicates the strategic risk and value of every broadband investment.*

Governance structures provide executive oversight. Governance members are typically nominated for appointments and, if accepted by the nominating body, appointed to serve the strategic interests of the organization with regard to program-level directions and investments in support of the best interests of the network. Governance, as it applies to broadband, consists of five critical decision domains:

- Ownership Rights
- Service Obligations
- Network Architecture
- Infrastructure Strategies
- Investment Priorities

A formal Broadband Governance Charter will need to be developed to address and explain the scope of control and levels of diligence that will inform the roles and responsibilities attributable to the appointed members of the Governance Board. It is conceivable and should be expected that the Governance Board may in turn appoint standing or ad hoc committees or work groups to execute issue-specific functions at the behest of the Governance Board under any one of the decision domains identified above.

### Key distinctions between Governance and Operations:

**Governance:** future-focused transformational issues to ensure relevancy of services

**Operations:** daily transactional issues to ensure continuity of defined services

The optimal design of a governance structure among broadband communities varies greatly depending upon a number of factors, including existing infrastructure, potential partnerships, ownership control issues, funding mechanisms, and service provisioning. Magellan Advisors has observed and worked with a number of these variations of what "optimal governance" means for communities. For example - Ownership:

**Cities OR Counties** - If governance is the responsibility of a city or county, the potential funding for infrastructure and operational assets is sought through municipal bonds (revenue or general obligation), operational responsibilities may reside with one or more general and/or enterprise funded agency departments.

**Cities AND Counties** - If governance is the joint responsibility of an inter-local government agreement between a city and county, the potential funding for infrastructure and operational assets may be sought through respective municipal bonds (revenue or general obligation) and/or some percentage of operating capital and expenditures, operational responsibilities may reside with some combination of one or more general and/or enterprise funded agency departments.

**Port Authority** – A governmental agency that can be created by one or more boards of county commissioners, municipal councils, boards of township trustees, and/or combinations thereof (ORC 4582.22 Creation of new port authority <http://codes.ohio.gov/orc/4582>), which is charged with overseeing and making direct broadband investments on behalf of the community. While such a decision is clearly in their prevue, it is likely to face resistance from the broadband incumbent providers if the port authority uses public investments as competitive capital.

All other configurations of public-private partnerships or cooperatives reflect combinations, to varying (and ever-emerging) degrees, of the same structures, approaches and access to funding sources, loans, grants or in-kind services.

For Stark County, should the community be able to bring private investments to the table, a not-for-profit entity may be the more appropriate governance structure for providing oversight through a board of directors comprised of local business, community, and government leaders but absent carriers and any broadband users constituting a majority of the market.

Regardless of the selected structure, the following examples of duties should be anticipated as within the scope of the Governance Board.

1. The Governing Board may be required to maintain legal powers to enter into and execute contractual obligations for the commercial use of broadband assets with other public or private organizations.
2. The Governing Board may be required to set and adopt a formal rate structure for assets that is compliance with established practices subject to the State of Ohio, Public Utility Commission of Ohio, or Federal Communications Commission regulations regarding public lease or Indefeasible Right of Use (IRU) relative to dark fiber, transport service, tower space, and physical property.
3. The Governing Board may provide supervisory oversight of an executive director and staff, any or all of whom may be employees or contracted agents of the Board.
4. A majority of the Directors shall be decreed, experienced, and/or presently or formerly employed in one or more technical, legal, governance, research, societal, economic, educational, and/or related aspects of the distribution field; and be it further that it can be modified if so desired.

**BOTTOM LINE:** The intent of this discussion is to provide a framework to develop consensus as to which governance structure presents the optimal benefits sought by the Stark County Broadband Network stakeholders. While the decision cannot be made at the moment, this discussion cannot be avoided or set aside as it could directly influence County or community buy-in to the project.

## CREATING A STARK COUNTY BROADBAND PORT AUTHORITY

### OWNERSHIP

Similar to what many communities, including Stark County, have done in the past for public transportation and utilities, the County should establish and empower a publicly-chartered entity to guide the development of policies and oversee the deployment and operation of the SCBN broadband assets for the benefit of the community. The creation of this port authority entity, the Stark County Broadband Authority (“the SCBA”), shall require enabling local legislation that, at minimum, satisfies city, county, and state requirements much like those used for established public conveyances. “The SCBA” functions as an independent body; subject to the letter and spirit of the enabling legislation.

## Enabling Legislation

The enabling legislation shall direct, at a minimum, the adoption of a governance charter or ordinance crafted to meet and exceed community expectations for collaboration, fairness, and transparency in managing the community's future portfolio of known, planned, and sometimes speculative investments in building a robust broadband-defined communications infrastructure. The enabling legislation shall address general organizational structure items including the type of organization, statutory authority, number of governance board members, voting and elections, quorum, term of board membership, meetings, officers, and signatory authority.

## Key Performance Indicators

Magellan-Advisors views the role of governance as critical to this effort and in meeting community obligations by serving four purposes:

### Strategic Leadership

As a strategic function within the community, the Broadband Governance Board (the Board) requires an understanding of the vision and goals of this broadband initiative, the immediate and near term impacts on citizens, businesses, and community institutions that provide for health and education throughout the community. The Board is committed to communicating its business throughout the community. The Board accepts their role as an oversight resource for the benefit of all Stark County citizens and businesses and expects that any member of the Board, now and in the future, must serve objectively and unselfishly in the best interests of Stark County, whose broad needs are greater than the needs of any one institution.

### Disciplined Processes

The Governance Board (the Board) recognizes that many benefits, such as increased opportunity and trust, are available to Stark County by instituting operational processes that are thoughtfully defined and broadly-communicated. Well-established processes have the power to transcend changes in the community.

1. The Board delivers great value to the community by instituting decision-making processes that are equitable and transparent. To be equitable requires the availability of an exception process that allows the Board to deliberate without pause over atypical or non-standard considerations.
2. The Board designs the decision-making processes for quality, simplicity, agility, and speed. This ensures that proposed initiatives, investments, and risks are diligently identified and mitigated.
3. The Board executes documented, repeatable processes that allow it to prioritize and recommend initiatives and enhancements.

### Collaborative Decision-making

The Governance Board (the Board) understands that within an organization without governance – all projects are of the highest priority. It is a primary goal of the Board to make objective, non-parochial, well-communicated, county-wide investment decisions.

1. Board decision-making is driven by the business needs of the community and by the availability of resources.
2. Board decisions are reached through consensus; the achievement of full support for a decision after a complete airing of differing viewpoints.
3. When considering a proposed initiative, the Board consistently applies documented and communicated decision criteria to support strategic alignment with the community's goals.

4. The Board values initiatives that focus on service integration and magnification opportunities rather than duplicative or individual solutions.
5. Board investment decision-making is not merely about implementing broadband solutions, but about implementing broadband-enabled change.

### **Sustained Innovation**

The Governance Board (the Board) energizes the County's capacity to grow and sustain a high-performance workforce to serve and support the needs of its citizens, visitors, and businesses. Once an initiative has been approved as a project, the Board provides high-level monitoring of the project's status and its consumption of resources. The Board incorporates best practices and lessons learned within both business and government to continuously improve its policies and processes.

For the Governance Board, education is a highly-valued aspect of county-wide governance. The Board participates as a group and as individuals in educational opportunities on emerging technologies and serves as a sounding board for new ideas and initiatives that may support educational and employment opportunities for all who live in Stark County and all who are welcome to join.

### **Assets and Infrastructure**

The cohesiveness of the future community infrastructure, unlike today's closed or private stakeholder-operated infrastructures, will be a dynamic composite of shared assets. Therefore, a comprehensive inventory of all assets by location, ownership, design, materials, capacities, age, physical condition and legal status/accessibility must be identified and categorized. As a result of this Study, Magellan Advisors in tandem with the Stark County Area Broadband Task Team, has begun to collect an inventory of broadband assets; however, it is believed there are still many assets that have yet to be identified.

For broadband purposes, infrastructure assets include conduit, dark fiber, lit fiber, public and privately-owned vertical structures, right-of-way, bridges, rail lines, rail crossings and property-specific land use restrictions in addition to city, township and County-owned properties and privately-owned and Community Anchor Institutions (CAI). All data relative to the overall configuration of the asset infrastructure will need to be imported to an accessible Geographic Information System (GIS)-enabled repository data to ensure that accurate record keeping, as defined by County and State standards, is maintained. Infrastructure assets must be physically inspected, verified, and updated within the GIS system per the requirements to commercialize the broadband assets. This inspection and reporting will become an ongoing function of the operation to verify and certify that conduit, dark fiber, tower space, and physical property are in the condition required for community broadband deployment.

The SCBA may choose to establish a pool of common broadband assets (materials, throughput devices and related tools) that can be utilized in expediting broadband initiatives. These assets may be retained by the SCBA or by a contracted agent and deployed when replacement or new facilities are required. The storage and common access of such assets could reduce or eliminate the duplication of costs by any party to the network in building-out aspects of the county-wide infrastructure.

### **Governance and Open Access Service Provisioning**

Should the SCBA choose to function as an Open Access Service Provider (OASP), the governance responsibilities and tasks will be driven by its role as owner and operator of the physical fiber-optic network and transport services through which retail service providers deliver services to last-mile consumers. The OASP provides wholesale transport connectivity to last-mile-service providers, who in turn design and extend services to reach their respective consumers using buried or overhead fiber-optics at broadband speeds or broadband-equivalent speeds via wireless.

Governance of the Open Access Service Provider model alleviates the appointed board from managing any end-point commercial resale services and last mile consumers. It allows retail providers to use the open access network to reach more customers without the need to build costly fiber infrastructure to subscribers; the open access provider is responsible for this function. Local governments find open access a compelling business model because it allows them to attract multiple service providers to their networks, which helps stimulate competition and keep prices low for subscribers.

Under the recommended OASP model, the SCBA is not permitted to engage in, provide, or support the sale of retail broadband services or related infrastructure for the purpose of commercial disaggregation to individuals, businesses, or agencies and/or for the purpose of reselling last mile services. The only exceptions could be:

- If a market is completely unserved by any carriers,
- Temporarily in cases of emergencies, i.e.
  - Force majeure
  - Carrier financial, judicial, etc. issues
  - Natural disasters
- National defense/homeland security needs.

End-to-end, broadband infrastructure assets under the SCBA may very well be a comingling of public and privately-owned assets. Should that be the case, the due diligence required to certify current assets or add future assets may require the creation of an arbitration board to hear and rectify continuity of ownership issues and concerns. Local governments have formed such organizations to leverage publicly owned broadband assets that are under their control. They are implemented similarly in structure and goals. For example:

#### Nelson County Broadband Authority

“The Nelson County Board of Supervisors serves as the Broadband Authority that oversees the Nelson County Broadband Project. The Nelson County Broadband Project is engaged in the design and construction of a combined fiber-optic and wireless middle mile network. The objective is to provide a state of the art high-speed network backbone generally through the center of Nelson County from north to south, providing the ‘highway’ for private providers to enhance and expand broadband Internet services in the county.”

[http://www.nelsoncounty-va.gov/government/board-of-supervisors/broadband-authority/.....](http://www.nelsoncounty-va.gov/government/board-of-supervisors/broadband-authority/)

#### Columbia County Community Broadband Utility – C3BU

The C3BU Department is a county department of the County Administrator’s office and is charged with building, operating and maintaining the Columbia County Community Broadband Network otherwise known as C3BU. C3BU’s mission is to provide a cost-efficient, self-sustaining middle-mile fiber network for the community. The C3BU network connects 150 community anchor institutions to enhance healthcare, public safety and government services throughout Columbia County, GA. In addition to over 200 miles of fiber deployed, the County deployed several communications towers throughout the urban core of the County, to deliver wireless services to the more rural areas. In addition to serving the community’s needs, the County is leasing excess dark fiber capacity, lit transport and wireless colocation space to retail Internet providers. The County has direct connections into Atlanta and even provides data center colocation and wholesale IP out of the C3BU data center located on County property.

<http://www.columbiacountyga.gov/government-/departments-a-c/broadband-utility>

## CHAPTER 8: BROADBAND INVESTMENT ROADMAP

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Magellan has worked extensively with the Stark Broadband Task Team and community stakeholders to understand the connectivity needs of key anchor institutions throughout the County. Those needs, documented in this Study, along with accepted broadband trends across the United States have shaped this Broadband Study's Investment Roadmap. This roadmap is meant to provide a high-level understanding of the programs, projects, and tasks that the region should undertake to begin investing in specific infrastructure projects, and to develop a long-term broadband infrastructure program which will have a meaningful impact on the Stark community.

This roadmap assumes an authority is formed to provide for ownership, maintenance/operations and leadership during the development of the County's broadband program. This authority would manage the day to day operations of running the Stark Community Broadband Network, under the framework of the Stark County Broadband Authority. This plan has assumed the full outsourcing or administration, outside plant (OSP) maintenance and expansion, and network operations. All costs included in this Study and supporting financials have assumed this structure.

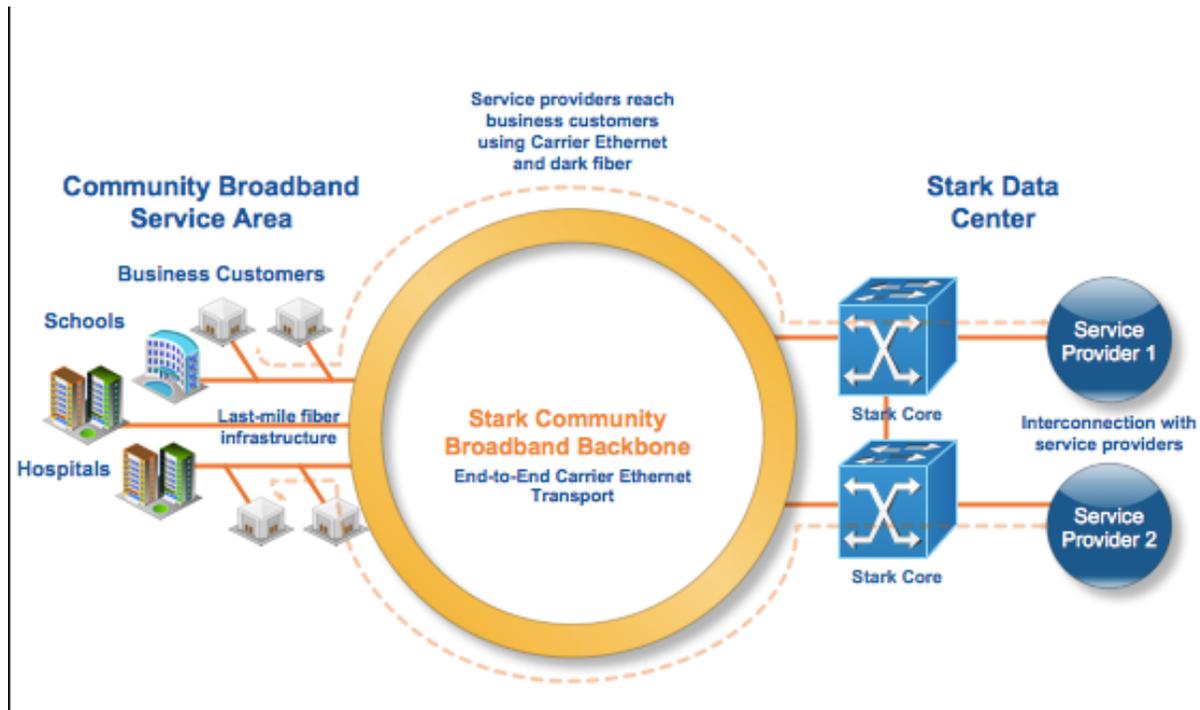
This roadmap is then distributed across an investment timeline, for the Stark County Broadband Authority (SCBA) to take action on. This defines the action and investment plan which outlines what should happen year after year, and at what cost as outlined in the supporting financial model. In addition, it outlines key metrics that must be met to ensure financial sustainability as outlined in the financial model.

The roadmap and action plan begins with low cost/no cost tasks such as formalizing process and public policy to support the development of dark fiber and conduit investments when appropriate, and focused on building middle-mile (backbone) network routes throughout the core of Stark County, interconnecting community anchors where feasible. Through development of this Study, these routes have been identified, estimated, and inserted into the financial model, while revenue projections have been based solely on uptake by potential anchor sites and revenues derived through other carriers to reach last-mile customers. Community leaders must seek consensus throughout the region on the recommended roadmap and investment requirements, where anchors are planned to be connected, and that some type of commitment has been achieved. ***Financial sustainability of this community owned network is based in large part to Community Anchors participation and their "taking of services."***

Once consensus has been reached and funding becomes available, Stark County must develop a business and implementation plan to bring this proposed network to market. In addition, an in depth design, engineering, and permitting study must be performed to ensure capital cost projections are in line with actual costs. It is very likely that official engineer's estimates could be required to secure funding. The Authority should be formed early to allow for adequate governance discussions, as the Authority will have to be formed to solicit debt.

The County has many options to affect change in the market through additional investment in middle-mile backbone fiber capacity. This new asset will provide a new community based choice in fiber connectivity, first focused on the bulk of the tax payer related spend, community anchors, and government organizations. The County, its governments and all community anchors have the opportunity to make investments in locally owned broadband capacity which will pay continuing dividends to each organization for decades to come. The benefits will include more control over bandwidth, budgets, investment decisions, scalability, and long-term cost reductions. The County's goal should include much more bandwidth, 1 Gb minimum to any anchor site at more realistic if not actual costs – a bottom up, cost + approach, ensuring affordable access to new fiber based services. Retail services provisioned over the SCBN should be discounted as a capital recovery fees will not be provided in the pricing model. Carriers will pay a discounted rate to access customers.

FIGURE 39: STARK COMMUNITY BROADBAND NETWORK - CONCEPTUAL DIAGRAM



Once formed, the Authority should focus its efforts on a "Community first vision" identifying partners and funders that recognize the importance of broadband to the future of the Stark community. There are deep economic and workforce issues in the community that can be positively influenced by more broadband investments, more speed, and access to next-generation fiber based services. In addition, Stark County, its municipalities, and anchor institutions will have a continued demand for more and more bandwidth. The SCBA and this Study have outlined an opportunity to redirect local telecommunications spend to a community based capital project, which will build foundational utility infrastructure for the Stark community.

The SCBA should strive to develop working relationships with each of the County's municipalities, townships, and individual communities where necessary to assist in last-mile deployment. Through smart public policy, a new carrier neutral, community owned fiber backbone, and On-Net<sup>92</sup> data center facilities, each community will be equipped with the tools to make last-mile deployment and competition possible. The SCBA can assist these communities with technical consulting, identifying funding opportunities, and providing other key levels of support in helping to accelerate last-mile deployment. In Massachusetts, the MBI (Mass Broadband Institute) applies for and receives state and federal grants and has built middle-mile networks throughout the state. In addition, they provide Last-Mile Consulting Services to the communities along the backbone. The state of Massachusetts budgets \$50 million dollars a year in broadband investments and MBI manages this pool of funds. The SCBA should function in a similar capacity at a more local level and should identify opportunities and grants to extend the network when possible, using local investments, and a combination of state and federal grant programs.

<sup>92</sup> A facility that is on a specific network and accessible without having to traverse other carriers' networks.

The SCBA and community partners will have to make final decisions on funding of this network. There could be a multitude of funding sources available including local or regional investors, bonding, public investment, E-rate for schools, Healthcare Connect funds for rural healthcare, and redevelopment funding. Many of these programs require competitive bidding, therefore it will be important for each organization that will use the SCBN to identify how it can contract for service.

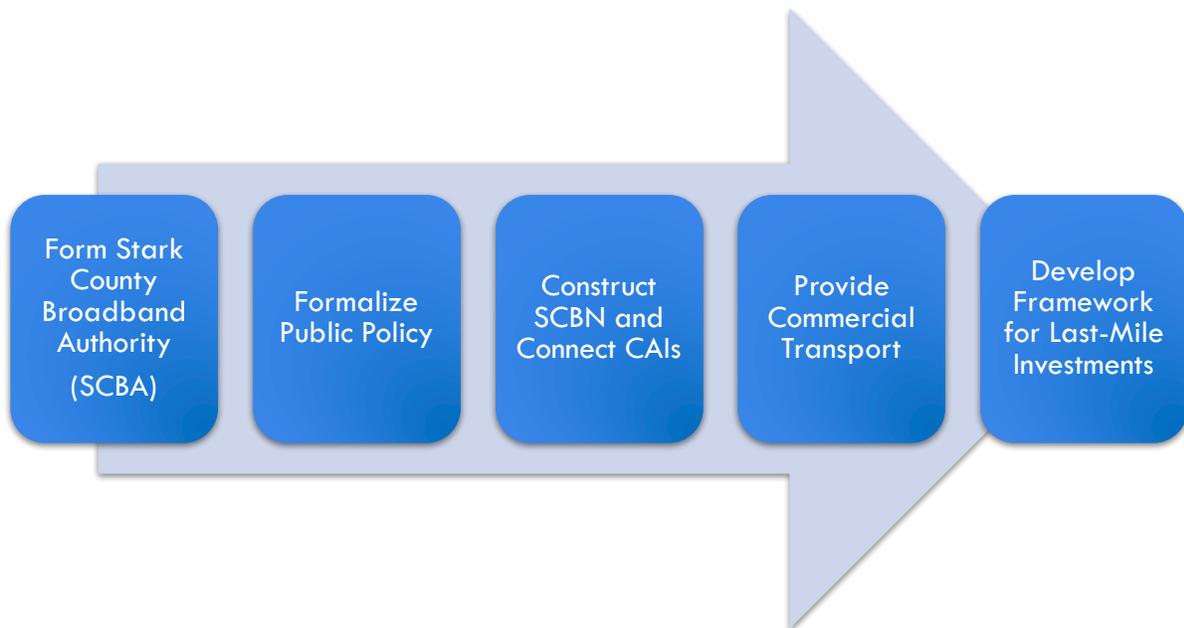
At each stage in the development of its network, the SCBA will have the opportunity to evaluate the deployment of the network based on its original goals to ensure that the network is serving the community as anticipated. This should be a methodological approach that assesses the realized values of the network to the Stark community.

Some key questions will include:

- How has the deployment positively impacted the community?
- What have we learned through our initial expansion?
- Did we plan for needs and opportunities correctly?
- Has the network accomplished its objectives?
- What would we have done better?
- How will we improve future deployments based on what we've learned?

A number of communities have found success using the process below that focuses first on expanding the existing network and connecting internal and external stakeholders, followed by expansion of the network to the business community, followed by a greater expansion of the network to support residential broadband needs. Communities have chosen to deploy these networks on their own and provide services directly, whereas in other cases, they have chosen to partner with private broadband operators who take on the responsibility for providing retail services using the communities network. Through this roadmap, the SCBA and its municipalities will need to make further decisions on deployment strategies and business models to drive last-mile investments that depend on the overall priorities in the community and needs of the stakeholders.

FIGURE 40: RECOMMENDED STRATEGIC BROADBAND INVESTMENT PROGRAM



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## ACTION ITEM 1: FORMALIZING BROADBAND FRIENDLY POLICIES AND STANDARDS

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Magellan believes that Stark County’s most immediate strategy to encourage broadband infrastructure growth will be to develop and adopt broadband-friendly public policies geared toward driving more investments. In meetings with stakeholders, it was discovered that many progressive broadband-friendly considerations are clearly already in place within the communities, however they are on an informal basis and are not coordinated across all government entities. During any type of community capital project, i.e., road widenings, utility undergrounding, water/sewer/gas expansions, coordination should be happening between all included parties and basic conduit infrastructure should be installed within the projects. This practice will save Stark County and its communities from having to build the proposed fiber routes independently, and will allow the areas to save large amounts of capital.

In support of this strategy, Stark County should immediately look to implement broadband-friendly public policy tools. These policy tools influence how broadband services develop throughout the community and show the community and prospective newcomers that the region is serious about promoting broadband growth and accessibility. Stark County should develop a team of Broadband Stakeholders from each participant agency to develop cooperative legislation which will allow broadband investments to be included incrementally through the County and within each of the Stark communities. The policies should be adopted at all levels, and should include coordination with any private or public utilities. Government should also explore the ability to require broadband infrastructure in private developments and buildings. Basic conduit infrastructure can be added in to development projects, again, for a minimal incremental cost, and will allow those buildings and properties to be considered “fiber-ready.”

Stark County and its communities must memorialize this forward looking endeavor and make sure there is consensus and collaboration as the region begins making these investments.

### WHAT ARE BROADBAND FRIENDLY PUBLIC POLICIES?

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Broadband-friendly public policies are tools that local governments can formalize to encourage broadband infrastructure growth. These include many items that are already informally performed by entities in Stark County, however there is no coordination. Below is a list of ways that the County and its communities can encourage broadband development through the adoption of broadband-friendly policies:

- Evaluate fees levied on broadband providers for constructing broadband infrastructure to ensure they do not discourage broadband investment.
- Develop methods to streamline the broadband permitting processes within public rights-of-way to ensure broadband providers do not face unnecessary obstacles to building infrastructure.
- Develop a process so that all Community Development and Public Works Departments coordinate with the County to identify projects that could include broadband infrastructure at reduced costs.
- Identify opportunities to install broadband infrastructure in conjunction with public and private construction projects.
- Maintain broadband infrastructure specifications in a County-owned GIS-based fiber management system, requiring updates as built, and implement processes for maintaining accurate documentation.
- Adopt policies that incorporate broadband as a public utility and create a policy framework to promote its deployment in public and private projects as appropriate.
- Draft policies to Stark County’s specific needs and adopt them into local policy, codes, and standards (including dig-once, joint trenching, engineering standards, etc.).

- Incorporate broadband concepts into Stark County’s Capital Improvement Plans (CIP), as appropriate, and make a commitment to fund broadband infrastructure.

## COMPREHENSIVE BROADBAND STANDARDS AND JOINT TRENCHING POLICIES

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Incorporating broadband infrastructure requirements into Stark County’s land development or general plan statutes will allow and encourage broadband construction in conjunction with other capital projects. For example, installation of fiber-optic conduit during all projects involving roads, sidewalks, trails, or lighting projects where the ground is to be opened for other purposes would be less costly than installing conduit through standalone broadband projects. Since the majority of costs to build broadband infrastructure is incurred through underground construction and restoration processes, this strategy can alleviate significant costs by opening the ground once instead of multiple times. In addition, these policies can assist the municipalities in minimizing ROW construction and disturbances. In many states and municipalities, this formalized policy is referred to as a “Dig Once” policy.

Stark County, through the use of its Capital Improvement Plan and interdepartmental communications, can determine projects that could best utilize this strategy. This policy should also be coordinated with private utilities operating in the region, broadband service providers, and other underground utility organizations to minimize the need to overbuild and to ensure that all service providers have an opportunity to place their infrastructure in capital projects as well. These joint trenching policies can facilitate more opportunities to install conduit, fiber, and other infrastructure due to lower costs. 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.

## GIS AND INFRASTRUCTURE RECORD KEEPING

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As part of the implementation of broadband-friendly public policy measures, all municipalities should require that Geographic Information System (GIS) documentation of all broadband infrastructure installations, upgrades, and other items be maintained and updated. Those that keep records currently utilize GIS to track conduit and fiber segments; however, this does not support fiber inventory or strand mapping. Stark County should invest in a fiber management platform that will provide this functionality. This will allow the County to maintain a clear understanding of locations of the broadband infrastructure such as conduit, vaults, pull boxes, transitions, fiber-optic cable, and other outside plant resources.

## HOW WOULD STARK COUNTY IMPLEMENT BROADBAND FRIENDLY PUBLIC POLICIES

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Implementation of broadband friendly-public policies requires Stark County and local governments to evaluate current land use, permitting, construction, and right-of-way policies along with informal policies and procedures to determine how these formalized broadband-friendly policies can be tailored to incent development of broadband infrastructure. In addition, the County should decide whether to require specific conduit for the County’s use to be included in all new building construction efforts.

Formalizing these policies will enable more opportunities for the installation of broadband infrastructure in conjunction with other public and private infrastructure projects occurring within the County’s jurisdiction. Many of these public policy tools will be codified and implemented according to the County’s existing procedures and ordinances, and must be approved by the Stark County Commission. It is recommended that this topic be carefully work shopped with county leadership, county departments that would be affected, and any other local government organizations that will participate.

## ARE THERE ANY RISKS?

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There is little financial risk in implementing policy tools because they require limited upfront funding if managed correctly. In some cases, municipalities 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 toward a common goal. The County and local governments should expect that some new business and operational processes would be required as well as changes to existing processes in order for the policies to be effective.

## ADDITIONAL CONSIDERATIONS

Stark County or the SCBA should develop a broadband investment infrastructure fund to support the expansion of broadband infrastructure, which would be required through the implementation of public policy options. Initially, the County could budget an annual fund contribution of \$100,000 per year to fund specific conduit expansion. However, the County, and other political subdivisions that may co-create the port authority, would likely grant funds or project seed money, but they would likely expect the port authority to become self-sufficient after the project is well underway.

\*\*Sample joint trenching and dig once policies are provided with the Appendixes.

**Best Practice**

### City of Clermont, FL

Clermont implemented a dig-once policy in 2006 just prior to a major water/reclaim capital project which was going to bisect the city. Clermont realized the opportunity, and decided to invest in conduit and basic box infrastructure. In 2012, the City developed a plan to connect all city sites, parks and other key facilities. Clermont was able to equip the existing conduit with fiber and make the routes operational on average for less than \$10k per mile, while newly constructed routes were constructed for closer to \$55k per mile.

Benefits:

- Built 20 mile fiber network connecting all city sites
- 50% built through smart public policy, 50% newly constructed
- City realized significant savings due to smart public policy



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## FIBER EXPANSION INITIATIVES

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### KEY INITIATIVE 1: DEVELOP MIDDLE-MILE FIBER-OPTIC BACKBONE

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Stark County should consider funding and constructing an intra-county, middle-mile fiber-optic backbone, the Stark Community Broadband Network (SCBN). This network would initially connect up to three local/regional data center facilities, 140 community anchor facilities, and would provide adequate excess capacity to serve area providers and/or businesses with fiber based carrier Ethernet transport services. This network can be funded by redirecting the annual local spend of numerous community anchor organizations throughout the County. These anchor sites could have the choice of moving from contracting with traditional service providers, to instead contracting locally from the Stark Community Broadband Network, a locally owned and governed service, or retaining service with their current ISP if they are using the SCBN. Revenues collected from use of the network would fund the debt service required to construct and operate the SCBN.

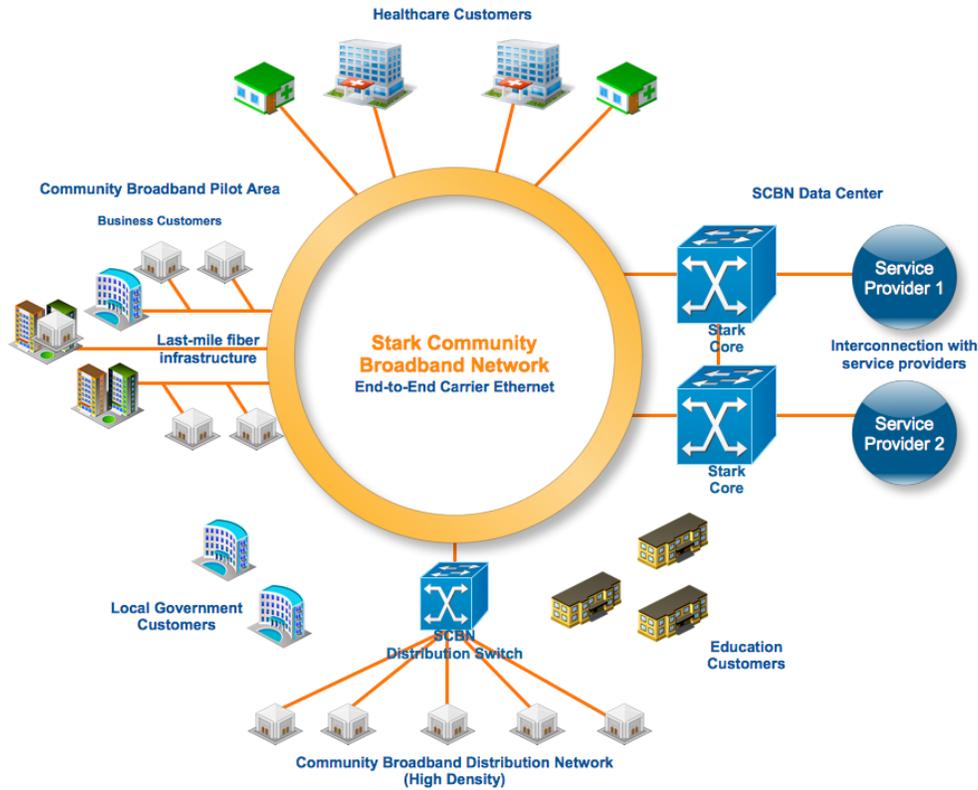
In addition, transport services would be made available to businesses, municipalities, and individual communities or neighborhoods as a component to serving the greater residential and small to medium business markets through last-mile investments.

Stark County must bring the community stakeholders to the table, and must have decision makers available to assist in development of a final plan to move the SCBN forward. Specific site data, current telecom spend, future plans and other key information that wasn't available for this Study, must be brought to bear so the community can develop consensus and most importantly to make informed decisions. This Study, including conceptual network designs, network specifications, and the resulting financial models have been developed to provide a high-level understanding of the opportunity to develop a Stark County Broadband Authority. The SCBA would administer the Stark Community Broadband Network and more specifically be required to execute the business and fulfill specific metrics that must be met to ensure long-term sustainability. These assumptions and final determinations of partners will require much more detail before any agreement to move forward or to finalize any partnerships.

The SCBN backbone would provide high capacity fiber-optic cables throughout the major corridors of the Stark County urban core initially. The proposed backbone includes nearly 100 miles of conduit and fiber-optic cable. Network access points should be placed along fiber routes to allow easy interconnection with facilities, county and municipal assets, business districts, vertical assets, and neighborhoods. Additionally, the conceptual backbone design, illustrated in Figure 39, route layouts have been optimized to border a number of commercial and residential areas of the initial service area. This will allow the backbone to be used in the future to facilitate potential connectivity to homes and businesses. This plan does not envision the County providing such services directly but allows the communities to decide for themselves on how best to serve their own constituents under various last-mile business model scenarios.

As depicted below in , the Stark Community Broadband Network would be architected in a ring topology. The SCBN would interconnect data center facilities, service providers, community anchors, and potentially businesses. The SCBN would focus primarily on lit transport carrier Ethernet services, interconnecting all sites at 1 Gb and 10 Gb speeds. The lit service would include route diversity and fully redundant self-healing rings.

FIGURE 41: STARK COMMUNITY BROADBAND NETWORK - LOGICAL CONCEPTUAL



## BACKBONE ROUTES AND SPECIFICATIONS

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### ADOPT BROADBAND INFRASTRUCTURE AND FIBER OPTIC STANDARDS

The proposed middle-mile fiber backbone, provides high capacity fiber-optic cables throughout the major corridors of the Stark County urban core. It includes proposed underground and aerial construction which is necessary to connect all identified public anchors and to address other community based needs. The construction proposed in this plan incorporates several high-speed fiber rings resulting in a robust, redundant, and reliable backbone fiber network. Access points are strategically placed throughout the fiber routes to allow easy interconnection with facilities, community assets, business districts, and neighborhoods.

Initial network routes focused heavily on the placement of conduit and fiber through major corridors, while future routes should be strategically planned to facilitate easier connectivity to businesses and or residential communities that may desire access in the future.

The fiber backbone will generally consist of 288-432-count fiber-optic cable on major routes. This cable size will enable the SCBA to allocate capacity among multiple applications, including:

- Community/government functions
- Future smart city applications
- Community anchor connections
- Broadband applications
- Revenue generation
- Spare capacity

Secondary or lateral fiber will consist of 12 to 24-strand cable connecting individual community organizations, MDUs, and other end user locations. Certain key facilities may have larger count cables; however that will be decided in future planning. Individual connections to businesses may be a smaller 2 count drop cable. The network will use an in-and-out splicing design that allows community anchors and points of interest to interconnect their locations in a “ring” topology, if required, that supports high redundancy for their communications needs. A range of specialized connections will be made to accommodate additional traffic signal, smart technology, and broadband applications that should be individually engineered based on the application.

General specifications of the backbone are found below. Actual specifications may change based on the forthcoming engineering design; however, it is important that the SCBA maintain compliance with these key specifications for the region to achieve its goals.

### Outside Plant Underground Specifications

<u>Basic Fiber Specifications</u>	<u>Basic Conduit Specifications</u>
<ul style="list-style-type: none"><li>• <u>Backbone cable size – 288/432 count fiber</u></li><li>• <u>Lateral cable size – 12/24 count fiber</u></li><li>• <u>Single mode, loose-tube non-armored cable</u></li><li>• <u>Jacketed central member</u></li><li>• <u>Outer polyethylene jacket</u></li><li>• <u>Sequential markings in meters</u></li><li>• <u>All dielectric</u></li><li>• <u>Gel-free/dry buffer tubes</u></li><li>• <u>12 fibers per buffer tube</u></li><li>• <u>Color coded buffer tubes based on ANSI/TIA/EIA 598-B Standard Colors</u></li></ul>	<ul style="list-style-type: none"><li>• <u>36" minimum acceptable depth</u></li><li>• <u>(3) 2" HDPE smooth wall reel-mounted pipe depending on application</u></li><li>• <u>Warning tape installed at 12" or 18"</u></li><li>• <u>Maximum fill ratio of 50%</u></li><li>• <u>Maxcell or smaller innerduct</u></li><li>• <u>Vault placement at intersections, every 500ft in commercial corridors</u></li><li>• <u>Vaults sized appropriately to house underground lid-mounted pedestals and splice enclosures</u></li></ul>

### Outside Plant Overhead (aerial) Specifications

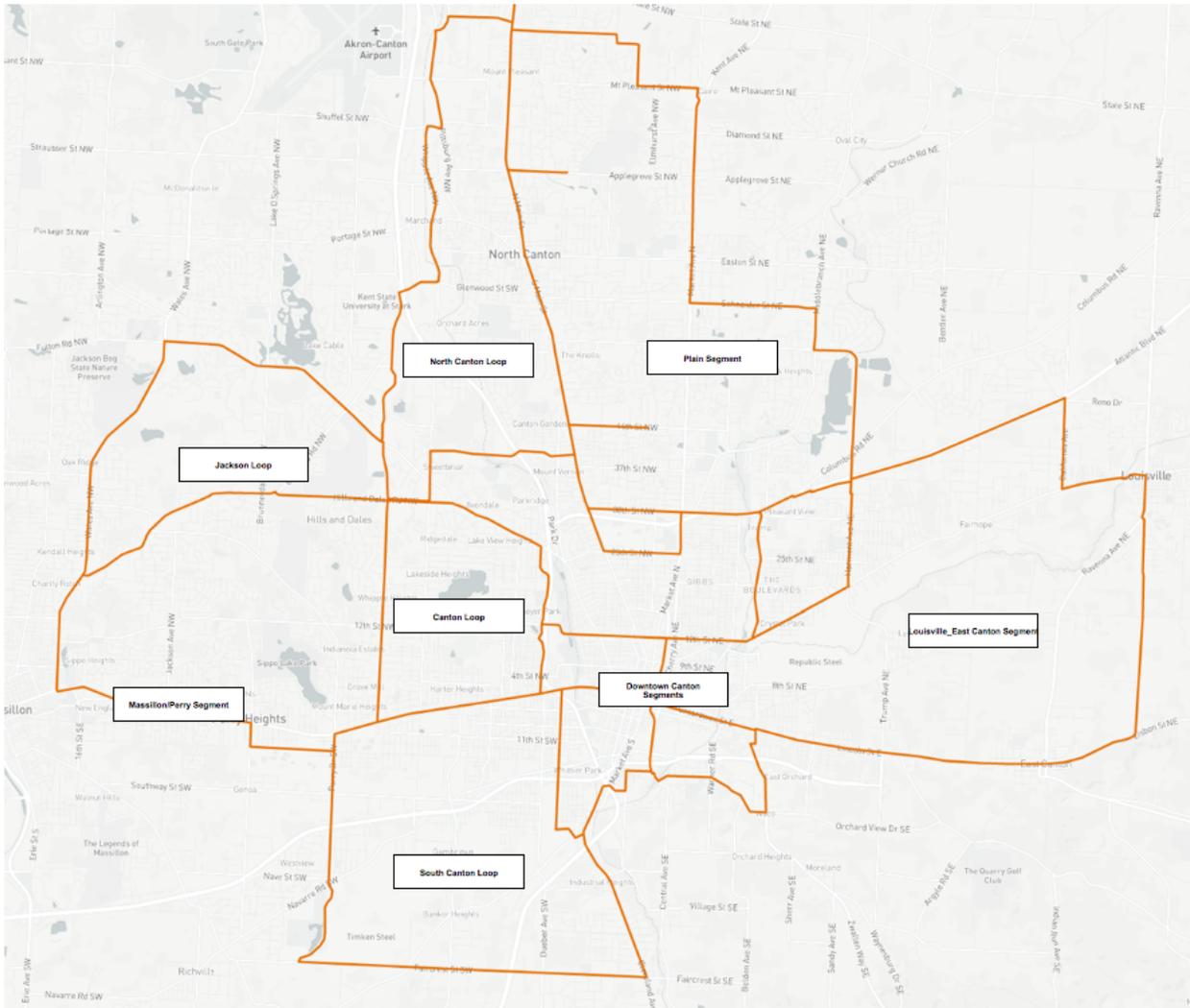
Aerial specifications are going to be highly dependent on the pole segments and ownership. Actual pole routes selection will occur in the network. A future design engineering study will identify the final overhead requirements and specifications.

Overhead placement standards and specifications should be coordinated through the public policy process as well and should be represented amongst all willing community partners.

### PROPOSED BACKBONE ROUTES

The following middle-mile backbone routes have been identified for deployment of the SCBN, routed to optimize the connections to area community anchors, data center facilities, and other key connection points throughout the area. As depicted below, the backbone routes include several fiber rings that are routed through key areas of the Stark County urban core, including areas like Jackson Township, North Canton, Louisville, East Canton, Canton, South Canton, Plain Township, Perry Township and Massillon.

FIGURE 42: BACKBONE ROUTES: SCBN ROUTES



The figures below include images of several of the individual fiber rings and linear segments.

FIGURE 43: BACKBONE ROUTES: JACKSON LOOP

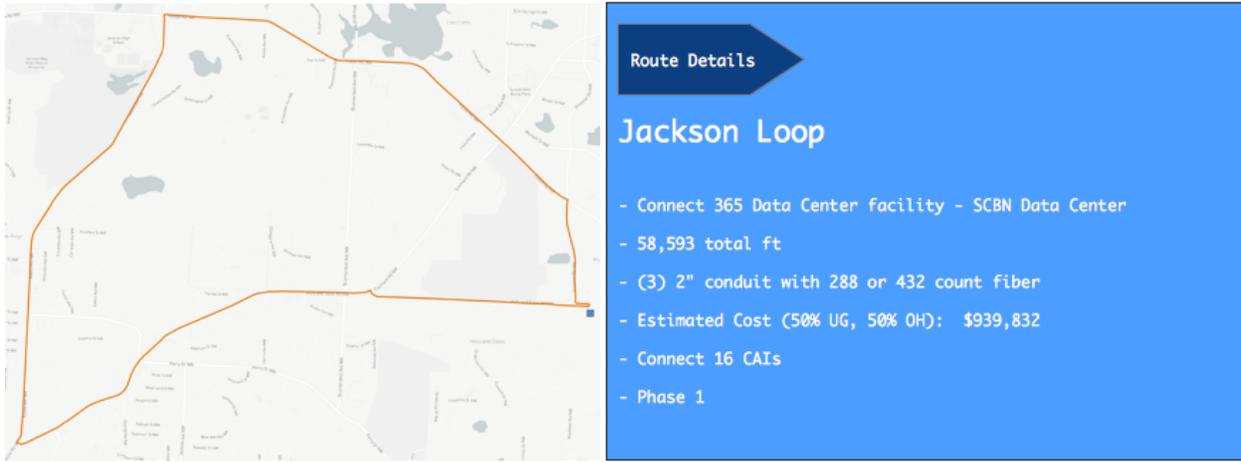


FIGURE 44: BACKBONE ROUTE NORTH CANTON LOOP



FIGURE 45: BACKBONE ROUTES: CANTON LOOP

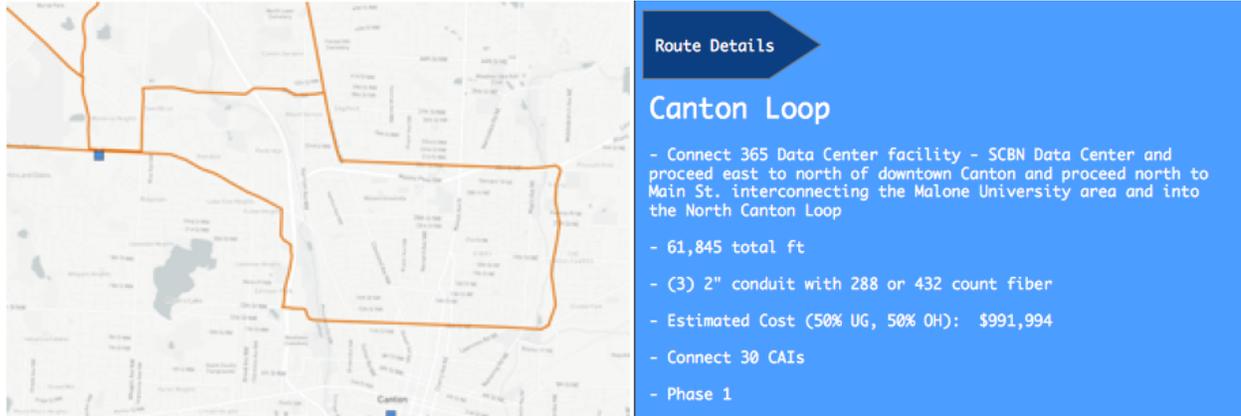


FIGURE 46: BACKBONE ROUTES: SOUTH CANTON LOOP

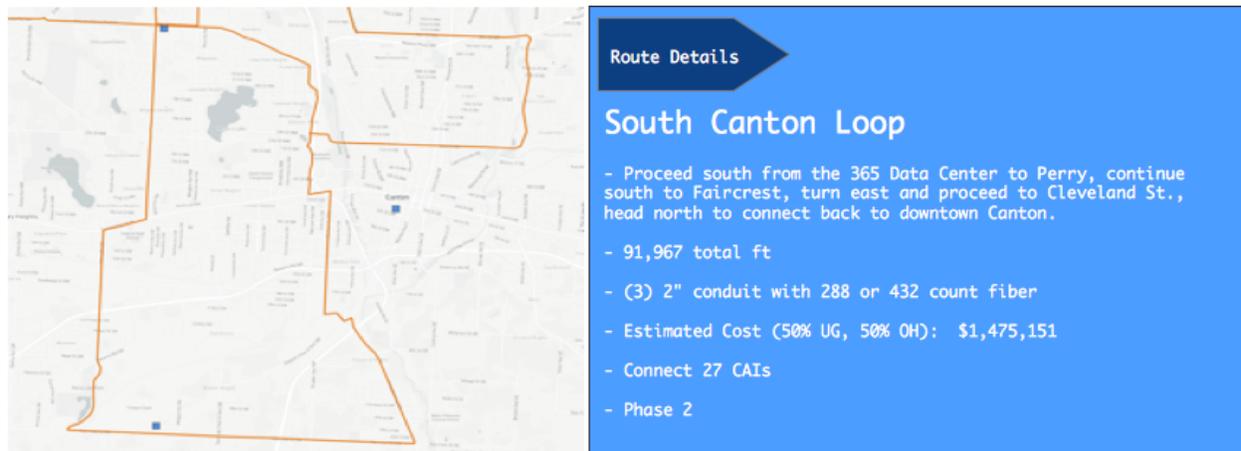


FIGURE 47: BACKBONE ROUTES: LOUISVILLE/EAST CANTON LOOP

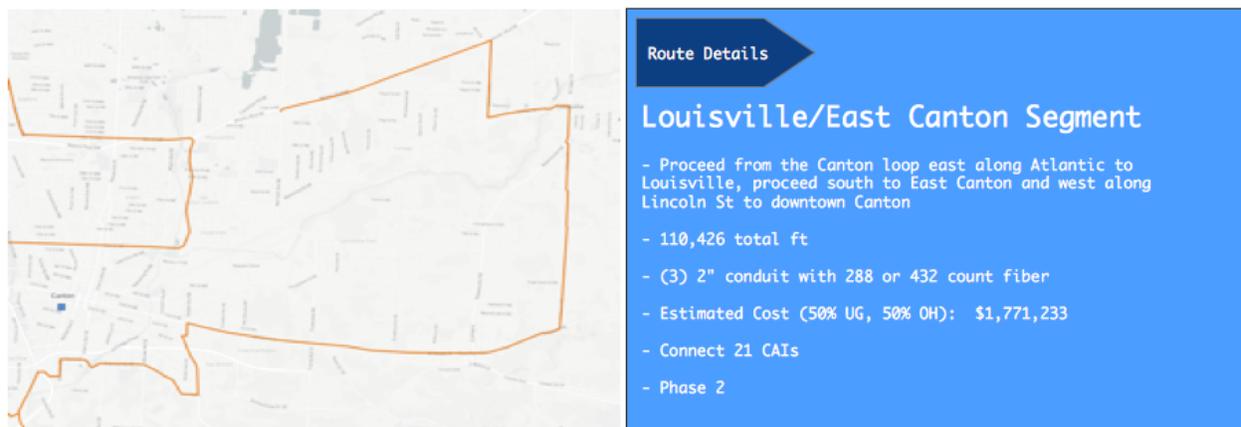


FIGURE 48: BACKBONE ROUTES: PLAIN SEGMENT

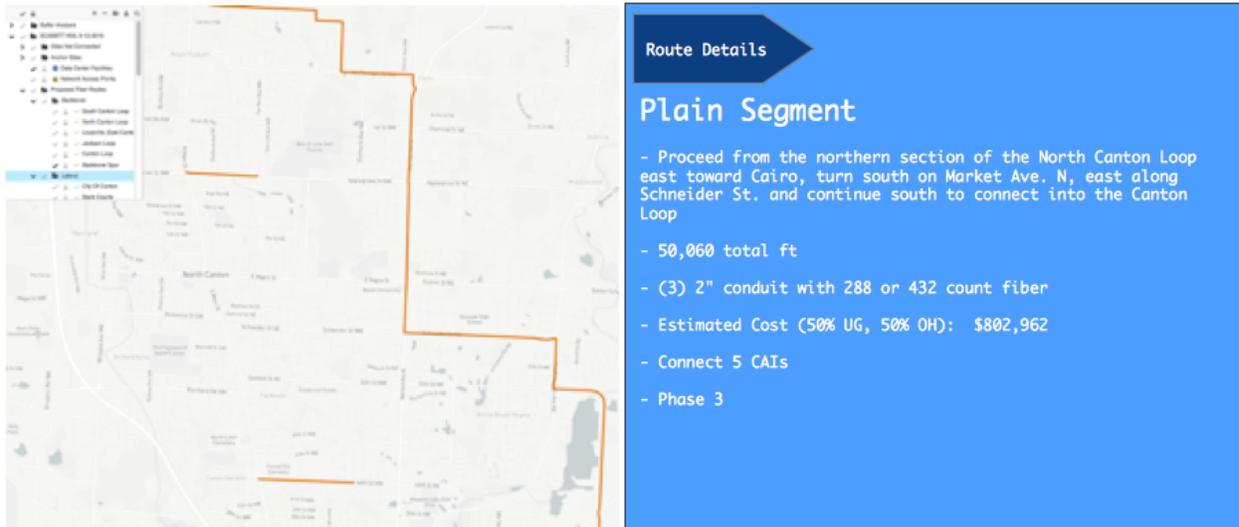


FIGURE 49: BACKBONE ROUTES: DOWNTOWN CANTON SEGMENT

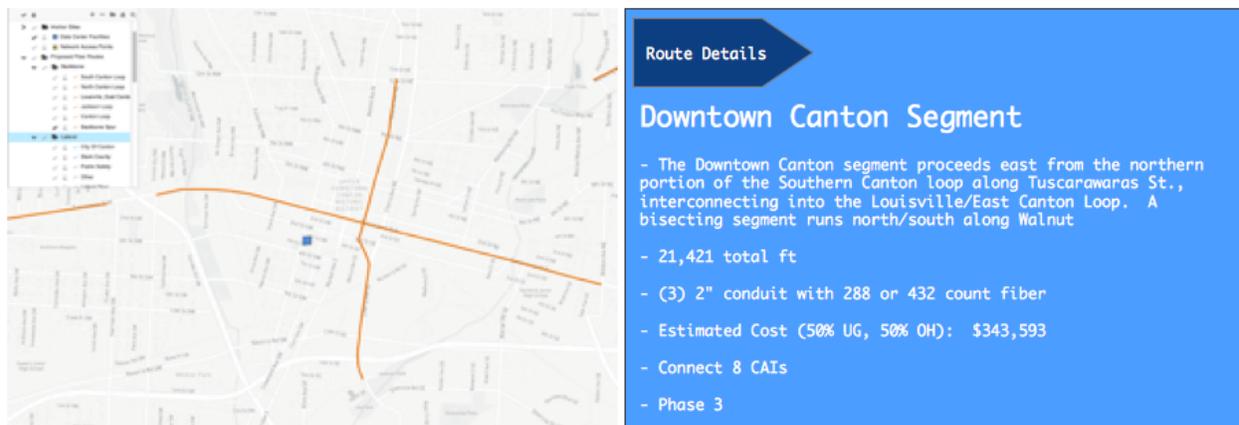
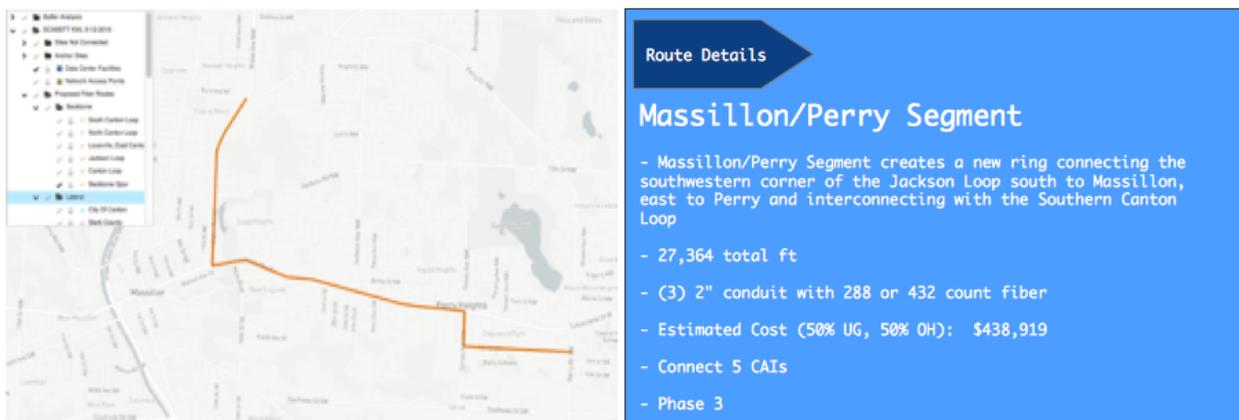


FIGURE 50: BACKBONE ROUTES: MASSILLON/PERRY SEGMENT



The proposed backbone includes over 513,000 feet or 97.18 miles of backbone fiber. While several different construction methods have been used to develop cost estimates, the model in this report focuses on utilizing a 50% UG (underground) and 50% OH (overhead – aerial) mix of infrastructure placement. While using aerial reduces the overall capital costs significantly, it does add additional operating costs into the model as pole attachment and other aerial related fees must now be accounted for. Below in Table 10, we’ve provided an analysis on the various construction methods and related cost estimates.

TABLE 10: BACKBONE ROUTE CONSTRUCTION METHODS

Construction Method	Total Miles	OH	UG	Total Cost	Poles Required	Pole Attachment Annual Expense
<b>0% OH / 100% UG</b>	97.18	\$0	\$12,094,474	<b>\$12,094,474</b>	<b>0</b>	<b>\$0</b>
<b>25% OH / 75% UG</b>	97.18	\$1,090,401	\$9,070,856	<b>\$10,161,257</b>	<b>713</b>	<b>\$57,014</b>
<b>50% OH / 50% UG</b>	97.18	\$2,180,803	\$6,047,237	<b>\$8,228,040</b>	<b>1,425</b>	<b>\$114,029</b>
<b>75% OH / 25% UG</b>	97.18	\$3,271,204	\$3,023,619	<b>\$6,294,822</b>	<b>2,138</b>	<b>\$171,043</b>

\*The shaded, 50% OH/ 50% UG method is utilized in this study’s supporting financial model.

As previously stated, this Study and supporting financial model utilizes the 50% UG / 50% OH construction method, pegging total capital cost for backbone buildout at \$8,228,040 and includes 1,425 estimated pole attachments. Table 11 below, outlines the costs per fiber loop and segment and includes a 10% construction contingency which brings total backbone construction to \$9,053,666 or \$93,164 per mile. We believe this cost can be value engineered greatly with the proper partnerships by identifying and utilizing existing local government conduit or through the coordination of active capital projects (next 3 to 5 years). Furthermore, final route selection and engineering design will likely yield additional savings and is meant to provide much more accurate construction estimates.

TABLE 11: BACKBONE ROUTE CONSTRUCTION COSTS BY FIBER LOOP AND SEGMENT

Roadway/Corridor	Length/ Distance	Estimated Construction	Phase of Construction	Anchors Connected
Jackson Loop	11.10 Miles	\$939,832	Phase 1	16
North Canton Loop	17.32 Miles	\$1,466,922	Phase 1	28
Canton Loop	11.71 Miles	\$991,994	Phase 1	30
South Canton Loop	17.42 Miles	\$1,475,151	Phase 2	27
Louisville/East Canton Segment	20.91 Miles	\$1,771,233	Phase 2	21
Plain Segment	9.48 Miles	\$802,962	Phase 3	5
Canton Downtown Segment	4.06 Miles	\$343,593	Phase 3	8
Massillon/Perry Segment	5.18 Miles	\$438,919	Phase 3	5
10% Contingency		\$823,061		
<b>Total:</b>	<b>97.18 Miles</b>	<b>\$9,053,666</b>		<b>140</b>

#### ASSUMPTIONS UTILIZED

\$23.57 per foot underground construction (new)

\$8.50 per foot aerial construction (pole attachment fees are in the financial model as OPEX)

Aerial span lengths – 180’

\$80 pole attachment fee – per pole per year

#### PROPOSED BACKBONE PHASING PLAN

Due to the overall size and distance on the SCBN, it is recommended that it be built in phases over multiple years. Magellan has outlined a phasing plan, which includes the full buildout of 97.18 miles over three different phases, Phases 1, 2, and 3. The phasing has been optimized to connect the most number of anchors as early as possible and includes a connection into the Secure Data 365 Data Center in the first phase, allowing the network to come online in stages before it has been fully built out to all anchors identified throughout this Study.

This phasing plan is incorporated in the financial model as outlined below.

TABLE 12: BACKBONE ROUTE CONSTRUCTION COSTS BY FIBER LOOP AND SEGMENT

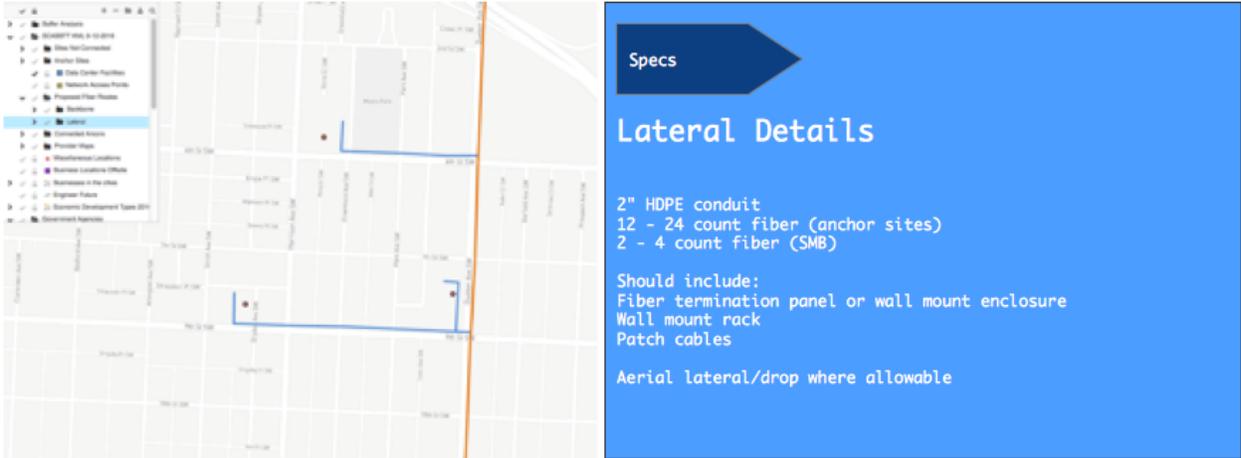
Phase	Length/ Distance	Estimated Construction	Anchors Connected
<b>Phase 1</b>	40.13 Miles	\$3,398,748	74
<b>Phase 2</b>	38.33 Miles	\$3,246,384	48
<b>Phase 3</b>	18.72 Miles	\$1,585,474	18
<b>10% Contingency</b>		\$823,061	
<b>Total:</b>	<b>97.18 Miles</b>	<b>\$9,053,666</b>	<b>140</b>

Backbone Construction Costs: \$9,053,666

**PROPOSED LATERALS**

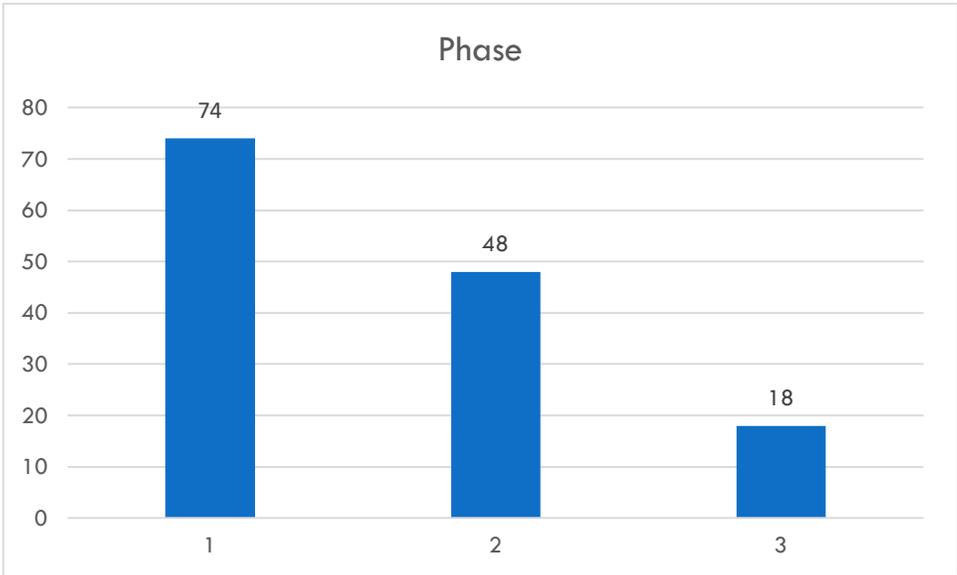
140 community anchors have been identified that could take service from the network at some period during the initial 3-year buildout. A lateral (fiber extension) will have to be built to connect each facility that will be included in the network buildout. This is a spur that is fed from a backbone route. The lateral will begin in the ROW near the subject facility and will end at the outside of the facility where a transition to the inside of the building will occur. This will be considered the demarcation point (demarc), where the fiber will terminate in a fiber term panel, and a 1/3 equipment rack will be installed with the network CPE and battery backup.

FIGURE 51: SAMPLE LATERAL (BLUE)



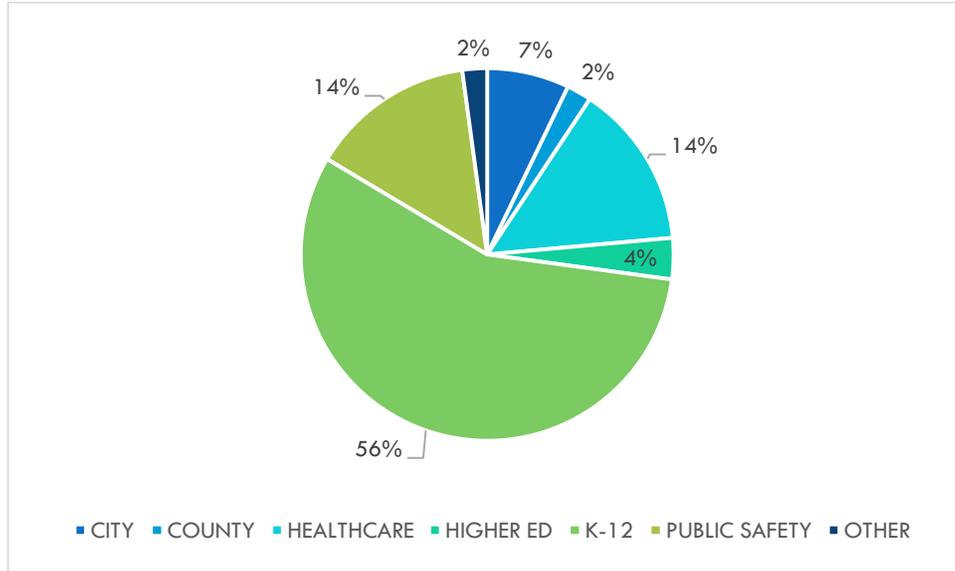
Lateral build out will occur with the backbone phasing plan, identifying specific community anchors along the route and connecting the facilities as the network buildout occurs. As outlined below in Figure 52, 74 anchors are slated for connection in Phase 1, 48 in Phase 2, and 18 in Phase 3.

FIGURE 52: COMMUNITY ANCHORS BY PHASE



K-12 schools will be the primary beneficiary of the SCBN at first, as nearly 80 schools are planned for connection. As depicted in Figure 53 below, over 56% of the community anchors identified in this Study are K-12 schools. This is followed by healthcare and public safety sites at 14% each.

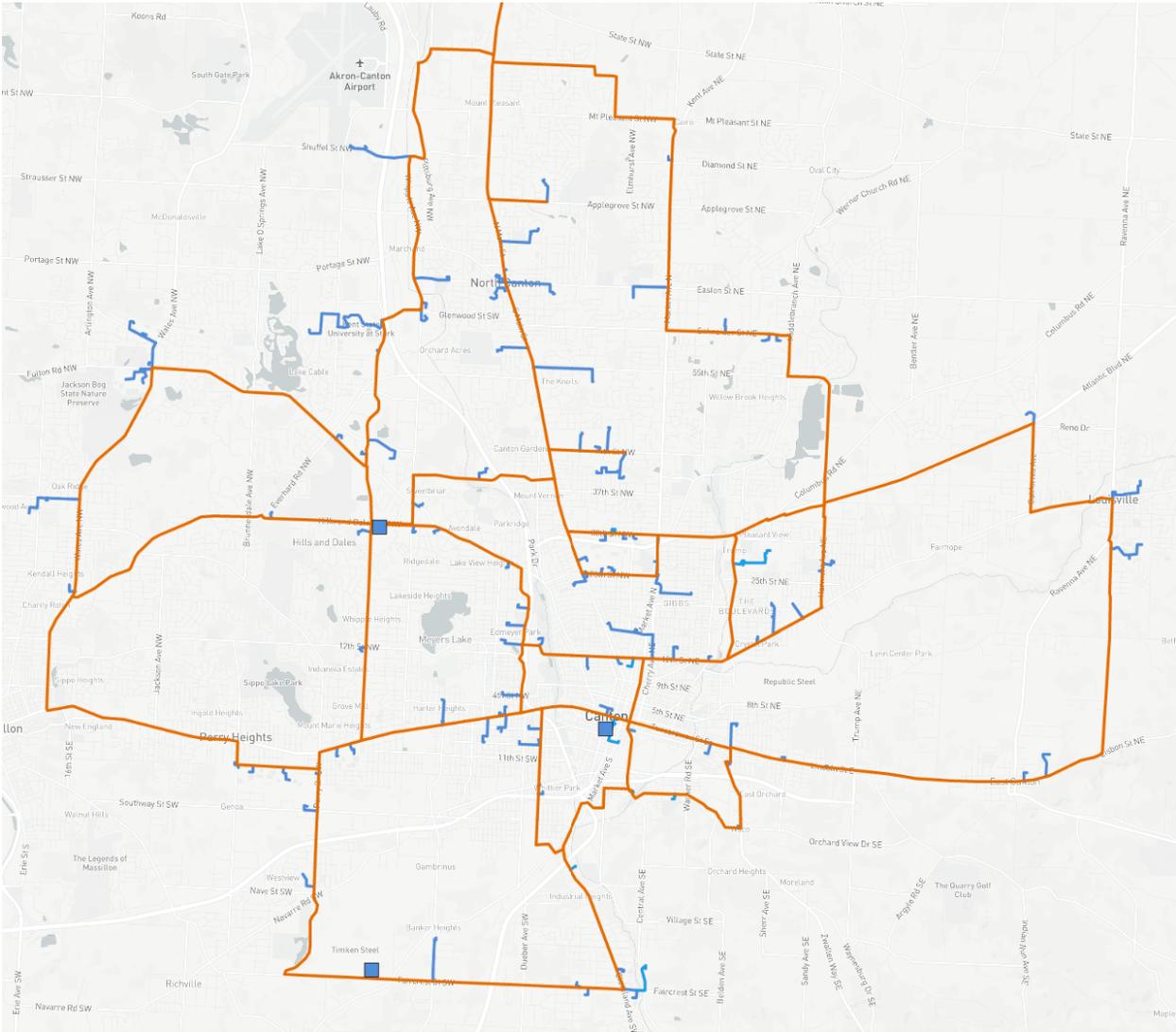
FIGURE 53: COMMUNITY ANCHORS CONNECTED BY CATEGORY



Laterals will consist of 12-24 count fiber-optic cable that will be installed inside a 2” conduit. In the Study and supporting financial model, all laterals have been assumed to be of UG (underground) construction, as actual site visits and walkouts were not performed at this level of the project. During actual design and engineering study, actual laterals can be value engineered to provide for OH (aerial) construction if deemed appropriate.

Laterals to businesses or other community based network components such as traffic cabinets, surveillance and wireless access points may all be interconnected to the network with smaller 2 or 4 count fiber cable – again, depending on final design requirements.

FIGURE 54: LATERALS TO CONNECT COMMUNITY ANCHORS (SHOWN IN BLUE)



As outlined, there are 140 community anchors sites and facilities identified for initial connection. These sites include city facilities, county facilities, healthcare sites, higher education, K-12, Public Safety, and other sites identified. All 140 laterals are estimated to cost \$3,433,805 inclusive of a 10% contingency. The overwhelming majority of the sites connected are K-12 schools and supporting facilities, followed by public safety and healthcare. As outlined in Figure 55, below, K-12 school laterals account for over \$2 million of the \$3.4 million estimated.

FIGURE 55: LATERAL CONSTRUCTION COSTS BY ANCHOR TYPE GRAPH

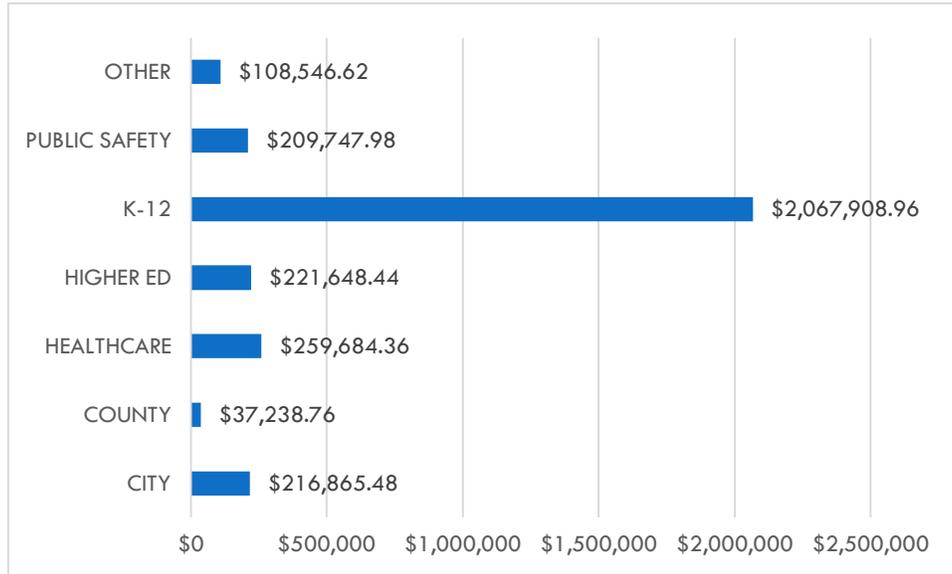


FIGURE 56: LATERAL CONSTRUCTION COSTS BY ANCHOR TYPE

Anchor Type	Length/Distance	Estimated Construction	Anchors Connected
<b>City</b>	2.16 Miles	\$216,865	10
<b>County</b>	.37 Miles	\$37,239	3
<b>Healthcare</b>	2.59 Miles	\$259,684	20
<b>Higher Ed</b>	2.21 Miles	\$221,648	5
<b>K-12</b>	20.63 Miles	\$2,067,909	79
<b>Public Safety</b>	2.57 Miles	\$209,748	20
<b>Other</b>	1.09 Miles	\$108,547	3
<b>10% Contingency</b>		\$312,164	
<b>Total:</b>	<b>31.64 Miles</b>	<b>\$3,433,805</b>	<b>140</b>

Lateral Construction Costs: \$3,433,805

## FACILITIES

### Colocation at Secure Data 365

The SCBN would require diverse fiber paths into the Secure Data 365 Data Center, and the conceptual design has accounted for this. Rack space is available for lease in this facility as well as other complimentary services. The SCBA should investigate opportunities to connect into Akron or Cleveland as well; however these will likely be leased transport circuits from other wholesale carriers. There may be opportunities to purchase excess fiber capacity or lease/IRU dark fiber to reach Akron – this should be further investigated. In addition to connectivity, community anchors and specifically municipalities could utilize this data center facility for municipal operations, deploying critical assets within the leased space. Potential business users could benefit greatly from access to these facilities for colocation and data backup.

Secure Data 365 Data Center provides partial racks, full racks, and cages, although cages are not preferred. 208v AC power is delivered in A/B configuration and power is billed as incurred. The Data Center also provides cross connects at no charge, and remote hands or other technical work if needed. The SCBA could potentially partner with the Secure Data 365 Data Center team for Network Operations.

#### Secure Data 365 Data Center Pricing

- Wholesale Internet (IP) - <\$10 per Mb
- Full Cabinet - \$1,200 / Half Cabinet - \$600 / Third Cabinet - \$300
- Energy Usage (billed as utilized) - \$0.22 kWh
- Remote Hands - \$150 per hour (ad hoc request)
- Remote Hands - \$100 per hour (scheduled request)

The Secure Data 365 Data Center includes many regional and national providers who collocate in the facility. The current providers include Level 3, Everstream, TWC, Zayo, Windstream, T1 Co., AT&T, FirstCommunications, and the WISP Lightspeed Technologies. Each of these providers is a potential customer for SCBN from day one of operation. Access to this facility will put the Stark Community and its users a single hop away from major Internet PoPs, not relying solely on private local providers for this access.

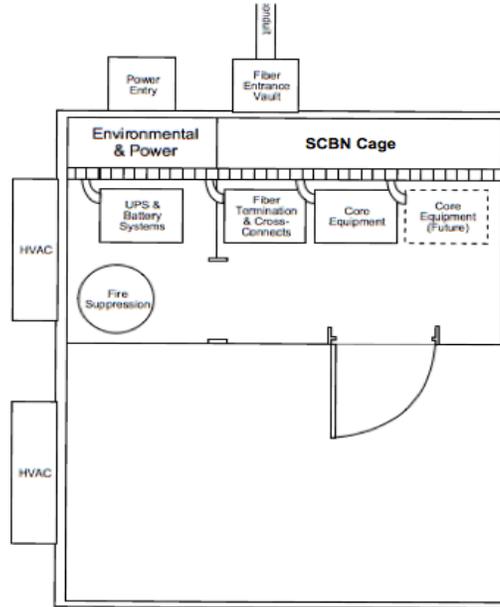
### Additional Nodes – Alternate Data Center or Preformed Huts

The proposed network architecture, as documented above includes up to four carrier Ethernet nodes configured in a mesh fiber topology. One node will be located in the Secure Data 365 Data Center, while the additional nodes will be strategically placed throughout the service area at major intersections of fiber backbone routes. As an alternative, these additional nodes could be placed in additional data center facilities that are strategically located around the service area, and can include the TimkenSteel Data Center if it was made available, or the AEP data center in downtown Canton. Should sufficient data center facilities not be identified, we recommend the usage of a 10ft x 10ft prefab shelter as outlined below in

Figure 57, with full buildout of power, fire suppression, security, and HVAC. These units can be preordered to spec and shipped directly to the locations for install. Generators, racks, ladder racks, and other supporting components will be required as well.

At least two diverse fiber paths should be pulled into each location to provide for physical redundancy.

FIGURE 57: PREFAB 10'X10' ENVIRONMENTALLY CONTROLLED FACILITY



**Admin Offices**

Administrative facilities may be required to house staff associated with the Authority. This could include existing space that could be donated by a community partner or leased space. All staffing costs in this plan have been considered to be outsourced at this point with no actual Authority staffing defined. Outsourcing costs have been accounted for in the financial model.

**Network Operations and Operations Center**

Network operations facilities have not been identified at this point, however funding for outsourced network operations is included in the model and is the recommended approach at this point of the Study. Staffing decisions will be made once a final governance structure has been selected. There are many network operators located in the Ohio market who could be hired to operate the SCBN. The County or any community partner could have a difficult time gearing up to operate a carrier class network operations center and staff. Execution risk is much more tempered using an experienced outsourced network operator over trying to stand up and staff a county department.

Network operations outsourcing costs have been accounted for in the financial model.

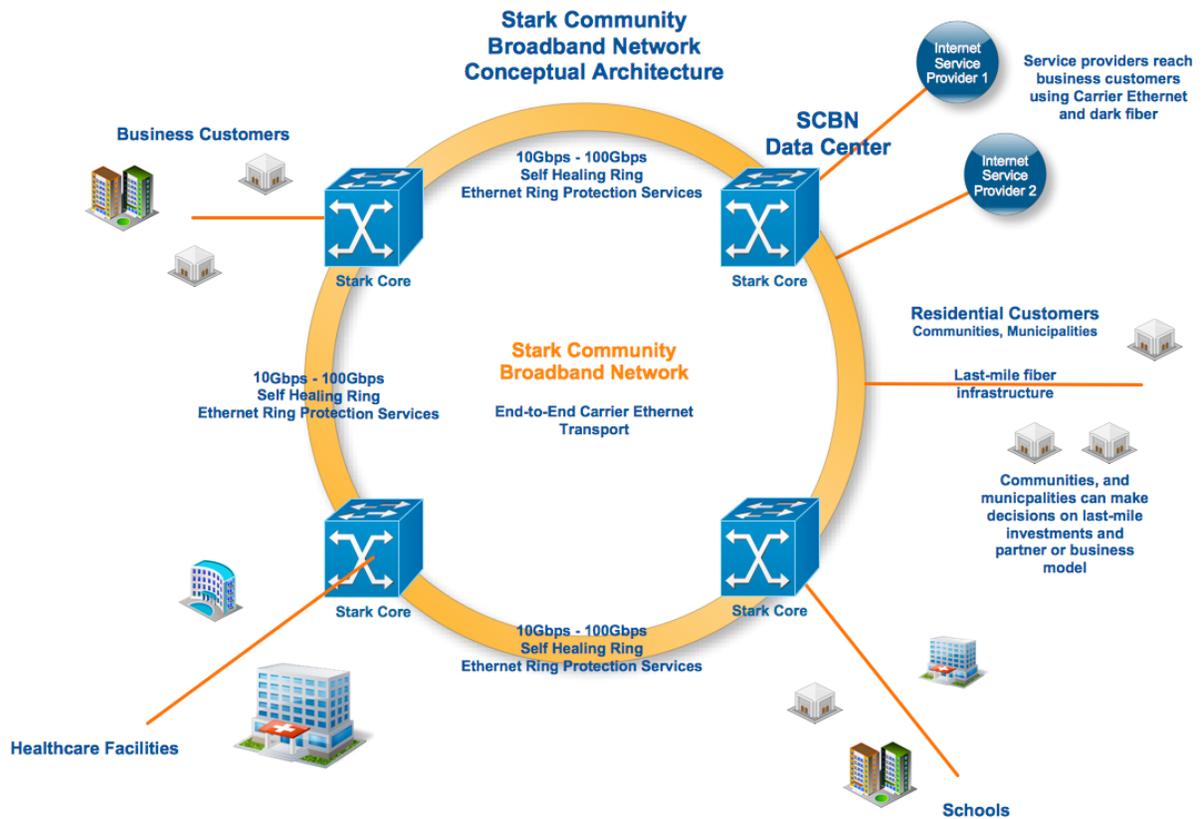
Facility and Building Capital Costs: \$300,000

## CORE NETWORK AND OPERATIONS REQUIREMENTS

### Core Electronics

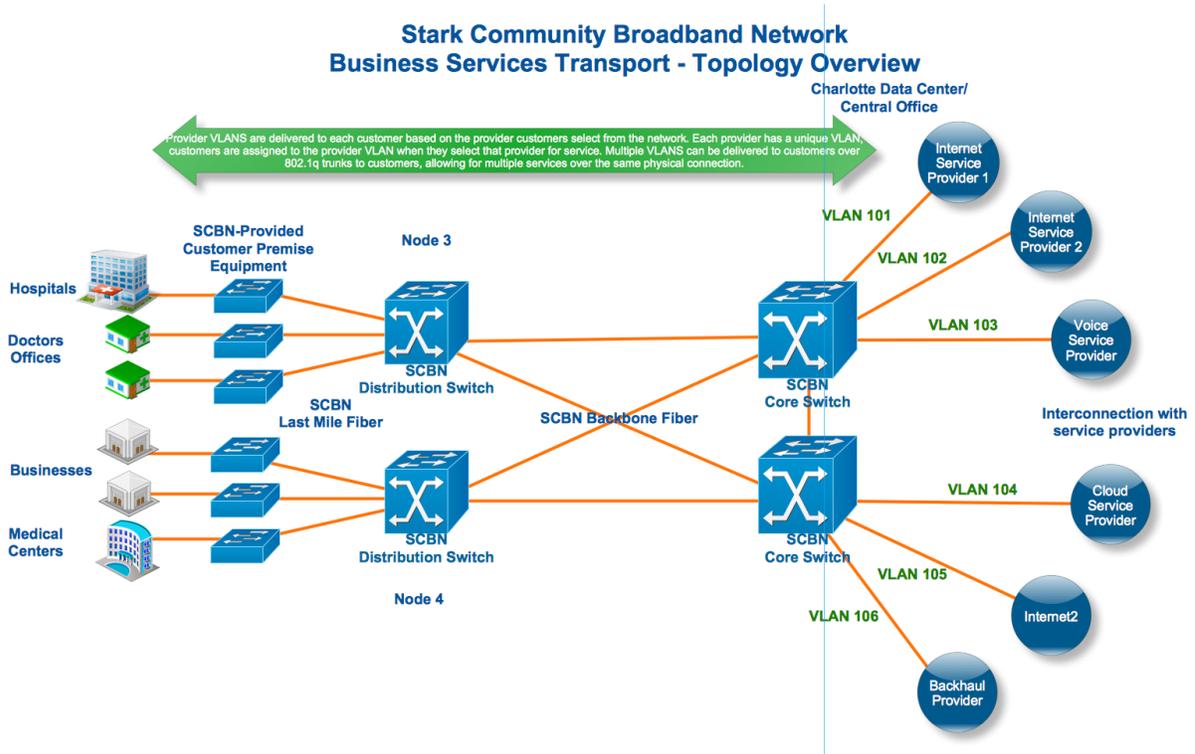
The core electronics connect the remote distribution/aggregation sites located throughout the service area, back to the Secure Data 365 Data Center where the SCBN core network and supporting systems will reside. This will interconnect the users around the community to dozens of regional and national providers. As depicted below in Figure 58, the network architecture calls for up to four carrier Ethernet nodes placed strategically throughout the service area. One of these nodes will be located in the Secure Data 365 Data Center, while the others are located in alternate data center facilities or through use of prefab facilities. The carrier Ethernet switches will aggregate all demand onto a high-speed, fully redundant lit backbone at speeds of 10 Gbps to 40 Gbps initially. The aggregation switches should support upgrades to 100 Gbps interfaces. The aggregation switches must provide for self-healing ring functionality utilizing Ethernet Ring Protection Services or similar protocols capable of providing sub 50ms failover and recovery.

FIGURE 58: STARK COMMUNITY BROADBAND NETWORK -CONCEPTUAL ARCHITECTURE



The SCBN aggregation nodes will aggregate anchors, businesses and other users traffic from the localized node service area, and will route traffic across the SCBN backbone. This will allow users to connect anywhere throughout the service area and “pop off” to any other location on the network, including data center facilities, and other provider networks. Organizations will have the ability to route fiber connections to multiple SCBN nodes if required to provide full site redundancy and failover.

FIGURE 59: STARK COMMUNITY BROADBAND NETWORK - AGGREGATION NODES CONCEPTUAL



In addition to the carrier Ethernet transport switches, additional components have been identified to support the operational requirements of the SCBN. These components include a core routing platform, switches, servers and storage.

TABLE 13: DATA CENTER/NETWORK EQUIPMENT COST ESTIMATES

Data Center / Network Equipment	Estimate
Carrier Ethernet Transport	\$1,000,000
Core Routing	\$250,000
Switches, Servers, Storage	\$100,000
<b>Total:</b>	<b>\$1,350,000</b>

## Network Management

### **Bandwidth Management and Visibility**

As SCBA's services grow, visibility and control of traffic will become a critical requirement for network operations. Bandwidth management and visibility tools will allow SCBA to understand the applications that run across its network, traffic types, quantities, sources, and destinations. It will also allow SCBA to identify suspicious and malicious traffic, including darknet, attack, phishing, Trojan, virus, and denial of service traffic on the network and enable SCBA to take action to block this traffic when required. Preventing these types of traffic from crossing the network will result in lower service-affecting customer issues and mitigate potentially threatening infrastructure-level attacks on the SCBA core network. Implementation of these systems are generally costly, between \$75,000 - \$125,000, but provide a strong ROI by reducing operational issues and customer outages. The platform that is widely used by most ISPs is Arbor Networks Peakflow.

**Arbor Networks Peakflow SP** - [www.arbornetworks.com](http://www.arbornetworks.com)

Arbor Peakflow products are deployed next to critical services—in the backbone, the peering/transit edge and customer edges of service provider networks—to detect, analyze, and mitigate a broad range of network threats using IP flow and application data.

### **Capacity Management System**

Similar to the bandwidth management and visibility solution, a capacity management solution will be an integral part of network management for SCBA. This system should allow SCBA to manage transport capacity on its network, identifying long-term traffic patterns and usage on the network. It will be important for SCBA to manage both protected and unprotected capacity to ensure it isn't oversubscribed in the event of a failure of one side of the ring(s). The capacity management system will enable SCBA to track usage of backbone resources and trigger points where upgrades are required.

In many cases, the bandwidth management and visibility system can provide capacity management functions, but it is important that the following features are available to accommodate SCBA's needs in delivering transport services:

- Real-time traffic graphing on layer 2 and any 3 interfaces
- Historical reporting of traffic with no averaging (peak values must be preserved)
- Aggregation of multiple traffic streams together into single traffic profiles
- Ability to report on SNMP based variables, both standard and enterprise specific
- Ability to generate alarms based on usage patterns (high, low, erratic)

### Software requirements

It's recommended that SCBA immediately invest in a telecom resource management system that provides documentation, inventory, work orders, and other relevant information about SCBA's telecom resources. These resources include outside plant, inside plant, equipment, and other relevant assets. This system will provide documentation, inventory, tracking, processes, and management of SCBA's assets throughout the system. The system is particularly important to manage SCBA's outside plan fiber-optic network to ensure that SCBA has valid documentation and control of as-builts, splice plans, work orders, changes and other information pertaining to the outside plant network. Availability of this information is crucial for both managing the existing network and future system expansion. These systems are also important for tracking and depreciation of assets with a long economic life, such as conduit, fiber, towers, and facilities.

Several providers of telecom resource management systems include:

**Enghouse Networks** - [www.enghousenetworks.com](http://www.enghousenetworks.com)

**M4 Solutions by Mapcom (M4 Foundation, M4 Fiber, M4 Conduit, M4 Circuits)** - [www.mapcom.com](http://www.mapcom.com)

**Telvent** - [www.telvent.com](http://www.telvent.com)

### Maintenance agreements

All vendor partners, whether hardware or software, will charge annual maintenance to warranty their systems. Annual maintenance costs are typically a portion of your investment, however this model is changing. Maintenance agreements have been included in the financial model.

Core Networking and Software Costs - \$2,520,000

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## CUSTOMER PREMISE EQUIPMENT

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Customer Premise Equipment (CPE) will connect CAIs and businesses to the SCBN network. A range of CPE options should be evaluated which offer 1 Gbps and 10 Gbps interfaces, and that support MEF 2.0 framework and all complimentary carrier Ethernet technologies. The SCBN should provide a range of CPE devices which can support the SMB market, while providing specific features and functionality that will allow healthcare, public safety, and other enterprise level customers to contract for competitive carrier-class services from the SCBN.

These devices should scale to meet the edge requirements of any potential SCBN customer. Security, speeds, handoff interface, throughput and other requirements must all be evaluated.

CPE - \$5,000 per CAI

## OUTSOURCED CONTRACTS

### Network operations

The SCBA will need a core set of tools and systems to manage network electronics and related services on the network. Network management systems should be capable of monitoring and managing core and edge equipment. For SCBA's transport network, Magellan recommends that network management be outsourced, with a selected partner who will provide a multi-year agreement to monitor and manage the core network. We recommend that SCBA work closely with the partner to define the operational requirements of managing the network, particularly coordinating between their core network management functions and other operational support functions within SCBA. Specifically, it will be important for the partner to integrate with the following operational functions that will be managed by SCBA and its contractors:

- Outside plant management
- Inside plant management
- Service delivery
- Incident and outage management
- Provisioning and activations
- Upgrades (software/hardware)
- Terminations and suspensions

Additionally, written SOPs should be co-developed between SCBA and the partner that define the standards for the above listed operational functions. It's possible this partner will be a remote operator, therefore, these SOPs will be important to ensure that each party understands the expectations and requirements of the other, particularly during incidents and outages. The partner should also understand the metrics and performance requirements of SCBA's SLAs and be able to meet these requirements through its network management function. This process should be executed in part using the SLA Management Software that SCBA will be purchasing to manage customer SLAs.

### Fiber Outside Plant (OSP) O&M

The SCBA would issue an RFP for a multi-year O&M (Operations & Maintenance) contract, for a construction firm that would provide emergency restoration of the fiber infrastructure, and would be available to expand the network as needed. Through this contract, all incremental construction, splicing, and other tasks would be performed ensuring the fiber and supporting passive components are functioning at optimal levels at all times. Any wholesale provider or CAI will require SCBA to offer industry standard Service Level Agreements (SLA) on the fiber infrastructure and transport network ensuring their ability to guarantee its services to its downstream retail customers.

The SCBA's contractor would have the necessary expertise and equipment available to maintain the SCBN fiber-optic infrastructure. The contractor will be required to respond to emergency fiber cuts and service outages within an agreed upon service level, i.e., response within 1 hour, onsite within 3. Due to the redundant nature of the design, fiber cuts along core routes and between SCBN nodes will recover immediately using ring protections services. However, fiber cuts in the route or laterals to customers are subject to extended periods of service affecting outages, unless additional redundancy is built to specific customers who may be requesting this service. It will be important for the partner to be local to the region and with adequate staff and equipment to deploy at any time.

The OSP contractor would likely be responsible for all aspects of OSP operations and maintenance. The responsibility would include adds, moves, and changes associated with the network as well as standard fiber maintenance. These tasks could include:

- Adding or changing fiber routes and patching requirements
- Extending service drops to customers
- Extending backbone and lateral segments as required
- Relocating fiber routes due to roadway construction activity
- Tree trimming as necessary
- Maintaining accurate documentation on network and all modifications (adds/changes)
- Maintain splicing diagrams
- Emergency repair services (24x7x365)
- Design, engineering as necessary
- Fiber locating

Outsourced Network Ops and OSP O&M - \$450,000 annually

**KEY INITIATIVE 2: EXPAND CONNECTIONS TO REGIONAL DATA CENTERS AND COLOCATION FACILITIES**

The Stark County backbone network should be connected to at least one colocation facility in Stark County, and ideally to another major facility in Akron or Cleveland. By connecting the fiber network to one of these facilities, Stark will be able to interconnect with a number of broadband providers that reside in these additional facilities. This enables any organization or community with network access to also potentially be connected to these locations. This network would serve as the last mile network to connect community anchors and businesses to providers that are "on-net" in this data center. This creates important economic development benefits and reduces costs by:

- Enables community anchors and businesses to choose from multiple providers
- Allows businesses to purchase Internet services for lower costs
- Allows Stark County to control the costs of broadband to end users
- Supports needs for data storage, cloud solutions and colocation requirements
- Enables the County and other municipality to expand its own capabilities

**Akron Colocation**

Involta-Akron  
Level 3 Akron #2  
110 South Arlington St.

**Cleveland Colocation**

365 Data Center  
1255 Euclid Ave.

ByteGrid  
1525 Rockwell St.

vXchnge  
200 West Prospect Ave.

Fidelity Voice and Data  
1621 Euclid Ave.

**Best Practice**

**Santa Monica CityNET**

The City of Santa Monica connected its community fiber-optic network to the One Wilshire Data Center in Downtown Los Angeles. By doing so, businesses connected to the City's network were able to reach hundreds of broadband and cloud providers. It also allowed the City to benefit from direct data center access for its cloud, storage and disaster recovery needs.

Benefits:

- More competition and choice of providers
- More affordable broadband services
- Branding the City as a connected community, "ready for business"
- Marketing the City's broadband to site selectors and developers
- Supported data storage and cloud computing opportunities



Stark County has a carrier neutral data center located just east of Hills and Dales called the Secure Data 365 Data Center. This facility includes six carriers, including several national carriers such as AT&T, Level 3, TWC, Windstream, T1 Co., FirstCommunications, Lightspeed Technologies, and Zayo. In addition, Eversteam, a regional competitive fiber provider is located in the facility as well. Our team toured the Secure Data 365 data center and had an opportunity to speak with corporate leadership. This facility has the necessary network capabilities, providers and data center features to function as the core node for the Stark County network. TimkenSteel also reports operating a data center facility which could provide necessary floor space and could function as an alternative data center option. Finally, major data center facilities are located in Akron and Cleveland, and Stark County would be well served bringing these facilities on-net as well. In this case, the County may need to procure

transport connectivity to these facilities, however it would open the door to additional providers who may have interest in the Stark County region, and would again, incorporate many new services and infrastructure onto the Stark County network.

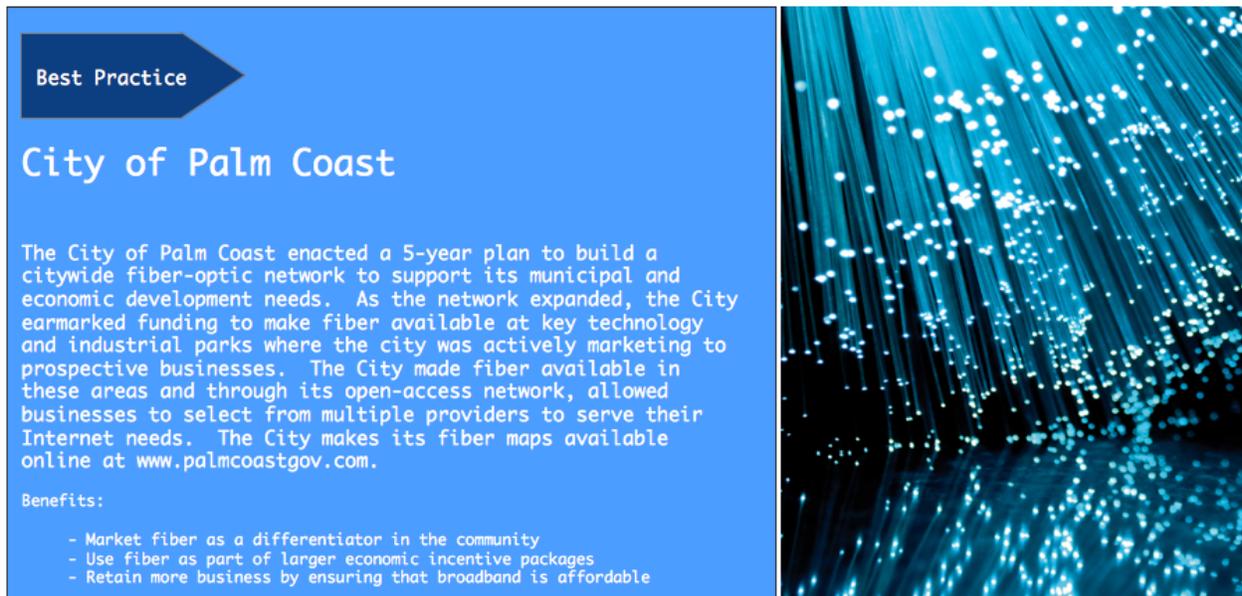
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### KEY INITIATIVE 3: EQUIP ECONOMIC DEVELOPMENT AREAS WITH FIBER CONNECTIVITY

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Corporate site selectors expect broadband. In fact, telecom and high-speed broadband have risen to the top four items required when organizations are looking for locations to move their companies. High-speed broadband is not a perk or special benefit. Locations with inadequate connectivity are quickly passed over for projects requiring this infrastructure. Communities lacking broadband infrastructure make the process of elimination easier for investment decision makers and influencers. That said, merely having broadband likely places a location on a level playing field when compared to other communities. In some cases, it will be the deciding factor for selection of a certain location.

Stark County needs to assure it is considered on this level playing field. The SCBA and its partners should identify key target areas for economic development and that adequate access to broadband is available. The proposed middle-mile network will be another tool to use to differentiate its community from others to prospective businesses. In this process the SCBA in coordination with County leaders could also develop incentives to prospective businesses by offering free or reduced cost fiber as part of its greater economic development packages. The County's economic development target areas could be equipped with fiber either directly or by the SCBA in conjunction with landowners and developers in the areas.



Best Practice

## City of Palm Coast

The City of Palm Coast enacted a 5-year plan to build a citywide fiber-optic network to support its municipal and economic development needs. As the network expanded, the City earmarked funding to make fiber available at key technology and industrial parks where the city was actively marketing to prospective businesses. The City made fiber available in these areas and through its open-access network, allowed businesses to select from multiple providers to serve their Internet needs. The City makes its fiber maps available online at [www.palmcoastgov.com](http://www.palmcoastgov.com).

Benefits:

- Market fiber as a differentiator in the community
- Use fiber as part of larger economic incentive packages
- Retain more business by ensuring that broadband is affordable

The SCBA should also identify key economic development facilities such as co-working spaces, business incubators, maker spaces and other vital workforce development assets. High-speed, low cost services are central to the evolution of startups and as documented in previous sections, will be crucial to supporting the economic transformation of Stark County.

**KEY INITIATIVE 4: TARGET BUSINESSES IN CLOSE PROXIMITY TO FIBER BACKBONE**

The middle-mile fiber network as proposed will pass thousands of businesses across Stark County's urban core. These routes have been specifically routed to pass through major business corridors to maximize the number of businesses that can make use of these assets for the purpose of potential future connectivity. Although direct last-mile retail services are not a part of the recommended roadmap, potential wholesale capacity can be made available for any retail provider that would like to access a potential customer. In addition, businesses can contract for transport connectivity to any On-Net data center facility. These routes will advance the County's economic development initiatives by providing a high-speed carrier neutral fiber backbone to area businesses.

As depicted below in the caption, there are 8,752 registered businesses within 1,000 feet of all planned fiber routes and 10,139 registered businesses within 1,500 feet. These businesses would have the opportunity to contract for service on an ICB (individual case basis), once pricing for construction has been determined. However, as a community based and focused operation, the SCBA will be able to take a longer approach on ROI, lowering the cost for connections.

**Opportunity**

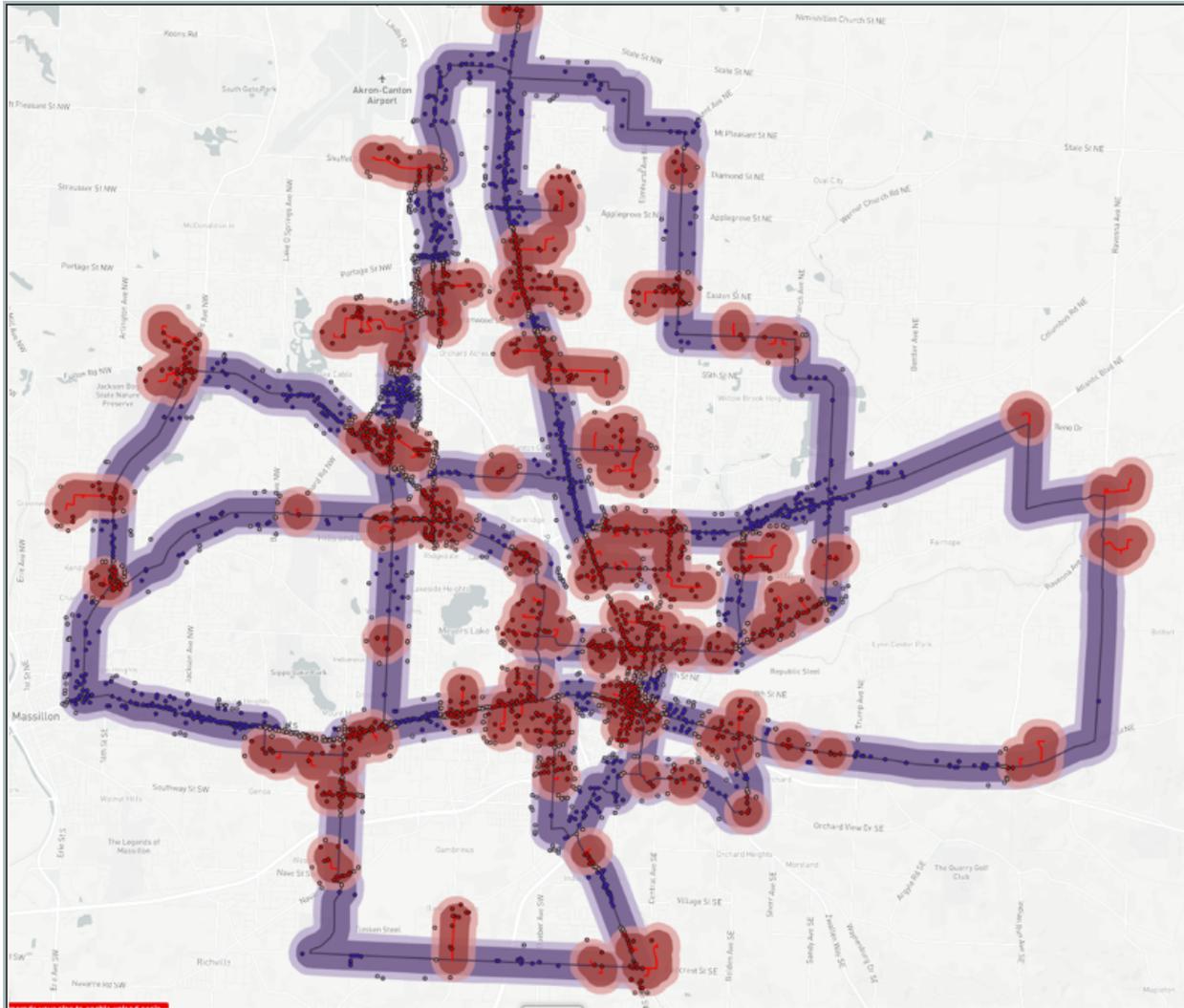
### How to Connect Businesses to Fiber

The proposed SCBN fiber routes will pass in close proximity to 10,139 Stark County-based businesses. For most of these businesses, fiber-based broadband services are unaffordable; yet, many small and medium businesses need this type of connectivity to support their growth.

The figure below illustrates a portion of the Stark urban core and a portion of the proposed fiber network surrounded by a 1,000 ft. and 1,500 ft. buffer. 1,000 ft. buffer is dark blue, while the 1,500 ft. buffer is light blue. Dots within the buffer areas represent Stark County-based businesses. These businesses are in close proximity to the SCBN and could connect to the fiber at relatively low costs delivering fiber-based broadband to businesses that today have primarily DSL and cable broadband services.

Stark should examine a number of ways its fiber network could be leveraged for economic development purposes and specifically to connect businesses that need fiber-based broadband services. A number of fiber leasing, wholesale and public-private-partnership models exist to employ the SCBN as a platform for business broadband.





**Opportunity**

- Network Buffer Analysis - 1,000ft. and 1,500ft.
- New Fiber Backbone - 97.18 Miles (513,130 ft.)
- New Fiber Laterals - 31.64 Miles (164,470 ft.)
- 140 Community Anchors Connected
- Nearly 9,000 Registered Stark County Businesses within 1,000 feet of new fiber
- Over 10,000 Registered Stark County Businesses within 1,500 feet of new fiber

The SCBN would provide lit transport for businesses that have interest in fiber based broadband services. The lit transport service would allow any business to access the Secure Data 365 Data Center and would allow them to select any provider they choose. Businesses would have access to many regional and national telecommunications carriers and cloud providers over the SCBN fiber network.

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## KEY INITIATIVE 5: DEVELOP LAST-MILE INVESTMENT FRAMEWORK AND FACILITATE DEPLOYMENT OF RESIDENTIAL FIBER TO THE HOME SERVICE

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Constructing the Stark County backbone will make fiber infrastructure available in close proximity to many of the County's neighborhoods. Although this network will not directly penetrate into neighborhoods, it can be used as a "jumping off point" to build fiber to the home services into the residential areas. In these cases, each community or neighborhood from a more macro level could work directly with any On-Net provider, providing high-speed broadband services to the residents. This may serve as a way to accelerate new residential deployments as many new providers would have access to these specific finite markets.

The fiber backbone has been designed to support high-capacity services such as fiber to the home. Interested providers could utilize the backbone to deliver new services to communities throughout Stark County. The fiber could be used to upgrade existing residential broadband services in less urbanized areas of Stark County where fiber resources are scarce. Providers need fiber resources to expand existing networks. The SCBN could facilitate this additional use with minimal upgrades in capacity. The SCBN network would interconnect with neighborhoods and providers no differently than a community anchor site. A vault with splice enclosure would be prepared to facilitate the necessary interconnect and to route the traffic to the nearest carrier Ethernet node. The leasing of dark fiber would also be an option.

Stark County could consider potential opportunities to facilitate partnership between cities, townships, and communities with On-Net or perspective providers. The SCBN would provide the necessary transport to service the potential areas. Cities, townships, and communities could determine the right last-mile business model on their own terms, utilizing the SCBN and its abundance of resources and connections to its fullest use.

Lack of competition in retail providers is influenced greatly by the availability of infrastructure or lack thereof, and by the enormous cost to build infrastructure. Many competitive regional or national providers will not take the risk of using their own capital to overbuild current incumbent networks, when the outcome may be to only capture a small portion of the market. Rather, providers will often times accept federal dollars in forms of grants or loans to buildout high-cost or underserved areas – relying on tax payer subsidies. This fact further negates the argument for fair competition as it relates to tax payer funded or "government owned networks", when most providers will only build into "areas that don't make the business case" when they're using other sources of capital or "other people's money."

The business case or justification for buildout throughout Stark County, under the "Internet is a utility" model, should necessitate local investments into furthering the access of next-generation broadband for all. With that being said, last-mile investments cannot be solely placed upon the SCBA, but must have buy-in from the local communities to be served. A "shotgun" approach for last-mile deployment throughout Stark County does not fit the "tribal" nature of government and public services currently in place. We should not assume broadband to be any different. With the proper tools, high-speed/affordable middle-mile capacity, On-Net data center facilities – and the resulting dozens of interconnected carriers, each Stark community or neighborhood could make the local decision on if and how to fund last-mile broadband buildout – and, if it's a fiber, wireless, or hybrid approach. They will even have finite control as to who their retail provider or providers will be.

Further, each municipality or township can make the decision on how to fund, operate, or partner to provide end user services. The makeup of a community and its demographics determines the availability of funding options, either grant or loan. Again, a shotgun approach to funding an entire County level project is likely to reduce the opportunities available and the likelihood of success. Hills and Dales and specific areas of Canton, as example, have vastly different geographic areas, demographics, and income levels and in turn would each have different needs. From a regional approach, it makes last-mile projects more successful if they can be executed locally, with supporting local grass roots efforts. Funding requirements are also much more manageable at the local level.

Municipalities and local communities have many options when selecting a business model targeted at incentivizing further broadband investment. These business models range in options for ownership, governance, and operations, all of which can vary greatly depending on funding/investment options. When selecting a business model, an organization must understand its operating and technical capabilities, and its willingness to add personnel if the determined model is labor intensive. While this roadmap is not meant to select any last-mile deployment option for the Stark communities, it is meant to provide each community with the required network assets and deployment frameworks which it can then use to make the best local decision on how to drive last-mile investment.

<p><b>Best Practice</b></p> <h3>Columbia County, GA</h3> <h4>Columbia County Community Broadband Network (C3BU)</h4> <p>Columbia County developed its initial fiber-optic and wireless network to connect hundreds of CAIs. It developed a carrier neutral data center, numerous communications towers and lit the network using a carrier ethernet self-healing ring architecture. Today the network sells transport, tower colocation, wholesale IP, and data center colocation to regional governments, education related organizations, business and retail telecommunications providers.</p> <p>Benefits:</p> <ul style="list-style-type: none"><li>- Consolidated regional government spend to community owned network</li><li>- Included wireless for more rural areas of the county</li><li>- Driving last-mile FTTH investments</li></ul>	
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## CHAPTER 9: FINANCIAL MODELING

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### MODEL ASSUMPTIONS

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1. All financial information is provided by fiscal year.
2. All financial information is provided in the cash basis format.
3. Construction and Implementation occurs as outlined, using a Phased approach.
4. Beta “Pilot” customers and “friendlies” will be connected in Year 2 but no significant revenues will be generated, as these customers will “beta test” the system – only 6 months of revenue booked for Year 2.
5. The network will be RFS (Ready for Service, Commercially) in Year 2.
6. The initial rates are used to establish a financially sustainable network.
7. Model assumes Lit transport is the only service provided.
8. Dark fiber and conduit leasing are additional opportunities to generate revenue, however these are not modeled.
9. Model assumes 140 anchors connected of varying organizations. The SCBA must develop partnerships and have commitments to participate before any network is constructed.
10. The model includes no local match or “cash infusion.” Funds are currently 100% borrowed. Any local funding that can be raised could drastically change the outcomes of the model and should be explored.

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ADDITIONAL NETWORK CONNECTIONS AND INCREMENTAL REVENUE OR COST SAVINGS FROM MUNICIPAL/COMMUNITY USE, INCLUDING: SURVEILLANCE, WIFI, TRAFFIC MANAGEMENT, AND OTHER SMART CITY INITIATIVES HAVE NOT BEEN FACTORED INTO THIS MODEL

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The SCBN will function as a carrier Ethernet transport network for Stark’s community anchors, local governments, and telecommunications carriers. The only service defined in this financial model and Study is dedicated transport services. The SCBN will also be utilized as transport to provide service to the business community and residential neighborhoods through partnerships with local governments and providers. While the SCBA could contemplate providing other retail type services, it will likely face stiff resistance and inject increased levels of risk into the project.

#### Transport Services

##### 1. Lit Transport Services

Transport services are the cornerstone of the SCBN’s service portfolio as they are the foundation on which all higher-layer services depend. CAIs and wholesale customers will both use transport services heavily throughout the service area. Based on future broadband demand from community anchors, residents, and businesses, the demand for transport on the SCBN should continue to grow, based on long-term broadband growth in the region. In addition to basic transport, which interconnects sites within the SCBN service area, transport will be important to build SCBN’s overall service portfolio. Transport connectivity from the SCBN into two potential POPs located in Akron and Cleveland enables the SCBN to connect its network to the marketplace of other carriers in those locations and beyond. Service providers in these locations will be able to provide many additional opportunities for education, research, public safety, inter-government, and community applications. Interconnection with other carriers in neutral colocation centers will become an important aspect of the SCBN to promote the introduction of new providers into the market. This will only grow SCBN’s transport services throughout the region as these providers deliver new services across the SCBN.

**a. Transport Demand in Stark County**

Review of the existing CAI market shows that there is a significant amount of customers that will make use of transport services on the SCBN. Designed with these in mind, the SCBN has the opportunity to interconnect many CAIs throughout the immediate fiber service area. In addition to the CAI market, the SCBN offers competitive service providers the opportunity to deliver their services across a redundant fiber-optic backbone to reach the majority of the service areas. Connectivity into the Akron and Cleveland colocation centers will enable an integrated transport service that allows service providers to interconnect with the SCBN and deliver services down to end users across the region.

**2. Leasing of Conduit and Dark Fiber**

The SCBA could consider leasing excess conduit and fiber within the service area to broadband providers. The SCBA infrastructure adds new supply of broadband infrastructure to the existing market and may assist providers in reducing their cost of new fiber construction by utilizing the SCBA’s infrastructure. New fiber construction can be costly, in the range of \$15 - \$35 per foot for new underground boring. If the SCBA can provide a lower cost option to providers by leasing its infrastructure, it may allow them to expand fiber access deeper into the community and at a quicker pace. The end goal of such a program would be to reduce the cost of fiber-based broadband to businesses in areas where SCBA maintains infrastructure.

Under a leasing model, SCBA would provide underground conduit and fiber for a monthly fee (operating lease) or one-time payment (capital lease, or indefeasible right of use) to broadband providers. The SCBA should expect to bear some upfront costs to make its existing network marketable to broadband providers. The proposed network does not cover all streets and locations in the service area; therefore, some additional construction is likely required to create a contiguous system that providers would utilize. Although the SCBA may bear some upfront cost to make its network a marketable system, it could do so on an opportunity basis once a provider required a specific route.

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**Indefeasible Rights of Use (IRU)**

A permanent, contractual agreement between the owners of a communications system and a customer typically lasting 20-30 years. These contracts obligate the purchaser to pay a portion of the operating costs, and the costs of maintaining the cable, including any costs incurred repairing the cable after mishaps. The right of use is indefeasible, so the capacity purchased is also nonreturnable, and maintenance costs incurred become payable and irrefusable. These agreements typically allow for a discount over time.

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The SCBA should consider viable market rates for leasing its fiber to providers. Keeping rates low will stimulate more opportunity with providers and result in better affordability to the end user. The SCBA should strive to cover its costs in any fiber-leasing program and develop a cost model that clearly lays out a financial plan for leasing conduit and fiber. The table below illustrates a number of cities that have developed fiber-leasing programs and the rates they charge per mile of fiber. It also provides capital leasing rates for long term “IRUs” and the maintenance fees associated with these capital leases.

TABLE 14: SAMPLE REGIONAL DARK FIBER LEASE RATES

	State	Monthly Lease Rate	20 Year IRU Rate	IRU Annual Maintenance Fee
City of Lakeland	FL	\$100		
City of Bartow	FL	\$125		
Eugene Water & Electric Board	OR	\$21		
Palo Alto Utilities	CA	\$336		
Springfield Utility Board	OR	\$16		
City of Holly Springs	NC	\$50	\$1,000	\$250
City of Rock Falls	IL	\$100	\$1,100	\$200
City of Gillette	WY		\$12,000	\$500
Black Rock Cable	WA		\$1,898	\$12
UC2B Champaign	IL		\$1,500	\$300

The SCBA should consider sharing the maps of its underground conduit with broadband providers to determine their interest in utilizing the conduit. Providers will have knowledge of the corridors where fiber or conduit is present and businesses they believe are important to reach.

Some of the key benefits and risks of dark fiber leasing for the SCBA include:

- **Benefits**
  - Lower cost fiber broadband to businesses and community anchors;
  - Minimal participation from the SCBA, infrastructure leasing only;
  - Lower capital investment required than other broadband business models, new fiber investments are only made when a revenue-based opportunity arises from a provider;
  - Investment in long-term assets that have a 20-year economic life;
- **Risks**
  - Slow approach that relies on providers to identify opportunities to connect businesses;
  - Limited to only certain corridors where high density of businesses exists;
  - Limited to businesses and community anchors, not applicable to residents;
  - Low revenue impact to the SCBA;

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## FINANCIAL PLAN

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This comprehensive financial plan provides a financial outlook for SCBA based on developed forecasts, projected revenues, capital and operational costs, loan funding and debt service for the organization. This financial plan provides a model that determines SCBA’s financial performance under a particular set of conditions and assumptions. As SCBA’s business environment and conditions change, the outcomes produced in the model will also change. Therefore, it is important that SCBA periodically update the forecast and financial model as business requirements change.

Magellan recommends a quarterly review of the forecast and financial plan for the first 12-month period to ensure that the assumptions made throughout this project remain valid and the Authority is meeting its financial obligations. Magellan’s model has been engineered to allow SCBA to make changes to key assumptions and automatically update the underlying financial plan. As the forecasts and financial models are subject to change, Magellan provides no guarantees that financial outcomes will match those determined in the model. No representation, warranty or undertaking (express or implied) is made and no responsibility is taken by Magellan Advisors for the merchantability, adequacy, accuracy, or completeness for the model or its assumptions (inherent

or explicit). Users of this financial model and its output do so entirely at their own risk and are responsible for performing their own due diligence. The model is a tool that should be utilized to forecast potential financial outcomes at the end users' discretion.

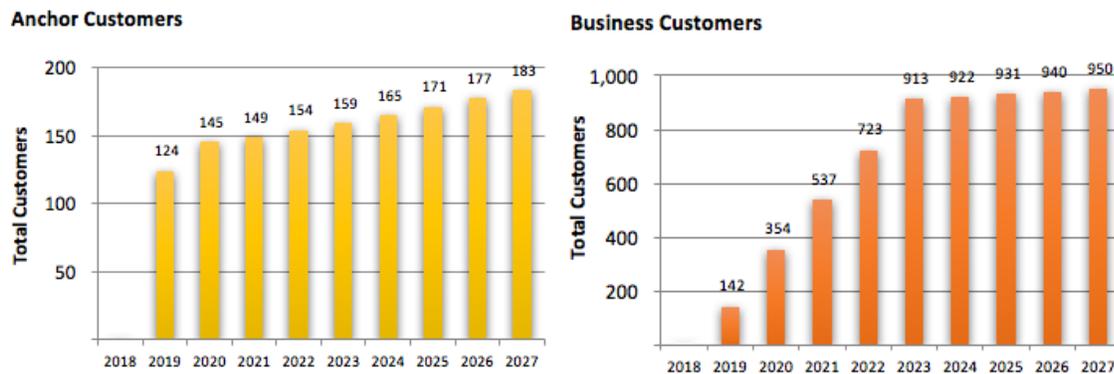
### REVENUE MODELS

The revenue model developed for this Study has been built dynamically based on the market forecasts for each customer segment including CAIs and wholesale circuits. Numerous CAIs have been identified and revenue is derived from carrier Ethernet transport services. Similarly, business transport revenues were derived from the forecasts for business uptake throughout the region. The services defined include 1 Gbps and 10 Gbps transport circuits for use by the two primary markets which would be served with local or regional transport services, including businesses, forecasting a conservative uptake based on ability of SCBA to complete its network in a timely fashion, mobilize its outreach, marketing efforts, and convert leads to active customers on the network.

Revenues have been projected for the 140 community anchors identified for connectivity. In addition, through GIS buffer analysis, over 8,000 businesses were identified within 1,000 feet of the proposed fiber buildout. While revenue was projected at 100% of the identified (140) anchors, only 10% of the total business market – those within 1,000 feet, were projected in uptake.

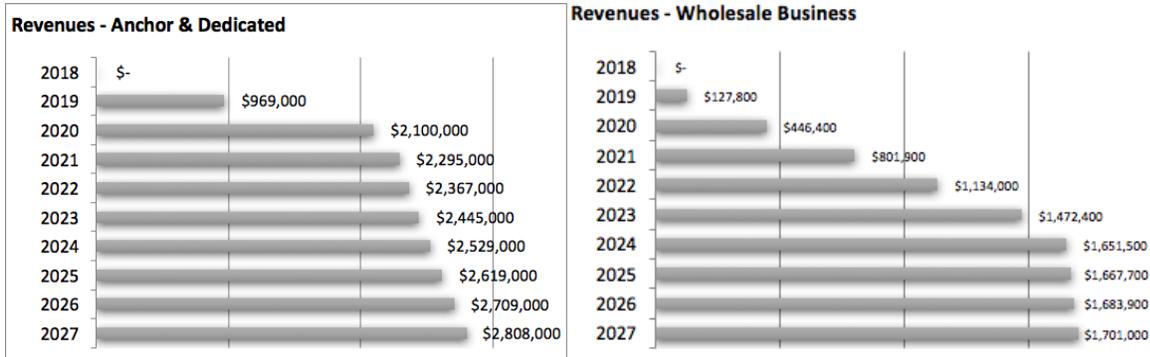
Projections included 2% annual growth in the business market and 5% growth in connected anchors. Business uptake will be determined in part from wholesale providers requiring transport by SCBA to serve customers in the region. Revenues generated by wholesale services grow year-after-year based on customer growth. This plan forecasts that wholesale transport from CAIs account for 67% of SCBA's revenues over the 20-year period, while 33% of SCBA's revenues come from wholesale transport to connect to business customers. Figure 64 shows projected Community Anchor Customers, and projected Business Customers.

FIGURE 60: PROJECTED ANCHOR AND BUSINESS CUSTOMER PROJECTIONS



Revenues generated from the SCBN will be used to fund the operation, cover debt service, and to expand and maintain the network and its services. Revenues come from Community Anchors and Wholesale Business customers. Revenue begins in Year 2 after initial customers are online. Year 2 revenues only account for a half year's revenue as not all sites will be connected at the same time and initial revenue will be inconsistent for the first several months. Full revenue in Year 3 is slightly over \$2.5 million and it will grow through Year 10 to nearly \$5 million. Community anchor revenue accounts for 66% of system revenues with current projections and financial model. Additional uptake in wholesale business or carrier revenues will affect this ratio.

FIGURE 61: PROJECTED REVENUES - COMMUNITY ANCHOR AND WHOLESALE BUSINESS



An important factor that poses risk to SCBA’s wholesale services is general price erosion. Wholesale telecommunications services, including Internet and transport are often subject to downward price pressure in the market where competing providers operate. This issue is caused by several technology factors, some of which include quickly depreciating network electronic assets, reduced renewal and replacement costs for new network electronics and new alternatives in the market. It is recommended that SCBA continually monitor competitor pricing for signs of price erosion and work to maintain current pricing levels wherever possible. While price erosion is common in the telecommunications industry the SCBA and its partnering providers can work to provide more bandwidth to its customers while maintaining stabilization of pricing.

The Rate Sheet contained within the BFS model provides a dynamic pricing tool that enables SCBA to analyze the impact of rate increases and reductions to overall profitability. The initial model has maintained pricing at current levels over the 20-year period. Pricing stability in the wholesale markets is critical to ensure SCBA’s long-term sustainability.

For SCBA, acquiring additional CAI customers (beyond the original 140) throughout its market should be the first priority in customer acquisition and, as described in the Go-To-Market Plan, Chapter 14 of this Study. These activities should begin immediately. The largest revenue contributions for SCBA come from K-12 Schools, Public Safety and Other Government Facilities, consisting primarily of city and county organizations. shows revenue contribution from each of the CAI categories. It will be imperative for SCBA to focus its outreach, sales and marketing efforts on acquiring as many of these customers as possible, targeting the largest users of broadband services first.

FIGURE 62: TOTAL CAI REVENUES CONTRIBUTED PER CAI TYPE

CAI Type	Revenue Contribution
K-12	56%
Healthcare	14%
Public Safety	14%
City	7%
County	2%
Higher Ed	4%
Other	2%

## COST MODELS

Detailed cost models were developed utilizing a combination of forecasted capital and operational costs. Magellan has worked to identify all potential costs required for the organization. shows assumptions for key cost accounts and future annual increases.

FIGURE 63: OPERATING COST CATEGORIES AND ANNUAL INCREASES

	Type	Per Unit	Annual Change
<b><u>Cost of Services</u></b>			
Billing and Mailing	Per Customer	\$ 1.25	1.0%
Broadband Transport & Internet Costs	Fixed Annual	\$ -	3.0%
Network Operations	Fixed Annual	\$ 300,000	0.0%
Dark Fiber Operations & Maintenance	Fixed Annual	\$ 150,000	3.0%
Facilities Maintenance, Power, Environmental	Fixed Annual	\$ 20,000	1.0%
Miscellaneous	% of Revenue	1.0%	1.0%
Network & Headend Maintenance	Fixed Annual	\$ 50,000	1.0%
Programming Costs Per Subscriber + Virtual Headend	Per Customer	\$ -	1.0%
Software Maintenance	% of Software	12.0%	1.0%
Utilities	Fixed Annual	\$ 20,000	0.3%
Vehicle Maintenance	% of Vehicles	5.0%	1.0%
Pole Attachments	Per Pole	\$ 80	1.0%
	Total distance	Span	Nbr Poles
Pole attachment calculation	256,565	180	1,425
<b><u>Sales, General &amp; Administrative Expenses</u></b>			
Administration	Fixed	\$ 300,000	2.0%
Professional & Legal Fees	Fixed	\$ 50,000	2.0%
Sales Commissions & Marketing Expense	% of Revenue	0.75%	0.0%
Reporting & Compliance	Fixed	\$ 10,000	2.0%
Travel & Entertainment Expense	Fixed	\$ 10,000	2.0%
Office Expense	Fixed	\$ 20,000	2.0%
General Overhead	Fixed	\$ 35,000	2.0%
Bad Debt Expense	% of Revenue	0.5%	0.0%

SCBA's significant upfront capital costs have provided the majority of the fixed-cost burden for the network, via capitalized conduit and fiber construction, data center, and network components and systems. SCBA's operating costs in Year 2 then Year 3 are significantly higher as the network comes online and begins serving customers. As a large amount of customers are activated on the network during this time, revenues increase significantly and operating costs normalize.

FIGURE 64: CAPITAL COST SUMMARIES

Subtotal Categories Annual	Totals
Middle-Mile Construction and Laterals	\$ 13,137,470
Premises Connected	\$ 6,475,000
Headend Equipment / PM	\$ 2,370,000
Building Improvements	\$ 300,000
General Equipment	\$ -
Wireless Equipment	\$ -

## RESERVE REQUIREMENTS

This Plan identifies three reserve funds for SCBA and calculates the reserves required for each fund on an annual basis. These funds include the following:

- Operating Reserve Fund
- Renewal Reserve Fund
- Capital Expansion Fund

Reserve funding will be required once the network is fully operational and begins to serve customers. The first full year of reserves are scheduled for Year 4. Reserve funding levels were calculated as follows:

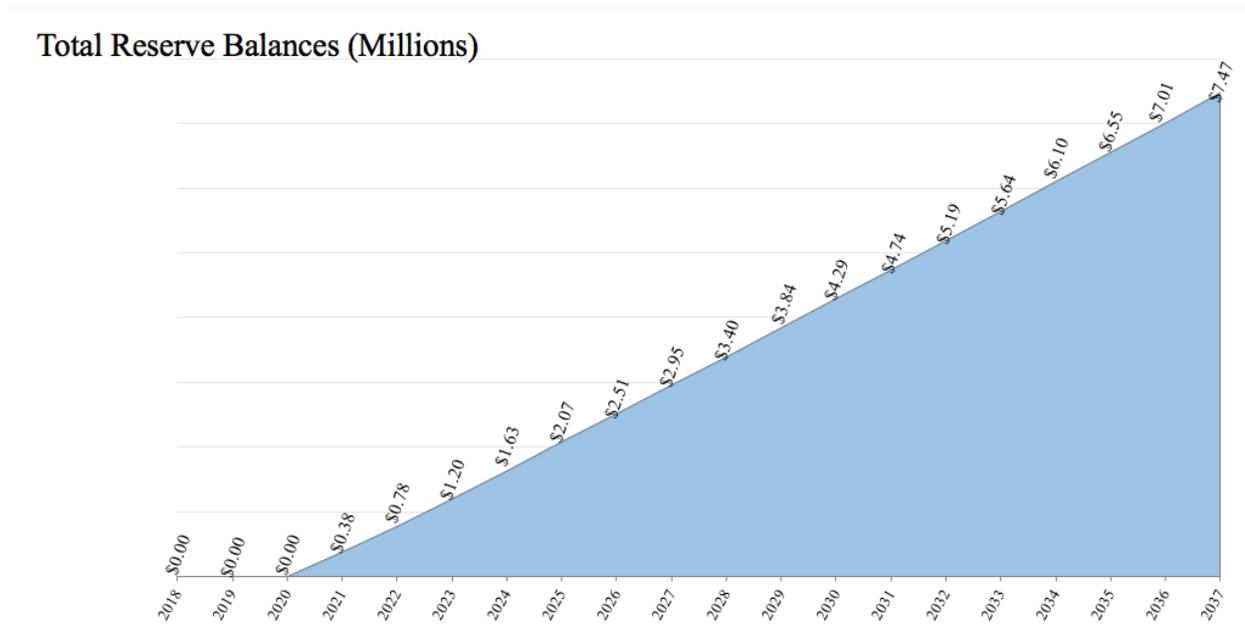
Operating Reserve Fund – 1% of total operating expenses

Renewal Reserve Fund – 1% of total invested capital

Capital Expansion Fund – 1% of gross revenue

These initial levels will need to be reviewed and revised periodically but provide a starting point for SCBA to ensure reserve funding is maintained by the organization. illustrates reserve fund growth over the 20-year period, accumulating \$2.95 million in Year 10 and nearly \$7.5 million by 2037. The capital expansion fund grows significantly over time, as it is tied to revenue growth. SCBA should evaluate its long-term capital expansion plans to ensure that there is adequate coverage on an annual basis for the capital expansion fund. If the capital expansion fund is excessive for the capital needs of SCBA, Magellan recommends it be restructured to be more in line with SCBA’s capital expansion plans. The capital expansion fund is utilized here as a set-aside for future capital spending, to ensure that SCBA’s revenues and future financing will provide coverage for potential capital expansion into more areas throughout Stark County.

FIGURE 65: RESERVE FUNDS TOTAL BALANCE



Operating reserves are tied to total operating expenses; as total operating costs rise, the operating reserve rises with it, at 1% of total operating expenses. Renewal reserve is initially set at 1% of total capital. This renewal reserve is utilized for replenishment and/or replacement costs incurred during normal operations of the network. For SCBA, this entails the purchase of additional equipment, line cards, spares, CPE and other assets required for existing operations, not including upgrades and future system expansion.

TABLE 15: RESERVE FUNDS OVER INITIAL 10 YEARS

<u>Reserve Fund Requirements</u>																				
Operating Reserve Fund	\$	-	\$	-	\$	-	\$	10,453	\$	10,646	\$	10,844	\$	11,007	\$	11,137	\$	11,268	\$	11,404
Renewal & Replacement Fund	\$	-	\$	-	\$	-	\$	184,525	\$	193,875	\$	203,425	\$	213,175	\$	213,925	\$	214,675	\$	215,425
Capital Expansion Fund	\$	-	\$	-	\$	-	\$	184,525	\$	193,875	\$	203,425	\$	213,175	\$	213,925	\$	214,675	\$	215,425
General Fund Repayment	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<b>Subtotal: Annual Reserve Fund Requirements</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>379,503</b>	<b>\$</b>	<b>398,396</b>	<b>\$</b>	<b>417,694</b>	<b>\$</b>	<b>437,357</b>	<b>\$</b>	<b>438,986</b>	<b>\$</b>	<b>440,618</b>	<b>\$</b>	<b>442,254</b>
<b>Subtotal: Cumulative Reserves</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>-</b>	<b>\$</b>	<b>379,503</b>	<b>\$</b>	<b>777,899</b>	<b>\$</b>	<b>1,195,592</b>	<b>\$</b>	<b>1,632,949</b>	<b>\$</b>	<b>2,071,935</b>	<b>\$</b>	<b>2,512,553</b>	<b>\$</b>	<b>2,954,807</b>

## PRO FORMA

The results of the financial analysis provide the following pro-forma for SCBA over a 20-year period. This pro-forma incorporates all revenue and expense information into a single sheet that anticipates net income and cash flow for the SCBA. Projections are subject to change based on fluctuations in SCBA's business environment. The pro forma and comprehensive financial plan are designed as a planning tool for SCBA to use in developing a long-term financial strategy for the Authority and its operations. Magellan suggests close tracking of SCBA's business and financial positions to ensure that the SCBA maintains performance, particularly in the first two years of operations. In the first 12 months of operations, Magellan advises that SCBA tracks monthly profit and loss information as the it moves into its operating stage. This close supervision of business growth and finances will enable SCBA to more easily make course corrections in its business strategy where required.

The next section and supporting figures depict Total Revenues, EBITDA and Net Income annually over a 10-year period.

## REVENUE

SCBA's revenues grow significantly between Year 2 and Year 6 as it captures a significant amount of the CAI market with transport services. Years 2 and 3 are particularly important in terms of uptake of SCBA's services, as this would be when the majority of the first set of anchors would connect. This critical time period requires SCBA to acquire 140 CAIs over the initial 3-year construction period. This target is achievable if the right partnerships and alliances are developed in advance. Additional revenue opportunities have the potential to add significantly more revenue from the operation.

TABLE 16: TOTAL REVENUE

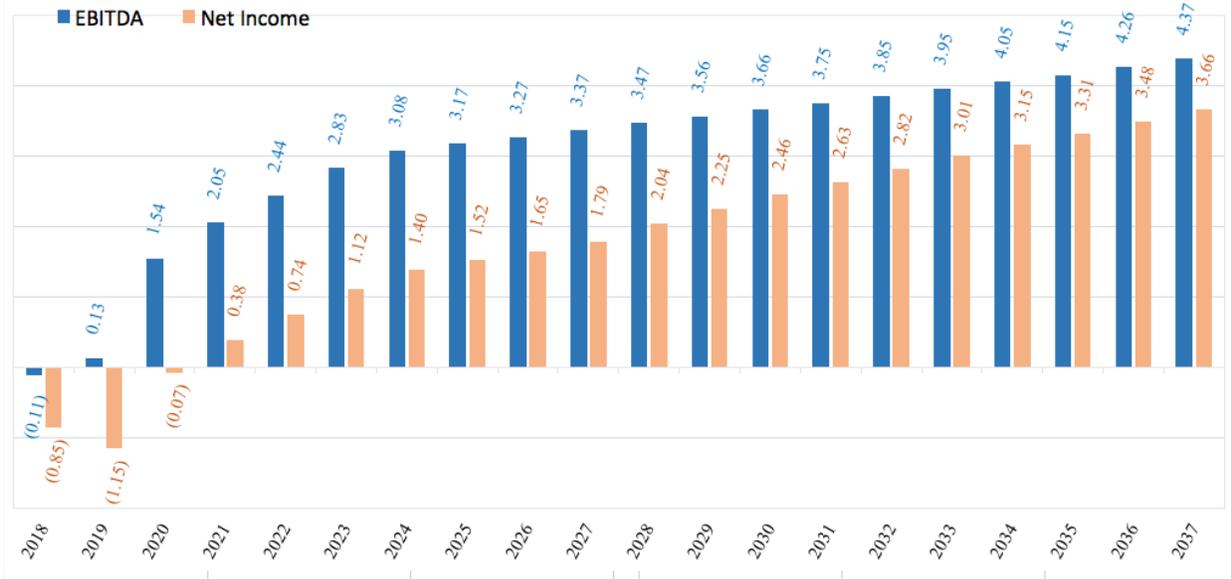
Business Service Revenues	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027										
[I] SMB 50 Down / 10 Up																				
[I] SMB 100 Down / 50 Up																				
[I] SMB 300 Down / 100 Up																				
[I] SMB 400 Down / 150 Up																				
[I] SMB 500 Down / 250 Up																				
[I] SMB 1000 Down / 500 Up																				
[I] ENTERPRISE 10 Down / 10 Up																				
[I] ENTERPRISE 50 Down / 50 Up																				
[I] ENTERPRISE 100 Down / 100 Up																				
[I] ENTERPRISE 200 Down / 200 Up																				
[I] ENTERPRISE 500 Down / 500 Up																				
[I] ENTERPRISE 1000 Down / 1000 Up	\$	127,800	\$	446,400	\$	801,900	\$	1,134,000	\$	1,472,400	\$	1,651,500	\$	1,667,700	\$	1,683,900	\$	1,701,000		
[P] Business Voice Average (3 lines per sub)																				
Additional																				
Additional																				
Additional																				
Additional																				
Additional																				
Subtotal: Business Service Revenues	\$	-	\$	127,800	\$	446,400	\$	801,900	\$	1,134,000	\$	1,472,400	\$	1,651,500	\$	1,667,700	\$	1,683,900	\$	1,701,000
Anchor & Dedicated Revenues	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027										
[I] Anchor 10 Down / 10 Up																				
[I] Anchor 50 Down / 50 Up																				
[I] Anchor 100 Down / 100 Up																				
[I] Anchor 200 Down / 200 Up																				
[I] Anchor 500 Down / 500 Up																				
[I] Anchor 1000 Down / 1000 Up																				
[I] 100 MB Point to Point - Metro Ethernet																				
[I] 500 MB Point to Point - Metro Ethernet																				
[I] 1 GB Point to Point - Metro Ethernet	\$	594,000	\$	1,290,000	\$	1,410,000	\$	1,452,000	\$	1,500,000	\$	1,554,000	\$	1,614,000	\$	1,674,000	\$	1,728,000		
[I] 10 GB Point to Point - Metro Ethernet	\$	375,000	\$	810,000	\$	885,000	\$	915,000	\$	945,000	\$	975,000	\$	1,005,000	\$	1,035,000	\$	1,080,000		
[P] Business Voice Average (3 lines per sub)																				
Additional																				
Additional																				
Additional																				
Additional																				
Additional																				
Additional																				
Subtotal: Anchor & Dedicated Revenues	\$	-	\$	969,000	\$	2,100,000	\$	2,295,000	\$	2,367,000	\$	2,445,000	\$	2,529,000	\$	2,619,000	\$	2,709,000	\$	2,808,000
Total Revenues - Residential	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Total Revenues - Business	\$	-	\$	127,800	\$	446,400	\$	801,900	\$	1,134,000	\$	1,472,400	\$	1,651,500	\$	1,667,700	\$	1,683,900	\$	1,701,000
Total Revenues - Anchor & Dedicated	\$	-	\$	969,000	\$	2,100,000	\$	2,295,000	\$	2,367,000	\$	2,445,000	\$	2,529,000	\$	2,619,000	\$	2,709,000	\$	2,808,000
Total Revenues	\$	-	\$	1,096,800	\$	2,546,400	\$	3,096,900	\$	3,501,000	\$	3,917,400	\$	4,180,500	\$	4,286,700	\$	4,392,900	\$	4,509,000

## EBITDA AND NET INCOME

SCBA generates a negative net income for the first three years of operations. Negative net income in the first three years of operations is a result of depreciation expenses and minimal revenues due to the onboarding of the CAIs. EBITDA is positive in all but Year 1, showing strong revenue growth and the ability to fund the majority of SCBA’s operating costs. SCBA generates a positive net income starting in Year 4 as it begins to develop economies of scale from its network. Growth in fixed costs slows in Year 4 in relation to revenues, allowing SCBA to show stronger profitability through future years as more customers come online.

FIGURE 66: EBITDA AND NET INCOME PROJECTIONS - 20 YEARS

### EBITDA & Net Income (Millions)

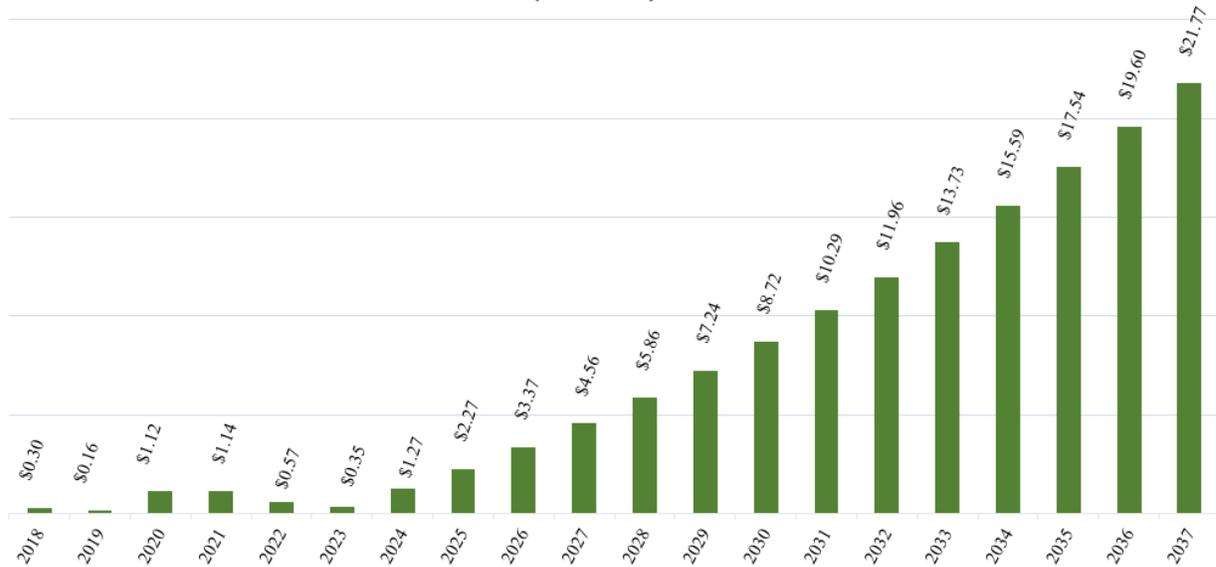


## CASH FLOW

In the first five years of operations, cash flow remains tight, and additional borrowing is required to cover shortages. After the initial 4 year borrowing period, in Year 5, net income will have increased enough to provide full coverage of all cash requirements, including capital and operating reserves. While free cash flow is stabilized after Year 5, reserves will be available to cover lags in cash flow, however, certain reserve levels must always be maintained for operating reserves, renewal and replacement and capital expansion.

FIGURE 67: CUMULATIVE FREE CASH FLOW PROJECTIONS – 20 YEARS

### Cumulative Unrestricted Free Cash Flow (Millions)



The SCBA, under this financial model and plan will accumulate over \$21 million in free cash flow over the initial 20-year period. The governance model and board should decide early how excess free cash flow will be handled and where investments will be directed. The free cash flow can be used in a number of ways, including:

- Buy down circuit rates to anchors or network partners
- Expand network infrastructure to other areas of Stark County
- Enhance service offerings
- Deploy complimentary WiFi in specific areas of the service area
- Identify “digital divide” investment opportunities
- Develop economic development grants targeted at high-tech industry
- Develop grant programs for low income groups, schools, and other community programs
- Technology initiatives
- Advance debt payments.

## FUNDING REQUIREMENTS

Under the current model, total borrowing amounts to \$22.5 million in capital to construct the network, connect anchors and a portion of the available business market with wholesale transport. The \$22.5 million includes \$13.15 million in middle-mile and lateral construction, \$6.5 million in premises connected and CPE, which includes project wholesale business customers, \$2.4 million in data center and network equipment and another \$300,000 in building improvements, and an additional \$2.9 million will be required to fund the operating costs of the SCBA for the first three years of operation.

TABLE 17: SUBTOTAL BORROWING

Subtotal Categories Annual	Totals
Middle-Mile Construction and Laterals	\$ 13,137,470
Premises Connected	\$ 6,475,000
Headend Equipment / PM	\$ 2,370,000
Building Improvements	\$ 300,000
General Equipment	\$ -
Wireless Equipment	\$ -

Under the premise that a governmental agency, or Authority, would finance this project, current funding mechanisms are based in the model on revenue or general obligation bonds at a rate of 4% over 20 years. It is recommended that funding be provided in multiple draws that coincide with the phased buildout plan. A single bond issue with multiple draws would be preferable to minimize interest and bond issuance expenses.

Alternatively, the \$2.9 million could be sourced locally from investment partners (CAIs) who wish to participate in the project. This could be a “buy-in” charge, or could be covered through general fund appropriations by the participating local government organizations. Any portions of operating funds that can be sourced locally will impact this financial model, as total borrowing will be able to be reduced. In addition, any locally sourced funds could be considered matching funds for any potential grants that may be made available to the County.

TABLE 18: BORROWING SUMMARY

Needed Capital Total:	\$ 22,432,470				
Expected Years of Borrowing:	4				
Operating expenses coverage # yrs:	3				
Needed Operating (initial x yrs):	\$ 2,836,549				
General Fund Infused Cash:	\$ -				
Infused Cash Spread Over x Years:	-				
<b>Borrowing Need:</b>	<b>\$ 22,474,019</b>	<i>incl oper</i>	<i>incl oper</i>	<i>incl oper</i>	
		<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
	<i>Year #</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<b>Borrowings</b>					
Principal	\$ 9,517,458	\$ 7,407,658	\$ 4,613,902	\$ 935,000	
Term	20	20	20	20	
Rate	4.00%	4.00%	4.00%	4.00%	
Yearly Payments	1	1	1	1	
Principal Adjustment (250,000)	250,000				
Annual Payment Amount	\$ 700,311	\$ 545,068	\$ 339,499	\$ 68,799	



SUPPORTING EXHIBITS

TABLE 20: PRO-FORMA – 10 YEAR

Pro Forma		Proprietary and Confidential Information									
Uptake (Res: 0%) (Bus: 10%) (Anc: 100%)		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Rate (Res: VARIED); (Bus: VARIED); (Anc: VARIED)		100%	2%	100%	100%	100%	100%	100%	100%	100%	100%
Year #		1	2	3	4	5	6	7	8	9	10
		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Service Revenues</b>											
Residential	\$	-	-	-	-	-	-	-	-	-	-
Business	\$	-	127,800	446,400	801,900	1,134,000	1,472,400	1,651,500	1,667,700	1,683,900	1,701,000
Community Anchor	\$	-	969,000	2,100,000	2,295,000	2,367,000	2,445,000	2,529,000	2,619,000	2,709,000	2,888,000
<b>Subtotal: Service Revenues</b>	<b>\$</b>	<b>-</b>	<b>1,096,800</b>	<b>2,546,400</b>	<b>3,096,900</b>	<b>3,501,000</b>	<b>3,917,400</b>	<b>4,180,500</b>	<b>4,286,700</b>	<b>4,392,900</b>	<b>4,509,000</b>
<b>Installation Revenues</b>											
Residential	\$	-	-	-	-	-	-	-	-	-	-
Business	\$	-	-	-	-	-	-	-	-	-	-
Anchor & Dedicated	\$	-	-	-	-	-	-	-	-	-	-
<b>Subtotal: Installation Revenues</b>	<b>\$</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Equipment Rental Revenues</b>											
Residential	\$	-	-	-	-	-	-	-	-	-	-
Business	\$	-	-	-	-	-	-	-	-	-	-
Anchor & Dedicated	\$	-	-	-	-	-	-	-	-	-	-
<b>Subtotal: Equipment Rental Revenues</b>	<b>\$</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>TOTAL REVENUES</b>	<b>\$</b>	<b>-</b>	<b>1,096,800</b>	<b>2,546,400</b>	<b>3,096,900</b>	<b>3,501,000</b>	<b>3,917,400</b>	<b>4,180,500</b>	<b>4,286,700</b>	<b>4,392,900</b>	<b>4,509,000</b>
<b>Cost of Services</b>											
Direct Staffing	\$	-	-	-	-	-	-	-	-	-	-
Billing and Mailing	\$	-	336	636	883	1,140	1,487	1,448	1,474	1,508	1,544
Broadband Transport & Internet Costs	\$	-	-	-	-	-	-	-	-	-	-
Network Operations	\$	-	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Vehicle Maintenance	\$	-	-	-	-	-	-	-	-	-	-
Facilities Maintenance, Power, Environmental	\$	-	20,200	20,402	20,606	20,812	21,020	21,230	21,443	21,657	21,874
Miscellaneous	\$	-	10,968	25,464	30,969	35,010	39,174	41,805	42,807	43,929	45,090
Network & Headend Maintenance	\$	-	50,000	50,500	51,005	51,515	52,030	52,551	53,076	53,607	54,143
Programming Costs Per Subscriber + Virtual Headend	\$	-	-	-	-	-	-	-	-	-	-
Software Maintenance	\$	-	-	-	18,100	18,360	18,540	18,720	18,900	19,080	19,260
Utilities	\$	-	20,050	20,100	20,150	20,200	20,250	20,300	20,350	20,400	20,450
Pole Attachments	\$	114,029	114,029	114,029	114,029	114,029	114,029	114,029	114,029	114,029	114,029
<b>Subtotal: Cost of Services</b>	<b>\$</b>	<b>114,029</b>	<b>515,583</b>	<b>531,131</b>	<b>555,822</b>	<b>561,866</b>	<b>566,450</b>	<b>570,075</b>	<b>572,139</b>	<b>574,210</b>	<b>576,389</b>
<b>GROSS PROFIT</b>	<b>\$</b>	<b>(114,029)</b>	<b>581,217</b>	<b>2,015,269</b>	<b>2,541,078</b>	<b>2,939,134</b>	<b>3,350,950</b>	<b>3,610,425</b>	<b>3,714,561</b>	<b>3,818,690</b>	<b>3,932,611</b>
<b>Sales, General &amp; Administrative Expenses</b>											
Administrative Staffing	\$	-	-	-	-	-	-	-	-	-	-
Professional & Legal Fees	\$	-	51,000	53,020	53,060	54,122	55,204	56,308	57,434	58,582	59,755
Sales Commissions & Marketing Expense	\$	-	8,226	19,008	21,227	26,258	29,381	31,354	32,150	32,947	33,818
Reporting & Compliance	\$	-	10,000	10,200	10,404	10,612	10,824	11,041	11,262	11,487	11,717
Travel & Entertainment Expense	\$	-	10,200	10,404	10,612	10,824	11,041	11,262	11,487	11,717	11,951
Office Expense	\$	-	20,400	20,808	21,224	21,649	22,082	22,523	22,974	23,433	23,902
General Overhead	\$	-	15,700	16,414	17,142	17,885	18,643	19,416	19,204	19,988	20,788
Administration	\$	-	306,000	312,130	318,362	324,730	331,224	337,849	344,606	351,498	358,528
Bad Debt Expense	\$	-	5,484	12,732	15,485	17,505	19,587	20,983	21,324	21,965	22,545
<b>Subtotal: Sales, General &amp; Administrative Expenses</b>	<b>\$</b>	<b>-</b>	<b>447,010</b>	<b>473,796</b>	<b>489,517</b>	<b>503,584</b>	<b>517,985</b>	<b>530,654</b>	<b>541,950</b>	<b>552,637</b>	<b>564,043</b>
<b>EBITDA</b>	<b>\$</b>	<b>(114,029)</b>	<b>134,207</b>	<b>1,541,473</b>	<b>2,051,562</b>	<b>2,436,350</b>	<b>2,832,964</b>	<b>3,079,771</b>	<b>3,173,011</b>	<b>3,266,053</b>	<b>3,368,568</b>
<b>Depreciation &amp; Amortization</b>											
Depreciation	\$	353,299	617,609	783,312	837,543	892,934	949,485	953,836	958,187	962,538	965,499
Amortization	\$	-	-	-	-	-	-	-	-	-	-
<b>Subtotal: Depreciation &amp; Amortization</b>	<b>\$</b>	<b>353,299</b>	<b>617,609</b>	<b>783,312</b>	<b>837,543</b>	<b>892,934</b>	<b>949,485</b>	<b>953,836</b>	<b>958,187</b>	<b>962,538</b>	<b>965,499</b>
<b>EBIT</b>	<b>\$</b>	<b>(467,328)</b>	<b>(483,402)</b>	<b>758,161</b>	<b>1,214,018</b>	<b>1,543,416</b>	<b>1,883,479</b>	<b>2,125,934</b>	<b>2,214,824</b>	<b>2,303,515</b>	<b>2,403,069</b>
<b>Interest</b>											
Borrowings	\$	380,698	664,220	825,538	832,556	799,711	765,552	730,027	693,081	654,657	614,697
<b>Subtotal: Interest Expenses</b>	<b>\$</b>	<b>380,698</b>	<b>664,220</b>	<b>825,538</b>	<b>832,556</b>	<b>799,711</b>	<b>765,552</b>	<b>730,027</b>	<b>693,081</b>	<b>654,657</b>	<b>614,697</b>
<b>NET INCOME</b>	<b>\$</b>	<b>(848,026)</b>	<b>(1,147,622)</b>	<b>(67,369)</b>	<b>381,462</b>	<b>743,705</b>	<b>1,117,927</b>	<b>1,395,907</b>	<b>1,521,743</b>	<b>1,648,858</b>	<b>1,788,372</b>

FIGURE 68: SCBA DASHBOARD



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## SUSTAINABILITY

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Local governments, school districts, and other community anchor organizations are realizing their needs for broadband services and general connectivity are going to continue to grow. At the same time, they are grappling with ever increasing costs of these services. With the right community buy-in and development of partnerships, the SCBA and the Stark Community Broadband Network will flourish, providing a locally owned and controlled broadband infrastructure that will meet the needs of the Stark community.

This model has provided important data which local leaders must now consume, and use to make important investment decisions. The fact that local tax dollars are being used today to fund telecommunications services should put to ease any concern that this endeavor is not feasible. The Stark community anchors must come together to decide how they should fund this project and begin to take the necessary steps to move this forward.

This model shows that the Stark Community Broadband Network financial model is feasible under the previously stated assumptions.

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## RISKS

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The risks of investing in the proposed middle-mile should be mitigated as much as possible by thorough project planning and development of partnerships with local funding sources, regional community anchors and Stark County's communities. This Study is meant to provide a framework and roadmap for the Stark Community and the community leaders to consider as it begins to take a more active role in broadband investment.

The consensus amongst Stark's leaders is that something must change for the long-term benefit of the community. While broadband is a piece of the solution, it is not a perfect solution. Community ownership of this very important asset will ensure the community has the decision making authority over how the region is served and more importantly that its constituents' health, education, and welfare are considered first when making local investments.

Strategic incremental investments in the middle-mile network and laterals to anchors will bring new additional fiber assets into the County, allowing more competition than is otherwise available.

Counties and local government organizations have and are building fiber-optic networks across the United States, due to the ever increasing requirements for connectivity. Local governments realize this is the "Fourth Utility" and are taking the appropriate steps to ensure long term sustainability of their communities through local ownership of these assets.

## CHAPTER 10: MARKETING PLAN, COMMUNITY AWARENESS, & EDUCATION

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The SCBN's market strategy places it in a competitive position to serve the majority of the region with a suite of broadband transport services. To capture this market, it will be important for the SCBN to structure its go-to-market plan in a way that targets large needs of the service area immediately and begins to activate services for key customers in the CAI and wholesale markets.

### A. Outreach and Marketing Plan to CAI Market

Outreach is a key component of an early-stage marketing plan. Utilizing a top-down approach with local community and government leaders in the service area will assist the SCBN market the benefits of its network to both the opinion leaders and the decision makers in the region. Sponsors of SCBN among SCBN's leadership team must take an active role in promoting SCBN's services throughout the community. Within SCBN's organization, leaders must become evangelists of SCBN's services, specifically targeting the core benefits of the network to each community function, including the benefits to:

- Local government
- Education
- Healthcare
- Economic Development
- Public Safety – Police, Fire, Sheriff and First Responder
- Community Support

#### K-12 Schools

It is also important that SCBN's board is apprised of the high-level benefits of the network and its services in the region. Sponsorship from a supportive board will significantly spread the message of SCBA throughout the CAI market as well as trickle-down into the business and residential markets. Successful broadband utilities have engaged their boards in implementing high-level outreach strategies that promote use and benefits of broadband to the local communities they serve.

Critically important anchor tenants on the network will be the school districts within SCBA's coverage area, as they will be a large user of transport and Internet services. In some instances, school districts are slower to adopt community broadband networks due to their strict service level agreements and E-Rate restrictions on broadband services. For SCBA, it will be important to develop a relationship with the school districts early and ensure that the districts understand the services available on through the network, as well as the timing for implementation of those services. It is also important that SCBA familiarize itself on the E-Rate program through the USAC website ([www.usac.org](http://www.usac.org)).

In addition, SCBA must convey its E-Rate provider status to the school districts to ensure that the districts will continue to receive E-Rate discounts via SCBA.

#### Healthcare

Healthcare organizations can often times be challenging customers to acquire for community broadband networks. Similar to school districts, they have significant performance requirements and strict SLAs with their providers. Generally, the larger telecom and cable companies' service hospital and medical center type healthcare organizations. For SCBA, demonstrating the performance and redundancy of the system, as well as the competence of the operations team will be critical to ensure buy in from local hospitals and other healthcare organizations. Doing so will enable SCBA's suite of services to be well received by the hospital systems, of which there may be strong interest in transport, Internet, colocation, and interconnection.

Many hospital systems have affiliated doctors' offices throughout their coverage areas. These affiliated doctors' offices generally are required to have transport connectivity back to their home hospitals, which are either controlled by each individual doctor's office or by the home hospital itself. SCBA may be able to provide an entire "healthcare ring" including the hospitals and affiliated doctors' offices, enabling connectivity between each office and each home hospital.

SCBA should develop relationships with local hospital CIOs and CEOs through community leaders, promoting the benefits of the SCBN. For healthcare, and other critical organizations, documentation, policies, procedures, and service level agreements will be critical to begin to convert these organizations into paying customers.

#### Cities, Counties, and Other Government Organizations

SCBA's access to city and county management and their boards should be used to spread the message about SCBA's network to decision makers in these organizations. As one of the prime beneficiaries of these network services, cities and the County have the opportunity to interconnect with the SCBA network for their own needs and to develop collaborative opportunities with school district, sheriffs' offices, and other organizations. This collaboration can spread throughout the SCBA region as a result of far-reaching network. In other areas, collaboration has helped streamline local government operations and significantly reduce cost.

For example, in Seminole County, FL, the county owns a 450-mile fiber-optic network connecting all county, school, city, community college, and public safety facilities. Over this network, these organizations have been able to share resources such as computer-aided dispatch, GIS, phone, Internet and other services, all as a result of interconnection with the local community broadband network. Magellan Advisors completed a study for Seminole County, FL in 2009 and found that the county and its affiliated local government organizations were saving upwards of \$1 million of taxpayer dollars every year as a result of the broadband network.

This concept should hold true in SCBA region as well. Collaboration between local government, education, and public safety organizations should lead to greater efficiency and reduced cost for taxpayers in Stark County. SCBA needs to market this message and the collaborative opportunities the network brings to local civic leaders.

TABLE 21: GO-TO-MARKET STRATEGY AND ADVERTISING CHANNELS

Customer Class	Marketing Strategy	Advertising Channels
<b>K-12 Schools and Libraries</b>	<ul style="list-style-type: none"> <li>• Become eligible E-Rate provider with USAC</li> <li>• Mine Form 470 Data to identify school board needs for future funding years</li> <li>• Target funding windows</li> <li>• Identify RFPs issued by school districts</li> <li>• Develop services and marketing around school board needs – high capacity/security/high availability</li> </ul>	<ul style="list-style-type: none"> <li>• Web, print and mail</li> <li>• Local broadband “roadshows” to City and County facilities</li> <li>• Community broadband workshops with local leaders</li> <li>• School board conferences, local and state</li> <li>• (Compliant with E-Rate guidelines for schools and libraries)</li> <li>• Lunch and Learns with educators and administrators</li> </ul>
<b>Community Colleges and Higher Education</b>	<ul style="list-style-type: none"> <li>• Develop broadband capabilities and interconnection with research, education and other networks, such as Internet2 and Lambda Rail</li> <li>• Work with last-mile providers to improve high-speed Internet, voice, video and other end users’ services that make use of SCBA’s transport network</li> </ul>	<ul style="list-style-type: none"> <li>• Web, print and mail</li> <li>• Identify leaders in higher education through local community leaders</li> <li>• Work with higher education IT departments to understand needs</li> </ul>
<b>Local Government</b>	<ul style="list-style-type: none"> <li>• Using outreach, target City and County contacts. Understand needs for transport, Internet, voice and other.</li> <li>• Work with last-mile providers to deliver end-user services in addition to transport and Internet</li> </ul>	<ul style="list-style-type: none"> <li>• Web, print and mail</li> <li>• Local broadband “roadshows” to City and County facilities</li> <li>• Community broadband workshops with local leaders</li> <li>• Present at local commission and council meetings</li> </ul>
<b>Public Safety</b>	<ul style="list-style-type: none"> <li>• Marketing around security and reliability of the broadband network</li> <li>• Identify wireless applications for Public Safety – 4G, WiMax, 800MHZ radio systems that require transport services</li> <li>• Additional services to current public safety wireless system</li> <li>• CAD integration</li> </ul>	<ul style="list-style-type: none"> <li>• Web, print and mail</li> <li>• Attend public safety conferences</li> <li>• Co-market at City and County meetings</li> </ul>
<b>Healthcare</b>	<ul style="list-style-type: none"> <li>• Market to health organizations and partnerships</li> <li>• Identify key services – such as layer 2 transport between hospitals, imaging centers, doctors’ offices, and clinics</li> <li>• Market “healthcare ecosystem network”</li> </ul>	<ul style="list-style-type: none"> <li>• Web, print, and mail</li> <li>• Utilize City and County leaders to meet with heads of hospitals and related organizations to push the importance of broadband</li> </ul>

	<ul style="list-style-type: none"> <li>• Attract Lambda Rail and other research networks in SCBA’s network</li> </ul>	<ul style="list-style-type: none"> <li>• Significant outreach to this market</li> </ul>
<b>Businesses</b>	<ul style="list-style-type: none"> <li>• Differentiated strategies for small, medium and large business within the region</li> <li>• Work with last-mile providers to co-market to business community</li> </ul>	<ul style="list-style-type: none"> <li>• Work with local economic development agencies, chambers of commerce, and other business-friendly organizations</li> <li>• Advertising to wholesalers, last-mile providers</li> </ul>
<b>Residents</b>	<ul style="list-style-type: none"> <li>• Regional broadband outreach to residents, broadband training and education conducted at community institutions</li> <li>• Close coordination with last-mile providers on service offerings and target areas</li> <li>• Interconnection agreements with incumbents for wholesale transport throughout region</li> <li>• NNI interconnects for services</li> </ul>	<ul style="list-style-type: none"> <li>• Work with new upcoming last-mile WISPs and other new market entrants to grow residential services</li> <li>• Develop relationships with incumbents and cable companies in region</li> </ul>

## B. Outreach and Marketing Plan to Wholesale Market

For the wholesale market, SCBA will need to establish relationships with different classes of service providers, all with unique needs. To establish service with any of the large telecommunications companies, such as telcos and cable companies, SCBA will need to demonstrate the capabilities of the network and ensure that it meets telco-grade requirements for performance, redundancy, and capacity. Based on the network design, SCBA network is clearly capable of supporting telco-grade services, for transport of voice, video, and other constant-bit-rate data.

### Telcos and Cable Companies

For telco and cable companies to utilize SCBA network there is a standard process that is followed to establish an interconnection agreement and network-to-network interface, or NNI. The interconnection agreement is generally negotiated between the wholesale division of each telco or cable company and SCBA. It governs the terms and conditions for connectivity, rates, term, payment, disclosure, liability, and termination. The NNI defines the technical interconnection between a telco or cable company network and the SCBA network, including the type of interface, speed, virtual circuit/VLAN mapping scheme, QOS policies, monitoring policies, provisioning, activation, and termination.

The process of negotiating and establishing an interconnection agreement and completing the NNI generally takes four to six months. For SCBA, it will be important to begin this process early, timed so that completion of the NNI is aligned with the activation of the network. Upon activation, the provider will require a three to five-day window to fully test the services to ensure that the NNI is performing to the standards provided in the interconnection agreement. To negotiate an interconnection agreement, SCBA will need the key service documents governing its network, including:

- Service level agreements
- Acceptable use policies
- Network operations policies and procedures
- Contact and escalation lists

Once established, wholesale transport services can be provisioned between the providers and SCBA quickly, utilizing only logical provisioning in most cases. Based on the providers' needs, they will utilize SCBA for transport connectivity throughout the region whenever a requirement for wholesale or retail transport exists. This will allow SCBA to enter the wholesale market as a "carrier's carrier," enabling new services for wholesale providers to expand their markets and deploy new high-bandwidth services.

#### Competitive Providers and WISPs

In addition to large telco and cable companies, SCBA's network has the capability to aide smaller providers to grow their markets in Stark County. In many middle-mile projects, newly built networks have become incubators for smaller providers to grow and service more of the communities in which they operate. For SCBA, the network can assist smaller facilities-based providers and wireless broadband providers reach more of the service area through competitively priced transport services. Outreach to these providers should be started quickly, giving them the time they need to prepare for SCBA's network activation.

For many smaller providers, interconnection agreements and NNIs are not generally created. Instead standard telecom contracts govern the transactions, including:

- Master Services Agreement
- Service Order
- Service Level Agreement
- Acceptable Use Policy
- Contact and Escalation List

## CHAPTER 11: FUNDING & GRANT OPPORTUNITIES

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Potential funding is available from a variety of sources to support broadband networking. The key is to take a broad view of potential sources of funding, consider all potential organizational partners and collaborators in the region and “cast a wide net.” In addition, it is important to present any request for funding based on the need it will meet and the people and institutions it will help. Funding requests for technology and fiber, detached from this type of needs assessment, have chance of success. Furthermore, employing a mix of funding sources is beneficial as obtaining all required funding from a single source is less likely to occur.

A number of federal programs are available to assist in the funding of broadband capacity expansion projects. These programs are available through various agencies, and each program has its own purpose, eligibility, and restrictions. But many of these sources are designed to extend broadband in rural and unserved areas (the FCC’s Connect America Fund); provide service to rural hospitals (the FCC’s Healthcare Connect Fund), and provide for distance learning and telemedicine (the Rural Utility Service’s Distance Learning and Telemedicine Grant Program). Due to Stark County’s geographic makeup, some of the programs may support expansion efforts in the more rural, less underserved areas of the County. As community broadband investments begin to take place, local communities should assess the funding opportunities at that time and perhaps a case to expand the network to more rural areas of the County can be considered.

Municipal bonds are one financing source that can be used, which have a current cost of less than 4% for a 20-year term. Municipal bonds are either “general obligation” or “revenue” bonds, with the latter requiring segregation of telecommunications costs and revenues, and 100% dedication of telecommunications revenues to the telecommunications function until the bonds are paid off.

Also, there are a number of alternative funding sources through private vehicles, such as private equity, that have emerged in recent years as investors pursue sources of return in a low interest rate environment. Communities have begun to finance their own fiber to the home networks directly through their Home Owner’s Associations (HOA) and other private means. Private HOA financing often provides interest rates a few percentage points higher than the traditional municipal bond market and in many cases, these rates still allow for reasonable returns on capital invested. In addition, HOAs are utilizing one time assessments to raise capital for the initial fiber network build. In some cases, the assessment covers the entire network, including the backbone, distribution, and the fiber drops to individual homes. In other cases, assessments cover only the backbone and distribution networks and individual connections (fiber drops) are left to the homeowners that want to subscribe to services. In general, assessments have ranged from \$1,500 per home to \$5,000 per home, depending on the density of the community, terrain, and services required. A common model for private financing is for the community to obtain bank loans that are collateralized by (1) the good faith and credit of the HOA (2) specific assessments that will be levied to homeowners over a specific time period and (3) revenues generated by the fiber to the home network. Options 1 and 2 are generally less risky for banks and yield a lower cost of money whereas revenue-backed loans are generally riskier for banks and are met with a higher cost of money. In all cases, if the community can source private financing for the network, it will yield negotiating power with retail broadband providers that wish to serve the community. The community should expect a share of the revenues generated on the network because these revenues are generated using assets that have been financed by the community. Several providers have agreed to this business model and are actively sharing revenues with communities that have financed their own fiber to the home networks.

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## MIDDLE-MILE FUNDING OPTIONS

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### Smart Public Policy

First and foremost, adopting Smart Public Policy, such as Joint Trenching or Dig-Once policies, would allow the local government organizations to build this vital infrastructure at nearly an 80% discount from what is documented as the Buildout Costs. Should the County and cities decide that this is something they wish to pursue, they should begin to coordinate and plan for capital projects that include the undergrounding of basic broadband infrastructure. Other regional providers and utility companies should be notified of upcoming projects in an effort to coordinate construction needs. If the region adopts these types of broadband friendly public policies, it could have these identified areas buildout over the course of several years. Broadband friendly public policy templates have been provided in APPENDIX II.

### Federal Funding Opportunities

A number of federal programs are available to assist in the funding of broadband capacity expansion projects. These programs are available through various agencies, and each program has its own purpose, eligibility, and restrictions. Take for instance, in Nebraska, where the Rural Nebraska Healthcare Network (RNHN) has tapped federal programs such as the Rural Healthcare Pilot Program of the Federal Communications Commission (FCC), to fund infrastructure projects. In Nebraska, the RNHN was a 750-mile, \$18 million fiber-optic network that spanned 12 counties in the western part of the state. The RNHN is a consortium of nine primary care hospitals and dozens of clinics. While there is no new funding available under the FCC Pilot Program, this is an example of the funding approach embodied in the HCF that could be explored as part of the broadband infrastructure plan.

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## FCC HEALTHCARE CONNECT FUND

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The Federal Communications Commission (FCC) established the Rural Healthcare program as a pilot program, and modified it in 2012 to form the Healthcare Connect Fund (HCF).<sup>93</sup> The HCF is capped at \$400 million per year, and this cap is not anticipated to be exceeded in the near future. The HCF will cover broadband connections for eligible healthcare providers either as a service purchased from service providers or through participant owned and constructed networks.

To obtain funding the eligible healthcare providers must have formed a consortium, must have identified the entity or organization that will lead the consortium, and over 50% of the sites to be served must be rural in nature. Consortia can include healthcare providers that are not rural and therefore not eligible, but connections for those providers will not be funded under HCF.

Under the FCC's rules for HCF, an eligible Healthcare Provider is defined as a:

- Not-for-profit hospital
- Community mental health center
- Local health department or agency
- Community health center or health center providing healthcare to migrants
  
- Post-secondary institution offering healthcare instruction, including teaching hospital or medical school
- Rural health clinic
- A consortium of above

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<sup>93</sup> <https://www.fcc.gov/health>

Also under the FCC rules, 2:1 matching funds are required such that the consortium must fund 35% of the eligible expenses. Future revenues from excess capacity can be used as a source of required match subject to certain conditions. Competitive bidding is also required, and a consortium must demonstrate that constructing its own network facilities are the most cost effective option.

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### FCC E-RATE PROGRAM

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The E-Rate program is administered through the Federal Communications Commission’s Universal Service Fund. The FCC adopted orders in 2014 that increased the size of the E-Rate portion of the USF from \$2.4 billion to \$3.9 billion, adjusted annually for inflation, expanded funding for Wi-Fi networks, simplified the administrative process, and provided additional construction options for schools and libraries. Beginning in 2016, schools and libraries can use E-Rate funding to construct their own networks under certain rules and regulations.

The E-Rate program uses a sliding scale of discounts based on income to subsidize rates for eligible broadband and telecommunications services. The discounts can be as high as 90% for the lowest income school districts.

In 2014, the FCC took a number of steps to modernize the E-Rate program. The FCC has set a short-term high-speed Internet access target of at least 100 Mbps per 1,000 students and staff, and a longer term target of 1 Gbps per 1,000 users.<sup>94</sup> The FCC increased the annual E-Rate program cap to \$3.9 billion in funding year 2015.<sup>95</sup> The FCC clarified its consortium rules to encourage cost effective consortium based purchasing, and has taken additional steps to address rural high speed connectivity gaps for schools and libraries.

The FCC found that only a fraction of rural schools are connecting at speeds that meet the FCC targets because of the high cost of connectivity, and many schools are unable to find a provider willing to provide service. These issues resonate in the Stark region. Relevant steps the FCC has taken in its Modernization Orders include allowing self-construction of high speed broadband facilities by schools and libraries when self-construction can be demonstrated to be the most cost effective option, and equalizing the treatment of lit and dark fiber. In doing so, the FCC aims to close the rural connectivity gap. The FCC will begin the self-construction option in funding year 2016.<sup>96</sup> “Self-construction can be a useful tool for some schools and libraries when they receive insufficient responses to their FCC Form 470 and associated requests for proposals.”<sup>97</sup>

Schools and libraries “interested in pursuing self-construction must solicit bids for both service and construction in the same FCC Form 470 and must provide sufficient detail so that cost effectiveness can be evaluated based on the total cost of ownership over the useful life of the facility for applicants who pursue the self-construction option.”<sup>98</sup>

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<sup>94</sup> *In the Matter of Modernizing the E-rate Program for Schools and Libraries; WC Docket No. 13-184; Second Report and Order and Order on Reconsideration; FCC 14-189, released December 19, 2014, at paragraph 3.*

<sup>95</sup> *Id.*, at paragraph 77.

<sup>96</sup> *Id.*, at paragraph 43.

<sup>97</sup> *Id.*, at paragraph 45.

<sup>98</sup> *Id.*, at paragraph 48.

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## US DEPARTMENT OF HEALTH AND HUMAN SERVICES OFFICE OF RURAL HEALTH POLICY

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US Department of Health and Human Services administers numerous grants and grant programs, including recent grants for providing telemedicine to underserved areas. The grants focus on rural children living in poverty and their families. Those recent grants are part of a pilot program that could be expanded if it meets health goals.<sup>99</sup> This grant program should be further explored as this Study is carried out.

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## US DEPARTMENT OF AGRICULTURE, RURAL UTILITIES SERVICE, DISTANCE LEARNING AND TELEMEDICINE GRANT

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The Rural Utilities Service (RUS) was formerly known as the Rural Electrification Administration. Today, among other programs, the RUS administers a Distance Learning and Telemedicine (DLT) grant program to support its rural development mission. The DLT program is designed to use the unique capabilities of telecommunications technologies to support rural communities in connecting to each other and to the world in order to overcome the effects of remoteness and low population density. Those eligible for grants include most entities that provide education or healthcare through telecommunications technologies.

The grant funding is awarded for acquisition of eligible capital assets and technical assistance for that eligible equipment. Criteria for the grants include “innovativeness of the project,” under which proposed applications that use advanced telecommunications technology in an advanced way earn higher scores. The DLT grant program is focused on premise equipment and technology, not transmission facilities and networking. The DLT grant program uses an annual application window, typically after the first of the year, and grants are awarded on a competitive basis.<sup>100</sup> The awards can range from \$50,000 to \$500,000. Applicants are required to provide a 15% match, which cannot be from another federal source.

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## RURAL ECONOMIC DEVELOPMENT LOAN & GRANT PROGRAM

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The Rural Economic Development Loan and Grant (REDLG) program through the USDA provides zero interest loans to local utilities which they, in turn, pass through to local businesses (ultimate recipients) for projects that will create and retain employment in rural areas. The ultimate recipients repay the lending utility directly, and the utility is responsible for repayment to the Agency. Grants may be requested to the amount of \$300,000, and loans of up to \$1 million. To receive funding under the REDLG program (which will be forwarded to selected eligible projects) an entity must be described as:

- Any former Rural Utilities Service (RUS) borrower who borrowed, repaid or pre-paid an insured, direct, or guaranteed loan
- Nonprofit utilities that are eligible to receive assistance from the Rural Development Electric or Telecommunication Programs; or
- Current Rural Development Electric or Telecommunication Programs Borrowers

Examples of eligible projects include:

- Business incubators
- Community development assistance to nonprofits and public bodies (particularly job creation or enhancement)

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<sup>99</sup> <https://www.fcc.gov/encyclopedia/rural-health-care>

<sup>100</sup> *The Application Guide for the last fiscal year is available at [http://www.rd.usda.gov/files/UTP\\_2015DLTApp-Guide.pdf](http://www.rd.usda.gov/files/UTP_2015DLTApp-Guide.pdf). The guide provides details on what costs are eligible, which costs are ineligible, and the application process. In particular, costs for transmission facilities and salaries/administrative are not eligible for funding under this grant program.*

- Facilities and equipment for education and training for rural residents to facilitate economic development
- Facilities and equipment for medical care to rural residents
- Start-up venture costs, including, but not limited to financing fixed assets such as real estate, buildings (new or existing), equipment, or working capital
- Business expansion
- Technical assistance

## CHAPTER 12: ACTION PLAN & NEXT STEPS

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Stark County must build consensus amongst the community and potential partners to develop final details beyond this Study. There are many answers that will have to be answered once the stakeholders are educated on the options.

Magellan’s recommendations outlined in this action plan are to provide the group guidance to what process is used to develop consensus and to bring this network to fruition. The Task Team and community leaders will have to begin hosting workshops and developing supporting legislation to move this project forward. A good debate will ensue.

Armed with the knowledge of what is possible, at what cost, and how these recommendations should be carried out, the Task Team and County can begin to move this process forward by taking strategic steps and making wise investments. With a business case, the County and its partners must understand the opportunity before them, and understand the basic concepts and benefits that this network will bring to the community. The community will have to support this project – at all levels – giving the necessary “buy in.”

The following tasks must be accomplished:

1. Finalize project partners (school district, county, cities and townships, healthcare providers)
2. Develop consensus on governance structure
3. Identify funding opportunities and loan requirements
4. Finalize site selections for facilities to be connected
5. Finalize fiber-optic routes
6. Identify potential last-mile projects and partners to develop a proof of concept
7. Perform a Design & Engineering Study to develop actual construction plans and engineers estimates for construction
8. Determine network components, systems, and data center requirements
9. Develop Business and Implementation Plans
10. Move into implementation