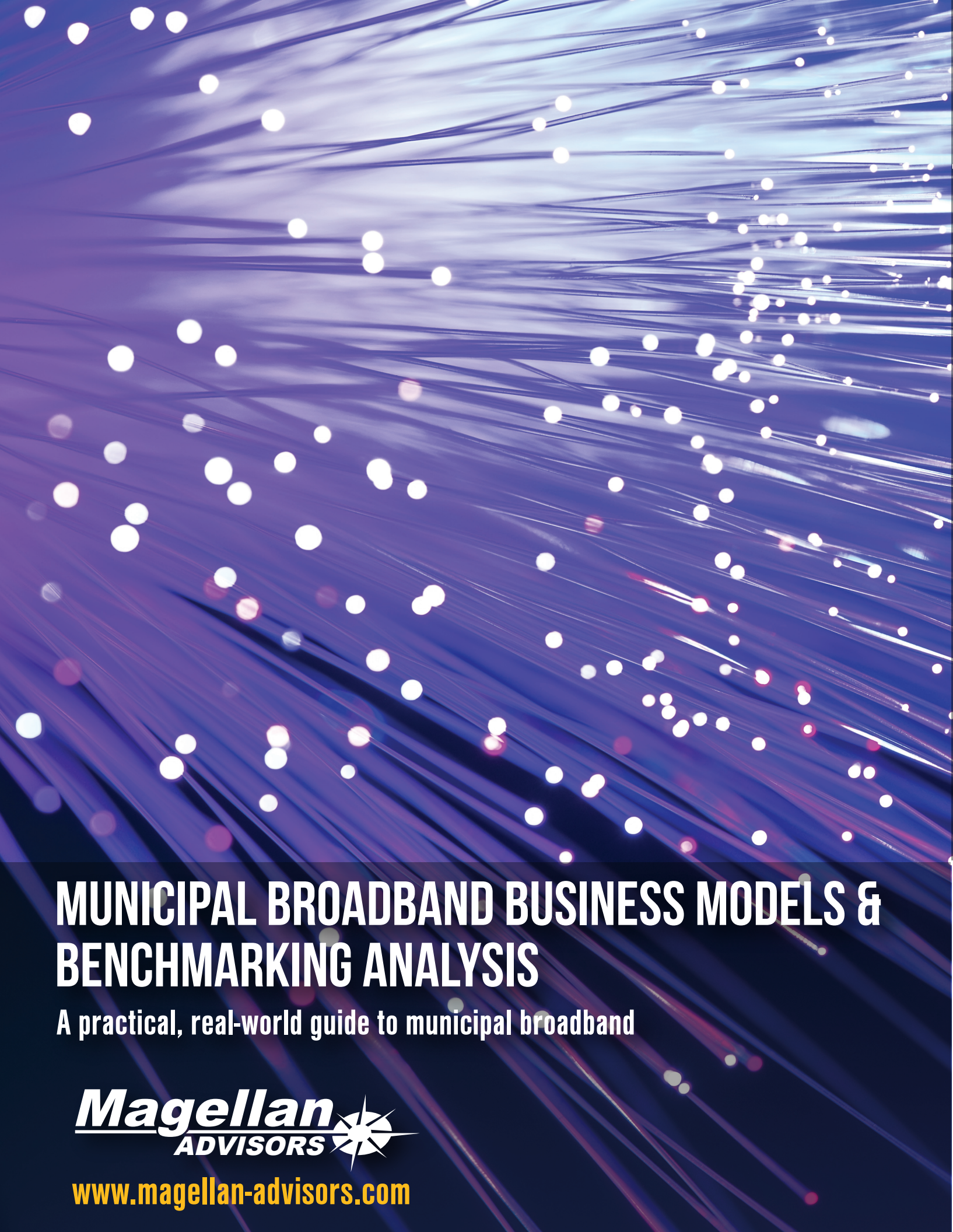

# MUNICIPAL BROADBAND BUSINESS MODELS & BENCHMARKING ANALYSIS

## A practical, real-world guide to municipal broadband

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# Executive Summary

Cities across the nation are realizing the importance of next-generation broadband services to support the future of their communities.. Next-generation broadband ("broadband") services based on fiber-optic technologies are on their way to becoming a reality in a number of cities across the country. Some notable examples where these services have been deployed include Kansas City, MO, Chattanooga, TN, Lafayette, LA and Austin, TX. Evidence suggests that broadband services have a net positive economic and social impact to communities by enhancing key functions such as, economic competitiveness, workforce development, training, educational capabilities, municipal operations, and smart city deployment.

Building knowledge around municipal broadband is important for cities considering municipal broadband to ensure that they create a solid foundation of knowlegge and understand the many forms that municipal broadband takes in the real world. This study provides extensive information and insight from communities that have implemented municipal broadband programs using a range of strategies and business models. It provides factual information on the successes and failures of municipal broadband through an analysis of local governments, including case studies, analysis, and benchmarking on a range of business models used by these organizations.

This study is applicable to a range of local, regional, and state government organizations for whom broadband is a key policy issue for their organizations.It focuses on the many municipal broadband business models that cities may consider, provides insight into how other municipal providers have implemented, and documents some key benchmarks that have resulted from their deployments.

Determining the right business model is key to the success or failure of a municipal broadband project. Selecting appropriate business models should be based on a number of factors, including a city's stage of broadband development, local environment, funding capacity, organizational capabilities and desired benefits to the community. Exploring all available options will help cities understand which business models fit best within their current environments using a context of of risk and reward, in terms of financial and community benefits. Figure 1 provides a high-level summary of the common business models used by municipalities. Many of these business models vary from city to city to some degree; however, they have been consolidated into six categories that define their key characteristics.

*Figure 1 – Summary of Municipal Broadband Business Model Options*

| Business Model | Description | Examples | Summary |
|---|---|---|---|
| Public Policy Only | • City uses policy tools and standards to streamline construction and reduce the cost of building infrastructure. | • Santa Cruz County, CA<br>• Knoxville, TN | • Low risk/reward option to support incentives to accelerate broadband investment but no "quick wins" to improve services |
| Public Services | • City financed or shared financing with other public organizations<br>• Dark fiber or data services to community organizations<br>• Sometimes retail services provided by the city to these organizations | • Seminole County, FL<br>• Leesburg, FL<br>• Columbia County, GA | • Improves the cost, access and collaboration among public organizations without forcing the city to compete with private broadband providers |
| Open Access | • City financed and operated<br>• Wholesale services only to retail broadband providers<br>• Retail providers deliver Internet, telephone, and other services | • Palm Coast, FL<br>• Danville, VA<br>• Provo, UT | • Enables more competition and choice but difficult to incentivize broadband providers to use municipal infrastructure |
| Infrastructure | • City provides conduit and/or dark fiber to businesses, broadband providers, and other public organizations<br>• City does not provide retail services | • Santa Monica, CA<br>• Palo Alto, CA<br>• Lakeland, FL | • Improves the cost and availability of fiber infrastructure to providers, businesses, and community organizations, not generally used for residential |
| Municipal Retail – Business Only | • City financed and operated<br>• Fiber services<br>• Internet and often telephone and data services to businesses | • Fort Pierce, FL<br>• Hudson, OH | • Enables the city to directly improve services to businesses but requires the city to compete with broadband providers and operate the network. |
| Municipal Retail – Residential | • City financed and operated<br>• Fiber and sometimes cable services<br>• Internet and often television and telephone to residents and businesses | • Bristol, VA<br>• Morristown, TN<br>• Ashland, OR | • Enables the city to provide major improvements to residential services but requires significant investment and operational capabilities. |

Equally important to these business models is the path that cities have taken to implement them. In many cases, municipal broadband networks have been forged over many years to become what they are today. Cities such as Bristol, TN, Morristown, TN, and Palo Alto, CA did not develop their gigabit fiber networks in one iteration; their initial networks grew over time from small operations supporting specific municipal needs into some of the most robust broadband networks in the country.

Lessons learned from other municipalities will help cities avoid pitfalls and help craft broadband strategies that have demonstrated success in these communities. Certain themes hold true across various business models and are important for cities to consider. Some of these include the following:

- Cities should consider broadband networks as long-term infrastructure programs similar to road, water, and sewer systems as opposed to one-time projects.
- Cities should gain strong local support from their stakeholders through an understanding of local broadband needs and opportunities.
- Cities should focus on the benefits of municipal broadband rather than the technologies to ensure that the community gains a clear understanding of the reasons for the program.
- Moving too quickly can be as risky as moving too slowly to achieve broadband goals, cities should take measured steps to ensure their strategies are well-planned and executed.
- Municipal broadband initiatives generally require a careful balance of community benefit and financial sustainability to remain successful over the long-term.
- Cities should focus on their strengths when evaluating options for municipal broadband and find solutions that build on current competencies; where cities do not have these competencies, they should consider public and private partnerships to fulfill the goals.

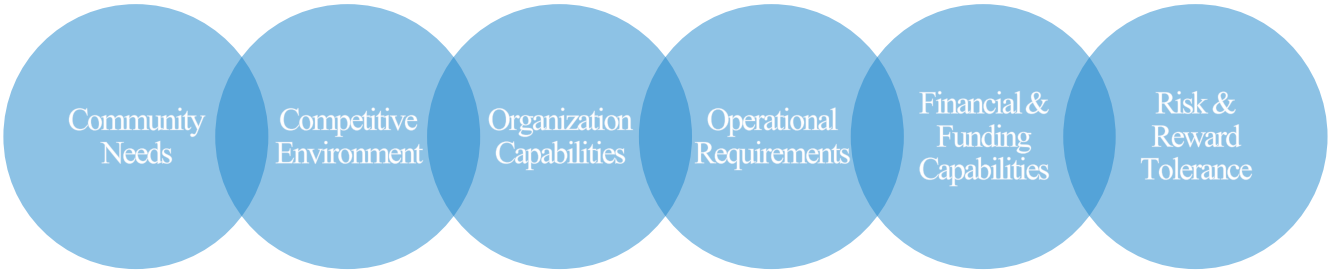
This study is designed to help evaluate the approaches other cities have utilized along with the best practices, policy decisions, and challenges they have encountered along the way. There are no cookie cutter approaches to municipal broadband, each approach must be customized to its individual community and the capabilities of its municipal organizations. This study will educate cities on the range of approaches and outcomes regarding municipal broadband by presenting case study and benchmarking information from real-world deployments across the US.

This study is structured to provide a comprehensive knowledge base on municipal broadband, providers, business models, and relevant anecdotal and quantitative data. The study is broken up into multiple sections; Section 1 introduces the range of municipal broadband business models used by cities today; Sections 2-8 provide descriptions, considerations and case studies for each business model. These sections provide information on: services, rates, markets, organizational features, and financial profiles of municipal broadband providers. “Cities,” “Municipalities” and “Local Governments” are used interchangeably to describe municipal broadband providers.

# 1. Introduction

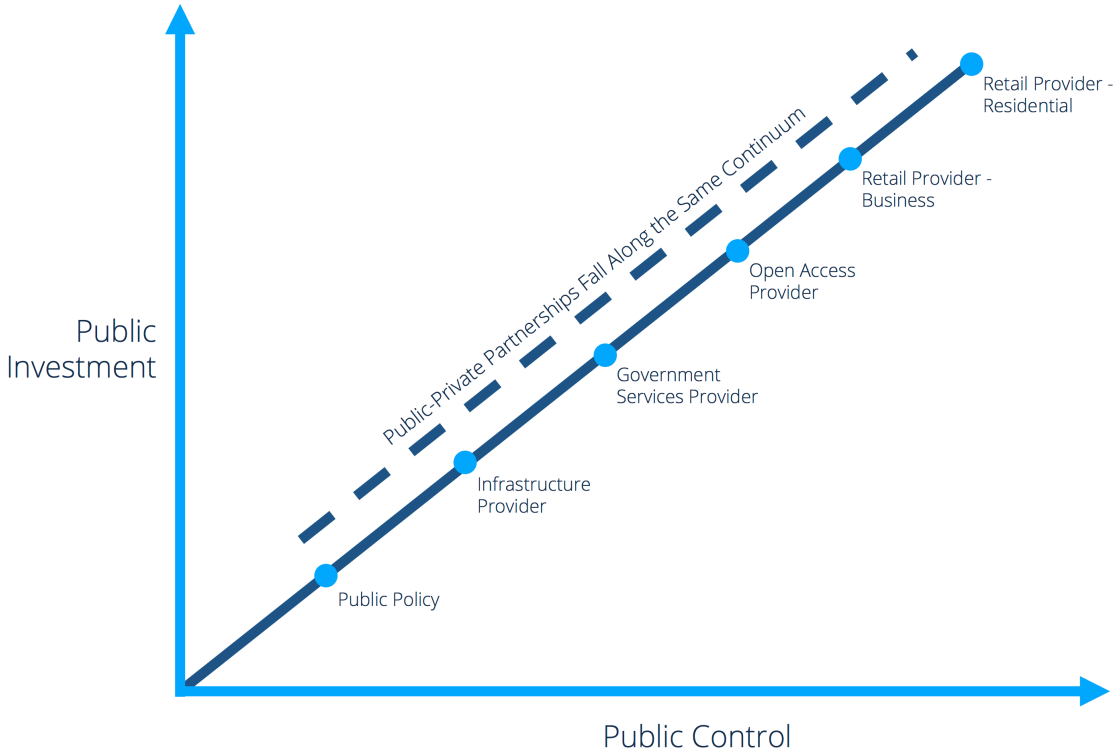
Local governments must analyze a number of factors to determine the right broadband business model to effectively meet community needs. The ability to understand the dynamics around each of these factors will dictate the most appropriate business model for a municipal broadband effort to organize and develop. Understanding the community needs, knowing the competitive market factors that define what infrastructure options fit well within the community, and determining organizational and operational capabilities of the local government all play into the selection process. Equally important is an understanding of the financial commitments and risk and reward factors that participating organizations are willing to commit in order to fund and sustain a successful broadband initiative.

*Figure 2 - Inputs to Selecting the Right Broadband Business Model*




Commonly implemented business models fall on a continuum that ranges from low risk, low investment options to higher risk, high investment options. As a local government evaluates the various business model options along the continuum, it will encounter greater degrees of risk and reward. The risks are often in terms of financial, operational, and regulatory risk, while the rewards are in terms of community benefits, revenue generation, and growth potential.

*Figure 3 - Continuum of Municipal Broadband Business Models*




Moving "up" and along the continuum implies greater local government participation in the delivery of broadband services. Models that provide only public policy support or provide only infrastructure are considered "passive" business models, whereby the government does not operate the broadband network. Business models that provide a public service, function as open access, or have the goal of providing retail service to residents and business all indicate the municipality actively operates a broadband network. Public-private partnerships fall along the continuum because unique partnerships take many forms and with responsibilities that vary among partners and situations.

Municipalities must determine which business models satisfy their risk/reward tolerance to achieve the community's broadband goals. Figure 3 describes the key features of each broadband business model in practice today. There are variations on each business model but they generally fall into the categories below.

In some cases, multiple options may be selected by an organization, while in other cases a local government will not utilize multiple models, as they may conflict with one another. For example, local governments generally utilize public policy with any of the business models, as the policies implemented by a local government will complement the other chosen business model. Conversely, a local government would not likely implement a retail model and public-private partnerships together, as these would lead to competition between the local government and one or more private partners.

This document provides descriptions of each of the prevailing municipal broadband business models and provides case study examples of municipalities that have implemented them to varying degrees of success.

*Figure 4 - Comparison of Municipal Broadband Business Models*

| | Government Does Not Operate | | | Government Operates | | | |
|---|---|---|---|---|---|---|---|
| | Public Policy Only | Infrastructure Only | Public-Private Partnerships | Public Services Provider | Open Access Wholesale | Retail Provider Business-Only | Retail Provider Residential & Business |
| Services Provided | None | Dark Fiber Only | None | Dark Fiber, Transport, Internet, Phone | Transport | Internet & Phone | Internet, TV, Phone & Value-Added Services |
| Customers | None | Broadband Providers | None | Public Organizations Only | Broadband Providers | Businesses | Businesses & Residents |
| Funding Required | Low | Moderate | Low to High | Moderate | Moderate | High | High |
| Competing with Broadband Providers | No | No | No | No | No | Yes | Yes |
| Operational Requirements | Low | Low | Low | Low | Moderate | High | Very High |
| Regulatory Requirements | Low | Low | Low | Low | Moderate | High | Very High |
| Revenue Generation | Low | Low | Low to High | Low | Moderate | High | Very High |
| Operational Costs | Low | Low | Low | Low | Moderate | High | Very High |
| Financial Risk | Low | Low | Low | Low | Moderate | High | Very High |
| Execution Risk | Low | Low | Moderate | Low | Moderate | High | Very High |

# 2. Public Policy Only

## 2.1 Overview

The municipality utilizes its public policy tools to influence how broadband services are likely to develop in its community. Public policies and local ordinances are shaped to streamline the processes of designing, constructing and managing broadband infrastructure in a local government's jurisdiction. Focus areas include right of way access, permitting processes and costs, construction practices and placement methods, and franchises and utility fee assessments.

Many local governments have also established "broadband standards" that provide engineering specifications for installing infrastructure in public right of way. These standards also establish policies for joint trenching that enable various organizations to cooperatively utilize a single open trench that has been dug for installation of utility or broadband infrastructure. Joint trenching and "dig once" policies are not simple to execute and often times take significant coordination between utility and broadband providers. These agreements are often executed on a per-project basis rather than as blanket agreements between public and private organizations.

More effective public policy standards set requirements for the incorporation of broadband infrastructure into an organization's capital projects. Many municipalities have embedded broadband development standards into their land development record to ensure that underground conduit is installed with any applicable capital projects. These include utility relocations that result from road widenings, water/sewer installations, and lighting projects. Underground conduit simply becomes part of the design process for the capital project, ensuring that the infrastructure is incorporated as part of the project, rather than an afterthought that may often be overlooked.

To be effective, these standards require a funding mechanism to ensure that there are monies available for the added design, labor, and materials needed for installing underground conduit coincident with the capital projects. Budgeting for this fund is best accomplished by analyzing the local government's capital project plan over a multi-year period and determining which projects present opportunities to install conduit. Costs for the design, labor, and materials to install underground conduit can be determined through local construction contractor rates, discounting construction costs by a percentage that is saved through use of the open trench already utilized in the project.

This option is not considered a true business model, but does impact the local broadband environment and is therefore included as one option. Local governments that do not wish to take a more active role in broadband development often utilize public policy participation to positively impact the local broadband environment. Local governments also enact these policies in conjunction with other business models.

## 2.2 Public Policy Case Studies

### 2.2.1 Santa Cruz County, California

#### *Community Profile*

Santa Cruz is known for its moderate climate, the natural beauty of its coastline and redwood forests, as well as its alternative community lifestyles and socially liberal leanings. It is also home to the University of California, Santa Cruz, a premier research institution and educational hub, as well as the Santa Cruz Beach Boardwalk, an oceanfront amusement park operating continuously since 1907. The county's population is approximately 262,000 and the City of Santa Cruz population is approximately 62,000.

#### *Development of Broadband-Friendly Policies*

The Santa Cruz County board of supervisors in November 2013 approved an eight-month timeline to overhaul its broadband infrastructure plans and regulations. Specific areas of focus include permitting fee reductions and a proposed "dig once" ordinance that would make it easier to install new fiber-optic cables during other work on area roads or utilities lanes.

The County continues a focus on broadband infrastructure throughout the county to enable businesses to function in the digital era, and students and households to have high quality access to information and communication. The county works with industry providers to develop a Broadband Master Plan in order to identify focus areas within the county that will be most suitable for gigabit services, particularly as the Sunesys backbone was constructed during 2014 and 2015 (Sunesys provides fiber connectivity to schools within Santa Cruz County). Through this, the County works with last mile service providers to ensure that these focus areas are deemed a priority, in order to support streaming requirements, product development, job creation, and online selling capability."

Zach Friend, Santa Cruz County Supervisor, said, "Many regions throughout the country face a situation similar to ours: deemed too rural for real capital investment by the Internet Service Providers but urban enough that this lack of investment really puts us at an economic and community disadvantage. To have these policies recognized at a national level shows their applicability and value throughout the country." County departments had one-on-one meetings with service providers, including AT&T, who applauded the efforts of the County.

## *Implementation of Broadband-Friendly Policies*

The initiatives were crafted together into a comprehensive set of policies:

- A “dig once” process that requires notification and an opportunity for broadband companies to join in whenever a street is cut open.
- Development of master lease agreements to simplify access to county facilities.
- Including conduit as part of public works projects, new developments, and land divisions
- Treating broadband projects like any other utility, subject only to a technical and safety review by county engineers.

That last measure produced a surprised and delighted gasp from Laurie Miller, AT&T’s director of construction and engineering, who deals daily with the complicated and time consuming approval process that is otherwise typical in California. “It doesn’t have to be baby steps,” Miller told the roundtable audience. “I encourage you to be aggressive and forward thinking.”

The County’s policies have been established since 2014. Key action items that were implemented during the process include:

- Allow the installation of equipment within public right of ways, subject only to "time, place and manner" of access, through the County's encroachment permit process.
- Streamline the application process and ensure permit fees are based on actual costs.
- Draft amendments to County regulations that facilitate the deployment of broadband technology.
- Work with broadband providers on economic development opportunities.
- Work with utility companies on their financing and installation of conduit as part of municipal projects.
- Draft an ordinance based on the San Francisco "dig once" model.

## *Impact to the Community*

As the policy changes have only been recently codified in Santa Cruz County, their impact remains to be seen in the coming years. The County and City of Santa Cruz have embarked on a broadband master planning process to determine the most feasible ways to expand broadband within their communities, for which the policy tools will become a contributing factor. The County is already assessing opportunities to install broadband infrastructure with companion projects by evaluating its capital project program over the next 10 years.

### *Challenges*

The key challenges to policy development and implementation relate to internal departments working together and communicating the gaps or shortcomings in current practices and policies. With a better understanding of overlapping or interdependent responsibilities, policies can be improved. For example, if broadband standards enable municipal stakeholders to install conduit with companion capital projects, it will need coordination from many municipal departments, local utilities, and even the local property development community. In addition, changes often come with an associated cost, so the municipality will also need to establish a fund to financially assist the early adoption of certain policies. Water and sewer projects will need to include infrastructure that may create issues with public works requiring separation between conduit and water and sewer assets. Part of the challenge in working together is learning the domain of broadband infrastructure, and how broadband works with other infrastructure, and this process simply takes time.

## 2.2.2 Knoxville, Tennessee

### *Community Profile*

Knoxville is located in east Tennessee, along the Tennessee River basin created by the foothills of the Appalachian Mountains to the east and the Cumberland Plateau to the west. The city's population is around 180,000, with 1.1 million in the metropolitan area, ranking it as the 64$^{th}$ largest MSA in the country. Knoxville is within a day's drive for 49.4% of the US population, ranking it sixth among metro areas (the top five are in Ohio) with the largest population base within a day's drive.

Home to the University of Tennessee, a top-rated Carnegie research institution and educational hub, and the US Department of Energy's Oak Ridge National Lab, Knoxville serves as regional gateway to the Great Smoky Mountains National Park, the most visited national park in North America at over 10 million annual visitors.

Knoxville is located 100 miles northeast of Chattanooga and its well-known fiber-optic network. About 100 miles to the northeast of Knoxville is Bristol, Virginia, which has also seen significant job gains as a result of Bristol Virginia Utilities Authority's publicly owned fiber-optic network that stretches into most of southwestern Virginia.

### *Development of Broadband-Friendly Policies*

There is no municipal network in Knoxville, broadband development plan or formal broadband policy in place. The prevailing opinion of city leadership is that when demand exists in Knoxville that service providers will grow to meet that demand. In other words, the city's strategy is a hands off approach – let consumers and service providers find each other. The downtown coordinator on the Knoxville Mayor's staff says, "If [service

providers] call us, we can be encouraging of them to come to our market and take a look at it."[1]

The Knoxville Utilities Board (KUB) provides electric, gas, water, and wastewater services to customers in Knoxville and parts of seven surrounding counties. KUB is governed by a seven-member board appointed by the Mayor and confirmed by Knoxville City Council who serve seven-year terms. The KUB has long maintained the position that their mission is to serve Knoxville with traditional utilities, and that telecommunications has no place at an electric and water utility. The KUB recently revisited the topic of becoming a broadband service provider, but the issue was quickly dismissed.[2]

## *Implementation of Broadband-Friendly Policies*

While not wanting to get into the broadband business directly, city officials do recognize the importance of broadband to the economy and a modern quality of life, and say they are more than accommodating when service providers want to expand infrastructure. Further, the city does acknowledge the prohibitive cost involved when installing new fiber, so there is talk of codifying a "dig once" ordinance that would require installation of fiber-optic cables or conduit during construction phases of roads and developments when ground is open.

Further, should a provider want access to existing underground conduit, the city and KUB claim they do all they can to assist. When surface roads are opened for construction, the city and KUB reportedly reach out to service providers to let them know that ground will be open during a given period and that arrangements can be made to install conduit or blow fiber should the provider desire.

## *Impact to the Community*

Knoxville's approach to improving its Internet access is analogous to crossing one's fingers and hoping for the best. Downtown Knoxville's network infrastructure is comprised of an inconsistent patchwork of AT&T DSL, Comcast, and a very limited amount of private provider fiber-optics. Some areas of downtown have no access, while others have no choices.[3] In areas of the city outside of downtown, a similar patchwork of infrastructure and limited choice in providers exist.

While several providers exist in Knoxville, one would think the city is well served with choices of providers in a healthy and competitive market, yet seldom do service provider coverage areas overlap, and as a result, residents and businesses are left with

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[1] http://electronicstaff.com/2013/downtown-knoxvilles-broadband-internet-access-kinda-sucks-can-it-be-fixed

[2] http://muninetworks.org/content/knoxville-news-station-envious-chattanooga-fiber-network

[3] http://insideofknoxville.com/2013/04/broadband-in-downtown-knoxville-reality-for-some-dream-for-others

few choices. As a result, Knoxville residents and businesses pay more for less bandwidth.

City leaders have been quoted in local media as saying they do not believe their broadband policy has deterred any businesses from locating in Knoxville.[4] The city believes that existing service providers are able to meet broadband demand as the demand is generated. However, the local NBC affiliate, WBIR, archives examples of companies that deliberately chose to expand to Chattanooga rather than Knoxville specifically because of the lack of Internet access.[5]

## *Challenges*

While the city tries to encourage downtown commerce with tax credits for developers and a new entrepreneur center, critical broadband connections are missing. City officials say the downtown area has a limited amount of aging conduit that is discouraging private providers and is cost prohibitive to expand. Likewise, old buildings with substandard internal wiring further discourage investment from private companies.

[4] http://muninetworks.org/content/knoxville-downtown-wondering-where-all-broadband

[5] http://archive.wbir.com/news/article/197475/2/Chattanooga-fiber-optic-network-attracts-Knoxville-business-expansion

# 3. Public Services Provider

## 3.1 Overview

If the organization becomes a public services provider, it will utilize its fiber and broadband resources to interconnect multiple public organizations with fiber or wireless connectivity. These organizations are generally limited to the community anchors that fall within their jurisdiction, including local governments, school districts, higher educational organizations, public safety organizations, utilities, and occasionally healthcare providers. The majority of these anchors require substantial connectivity and often, the local government's network can provide higher capacity at lower costs than these organizations are able to obtain in the commercial market.

Local government and utility networks across the country have been built to interconnect cities, counties, school districts, and utilities to one another at lower costs and with long-term growth capabilities that support these organizations' future needs and protect them from rising costs. In these cases, public services providers may be cities, counties, or consortia that build and maintain networks. The providers utilize inter-local agreements between public agencies to establish connectivity, rates and the terms and conditions of service. In many cases, these networks may be restricted from commercial use, in others, local governments deploy commercialized broadband services across them.

Many of these networks grow organically from serving a single entity, such as a municipality or school district, to serving multiple entities throughout the local area or region. Municipalities have been particularly successful deploying these networks for their own needs and expanding them to serve surrounding public organizations. In many cases, the networks are established by municipal IT, public works, or utilities departments. Through relationships with surrounding organizations, they expand to facilitate more connectivity needs. The success of these networks depends on the relationships held between local organizations and their willingness to collaborate with one another.

Public service providers generally do not engage in providing any commercial broadband services across their networks. The fiber networks have not generally been designed to provide commercial broadband and they sometimes lack the capacity and redundancy to facilitate commercial services. Instead, they have been designed to meet local organizational needs for fiber connectivity over which Internet, phone, cloud, and other services are carried.

## 3.2 Public Services Provider Case Studies

### 3.2.1 Seminole County, Florida

#### *Community Overview*

Seminole County is in central Florida, northeast of Orlando on the I-4 corridor. With a population of 422,718, Seminole County has been one of Florida's fastest growing counties over the past 10 years in terms of economic growth and residential development. Between 2004 and 2014, the county's population grew about 30%.

#### *Development of the Initial Network*

Seminole County owns and operates a 450-mile fiber-optic network that was installed over the past 20 years by the county's Public Works departments primarily to serve the needs of transportation. The county's Traffic Engineering Group initially developed the network by connecting traffic signals to fiber in the early 1990s to provide enhanced communications and better reliability. What was originally conceived to be a network used exclusively for transportation became a resource that connected public organizations across the county. By 2000, multiple agencies were connected to the county's fiber network.

Inter Local Fiber Maintenance Agreements were signed with Seminole Community College, Seminole County School Board, and the Cities of Lake Mary, Altamonte Springs and Winter Springs. Most fire stations at this time were connected by frame relay services, for which the county was paying the telecom providers for connections, repairs, and maintenance. These connections were disconnected as new fiber connectivity provided greater capacity at lower costs to the local organizations.

To date, the county's Traffic Engineering Department has connected 26 fire stations, 58 county buildings, 44 schools, 4 Seminole Community College campuses, 41 city buildings, and 17 water treatment plants to the fiber network. In addition to the network, the department maintains over 375 traffic signals, 148 school flashers at 73 locations, 46 beacons and flashers, and 29 variable message signs. The fiber network consists of different types of cables and strand counts: single mode, multi-mode, and hybrid. This results in approximately 1,246 active strand pair miles of fiber.

#### *Development of Broadband Services*

Although the county has benefited significantly from the fiber program, including the connection of a number of county buildings; Traffic Engineering's main goal and reason for the network has been and continues to be traffic safety, improved traffic signal management, citizen information, and driver safety. In 2009, the county conducted a broadband study to determine how this network could expand broadband services throughout Seminole's communities.

The study found specific opportunities to expand the county's network in partnership with broadband providers; however, several obstacles were identified that limited these potentials. First, some portions of the network were constructed using Federal Highway Administration funding, which places certain restrictions on commercial use. Second, some portions of the network were shared with the Florida Department of Transportation, which also placed restrictions on commercial use of the network. Workarounds were developed to mitigate several of these key issues, however, the County did not want to risk the current benefits of the network to the various organizations using it and has since tabled the broadband initiative.

### *Impact to the Community*

The county's network has saved the public organizations connected to the network millions of dollars that would have otherwise been spent on broadband connections between facilities. The network now connects several hundred government, city, county, school and community college facilities as well as provides a far-reaching communications network for the vast majority of Seminole County's traffic signals. The network has enabled the county and its cities to:

- Share resources between the county, cities, schools and community colleges
- Aggregate demand for public procurements to attain volume purchasing power
- Provide inter-jurisdictional public safety communications between the County and cities
- Reduce public organizations spend on communications services on a countywide basis
- Future-proof the communications needs of all organizations connected to the network

### *Challenges*

Significant challenges were identified in certain portions of the County's network, resulting from the commingling of fiber assets with the Florida Department of Transportation (FDOT). The restricted use of the FDOT's assets limited the County's opportunities to utilize this fiber in commercial transactions. However, the County was still able to utilize these assets for its own purposes as well as other public organizations connected to the network.

### 3.2.2 Leesburg, Florida

#### *Community Overview*

Leesburg is in Lake County, located in central Florida between Lake Harris and Lake Griffin at the head of the Oklawaha River. Leesburg is part of the Orlando–Kissimmee–Sanford Metropolitan Statistical Area. According to the US Census, the city has a total area of 24.4 square miles, 5.8 square miles of which is water.

The City of Leesburg is home to 20,464 people and 8,485 households, with a population density of 653.2 inhabitants per square mile. The median income for a household in the city was $33,698, with per capita income for the city at $19,409. About 16.2% of families and 21.4% of the population were below the poverty line.

Several major highways pass through Leesburg, including US 27, US 441, and SR 44. The Florida Turnpike passes just to the south and west of Leesburg. Leesburg is the home of Beacon College and Lake-Sumter State College, with campuses also in Clermont and Sumterville.

In the early 20th century, Leesburg developed as an agricultural center important for watermelon production and later for the citrus industry, which was the principal business in Leesburg for many years until colder winters pushed citrus to the south. Today, most of Leesburg's growth and economic development is the result of the increasing popularity of the area as a retirement destination and the rapid growth of nearby Orlando.

#### *Development of the Initial Network*

In 2001, Lake County began offering private businesses access to one of Florida's most extensive, municipally-owned broadband networks, which at the time included about 185 miles of fiber. The fiber-optic network connected to hospitals, doctor offices, private businesses, and 44 schools. While the majority of communities find success supplying broadband, Leesburg has actually gained notoriety using fiber for other purposes.

Faced with sky-high wholesale power costs, Leesburg took action to reduce those costs using smart grid technology. The utility was an early adopter of smart grid and automatic meter reading, and in 2008, the utility put together a smart grid business plan that projected operational savings of $900,000 for the city's electric system and an additional $400,000 for the water system.

Then, in 2009, Leesburg became one of 33 public power utilities to win smart grid grants from the Department of Energy under the American Recovery and Reinvestment Act. The utility received $9.75 million for its smart grid project, plus a $1.4 million energy efficiency and conservation block grant. With the grants, Leesburg is installing smart meters for all of its 23,000 customers, plus more than 4,000 energy management

systems that allow customers to program when they operate their electrical appliances and heating and cooling systems.

### *Development of Broadband Services*

The City of Leesburg's Information Technology Department provides technology planning, continuous operation, and security of the city's data center operations. The IT department is also responsible for design, development, and modification of custom applications, such as financial reporting, revenue collection, payroll, personnel records, accounts receivable, accounts payable, and pension.

Still, the city would rather not serve as a retail service provider, preferring to use the wealth of fiber network assets and investments as an infrastructure provider to enable advanced municipal services. Among Leesburg's existing clients are Lake County government, Lake County Schools, and Central Florida Health Alliance. The Google test project could expand that fiber-optic network to a new group – residents.

When Leesburg applied for the Google Gigabit project, they noted their fiber-optic assets in seeking out Google as a services provider. The city already provides one of the most important components for Google's plan – more than 185 route miles of fiber-optic cable spanning the city and county, which would be vital for Google to reach thousands of local businesses and homes. At the time the Leesburg City Manager explained that "Leesburg can offer Google a well-established and well-maintained fiber-optic backbone from which they can launch their fiber-to-the-home initiative. Our community's diverse demographic will be an excellent test bed for all kinds of bandwidth intensive consumer applications."[6]

### *Impact to the Community*

Leesburg and Lake County had experience with fiber deployments in the late 90s, before many other higher profile communities considered their own deployments. Therefore, in the 2000s, when many communities began formulating the economic development justifications for deploying their own networks, many economic researchers turned to Lake County for a look at economic impacts. An early study[7] of the economic impact of municipal networks shows that Lake County experienced approximately 100% greater growth in economic activity relative to comparable Florida counties since making its municipal broadband network generally available to businesses in the county.

Further, in Lake County and Leesburg, the benefits of the fiber network deployment are not just limited to broadband Internet and voice services. Until the late 2000s, the City of Leesburg had some of the highest power rates in the state. However, today the

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[6] http://www.leesburgflorida.gov/news/news_item.aspx?item=Leesburg_Seeks_Partnership_with_Google

[7] "Broadband and Economic Development: A Municipal Case Study from Florida" *Applied Economics Studies*. Ford and Koutsky, April 2005.

municipal utility employs end-to-end smart grid technologies – from smart meters to transmission system upgrades, to deliver power cheaper and more efficiently to Leesburg residents than elsewhere in the state. Thanks to the fiber network, the city strives to be the lowest-cost retail provider of electricity in Florida.[8]

When it comes to electrical infrastructure, the same trends as in broadband infrastructure -- communities are better off when the infrastructure puts community needs first. Private companies, even regulated ones, are simply not structured to do that. In Leesburg's case, they knew that just an advanced meter deployment would cut their cost. "We told our commission we're not going to increase our rates because we're rolling this out," said the Electric Director of Leesburg Power. "We know we'll be reducing the customer charge to share those savings." Moreover, that proved to be the case, because by the end of 2010, the city had saved over $1 million.[9]

### 3.2.3 Columbia County, Georgia

#### *Community Overview*

Columbia County is located on the northeastern border of Georgia, along the Savannah River approximately midway along the state line with South Carolina. The legal county seat is Appling, but the location of Columbia County's government and courts is Evans. As of 2013, the population was 135,416 with almost 44,000 households. The county is approximately 308 square miles, of which about 18 square miles is water, giving the county a density of 428 people per square mile.

Transportation access is excellent in Columbia County, with east-west Interstate 20 passing through the county, three US highways, including US 78, US 221, US 278, and several state highways. The median income for a household in the county is $69,306, with per capita income of $30,949. About 8.3% of the population is below the poverty line.

In post-WWII era, the county's population increased dramatically as military personnel stationed at Fort Gordon settled in Columbia County. Soon after, agriculture declined, as farmland was redeveloped as suburban housing for people employed in nearby Augusta. Columbia County is included in the Augusta, GA-SC Metropolitan Statistical Area, and is considered one of the fastest growing counties in the United States.

#### *Development of the Initial Network*

The National Telecommunications and Information Administration (NTIA) awarded the Columbia County Information Technology Department a $13.5 million BTOP grant to build an $18 million 220-mile fiber-optic network to better serve county residents and businesses. The goals stated in the BTOP application were those of economic

[8] https://www.smartgrid.gov/files/City_of_Leesburg_Project_Description.pdf
[9] http://www.greentechmedia.com/articles/read/are-munis-and-co-ops-leading-in-smart-grid

development, job creation, improved educational opportunities, and support of a high-capacity data center at the Medical College of Georgia.[10]

On December 13, 2010, Columbia County initiated construction on the fiber-optic network at a groundbreaking ceremony near the Columbia County Library in Evans, GA. This library was the first Internet access point for the network and houses network servers. Upon completion, Columbia County had connected nearly 100 community anchor institutions to its countywide fiber middle mile network. The county improved access to healthcare, public safety, and government facilities, as well as provided dozens of free Wi-Fi hotspots to community locations, including parks, libraries, and community centers. The county constructed seven wireless towers (five are BTOP-funded) to improve wireless communications capabilities throughout the region.[11]

## *Development of Broadband Services*

The Columbia County Broadband Utility is a department of the Deputy County Administrator's office, which operates and maintains the Columbia County Community Broadband Utility, or C3BU for short. The C3BU's mission is to provide a cost-efficient, self-sustaining middle-mile fiber network for the community.[12]

One of the primary stated goals of the network was to enhance public safety communications in the county. Using the new towers, the county connected more than 30 public safety entities and connected traffic devices, including stop lights, surveillance equipment, and notification boards to the statewide Intelligent Transportation System to improve public safety and traffic flow along the major transportation corridors.

## *Impact to the Community*

The first entity to benefit from the high-speed access was the Sheriff's Office, which was previously in serious need of improved communications. In addition to county government facilities, public services, and community anchors, the network provides free Wi-Fi in Columbia County parks and libraries.

In February 2014, a brutal ice storm swept through the South. Power went out to most of Columbia County, with many land phone lines frozen or knocked down by falling trees, and cellphone service was spotty and unreliable. However, one service never failed or faltered – the county's fiber network. Geared for public safety, the entire 220-mile fiber-optic network is underground.[13]

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[10] http://www2.ntia.doc.gov/files/grantees/ga_columbiacounty_final.pdf
[11] http://www2.ntia.doc.gov/grantees/ColumbiaCounty
[12] http://www.columbiacountyga.gov/how-do-i/broadband-utility
[13] https://www.benton.org/node/180775

## *Challenges*

The director of the broadband utility discussed some challenges to help explain what the network means to the public. "It is not", he said, "built to give everyone free Internet. That's just not feasible."[14] "We're not here to compete with commercial interests, but this is about economic development. We see this as another reason people may be attracted to Columbia County. We are wholesalers. Who the customers are remains to be seen."

Also, as true in many states, the strength of incumbent providers and their lobbying efforts often gain the support of state representatives. Through the last decade, incumbents have fought to overrule local authority on broadband and telecommunications issues.[15] The Georgia State Assembly's mulling of Municipal Broadband restrictions each year (2012 SB313, 2013 HB282) could potentially curb a community's ability to transport digital commerce. These legislative activities could also severely affect the option of growing municipal fiber services in communities in the future. However, for the time being, and after many years of fighting the telecom lobby in Georgia, municipalities appear to have defended their authority and the ability to compete in the broadband market.[16]

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[14] http://chronicle.augusta.com/news/metro/2012-09-21/new-broadband-sytem-brings-speed-columbia-county-communications

[15] http://chronicle.augusta.com/news/government/2012-01-26/bill-would-limit-government-internet-systems

[16] http://stopthecap.com/2013/03/11/georgia-votes-down-municipal-broadband-ban-in-bipartisan-94-70-vote

# 4. Open-Access Provider

## 4.1 Overview

Open-access provides a business model whereby the local government generally owns and operates the physical infrastructure and the network electronics necessary to provide a lit transport service. A lit transport service is a data connection from a location where the local government network interconnects with one or more broadband providers to a customer's premise. Local governments generally own the entire fiber infrastructure along this path and the terminating equipment at either end. Open access networks establish a transport connection, similar to a Type II telecommunications service from a network-to-network interconnection to an end user, which could be a business, residence, or community anchor organization.

Local governments that adopt open-access generally own substantial fiber-optic networks in their communities. Open-access allows these local governments to "light" the fiber and equip the network with the electronics necessary to establish a "transport service" or "circuit" to service providers interconnecting with the local network. Service providers connect from a common interconnection point and have access to all customers connected to that network.

Open-access defines a network that is available for any qualified service provider to utilize to reach end users in the serving area. It allows a local government to aggregate demand on a single network that they are able to interconnect with participating service providers. The concept of open-access enables competition among service providers across a network that is owned by the local government. The local government remains neutral and non-discriminatory with providers who deliver services over the network. The local government establishes a standard rate structure and terms of service for use by all qualified participating service providers. Service provider lease access to the network based on the amount of bandwidth required by the end customer.

In practice, open-access networks in the US have experienced varying degrees of success and failure. Some of the most notable open-access networks include UTOPIA in Utah, nDanville in Danville, Virginia, and FiberNET, in Palm Coast, Florida. UTOPIA has experienced its fair share of issues, many of which are not directly a result of its open access business model. However, open-access complicates the operations, management, and financial sustainability of networks because multiple parties are reliant on each other's success for the network to sustain itself financially. A number of issues are common when developing and operating open-access networks:

- What are providers willing to pay for access and can these rates sustain competitive retail pricing to the end users?
- Can the local government set rates to providers low enough to incentivize demand and use while still generating enough revenue to cover operating expenses and debt service?

- What incents broadband providers to market and sell services on the network, as they will ultimately determine the revenues received by the local government to sustain the network?
- Will the open-access network stimulate competition or drive significant market share to a single dominant provider while other providers cannot compete?

## 4.2 Services and Rates

Open access providers have used deployed fiber services to primarily businesses, community anchors and in some cases residents. They generally charge wholesale rates to retail broadband providers to use their networks. Figure 5 provides a comparison of the services offered by three municipal open access providers. They publish rates to competitive service providers, charging a monthly recurring fee based on either bandwidth of the service utilized or a flat fixed fee per month.

*Figure 5 – Municipal Open Access Provider Service Portfolios*

| | Danville, VA | Palm Coast, FL | Burbank, CA |
|---|---|---|---|
| Commercial | | | |
| Internet | ✔ | | |
| Telephone | ✔ | ✔ | ✔ |
| Data Connectivity (Transport) | | ✔ | ✔ |
| Wholesale | | | |
| Data Connectivity (Transport) | ✔ | ✔ | ✔ |
| Dark Fiber | ✔ | ✔ | ✔ |
| Community Anchor | | | |
| Internet | ✔ | | |
| Telephone | ✔ | | |
| Data Connectivity (Transport) | ✔ | ✔ | ✔ |
| Dark Fiber | ✔ | ✔ | ✔ |

## 4.3 Market Penetration

Open access providers focus primarily on equipping local businesses and community anchors with improved connectivity. Their markets are determined by extending fiber to business parks, school campuses, hospitals, and other key business and community locations. As such, penetration of their services in these local markets is not clear-cut and should be tied to the specific geographies that they cover versus the entire market. As a result, low market penetration is not an indication of the success or failure of an open access provider.

Figure 6 illustrates the number of customers connected to each of these providers' networks. In these cases, providers have low market penetration because their fiber networks are not deployed on a citywide basis; rather they are deployed strategically to connect the customers that require service.

*Figure 6 – Market Penetration Benchmarking – Municipal Open Access Providers*

| | Danville, VA | Palm Coast, FL | Burbank, CA |
|---|---|---|---|
| Commercial | | | |
| Premises Passed | 2500 | 1500 | 6000 |
| Subscribers | 200 | 70 | 58 |
| Penetration | 8% | 4.67% | 0.97% |
| Community Anchors | | | |
| Schools | 17 | 16 | 8 |
| Libraries | | | 3 |
| Healthcare | 50 | 9 | |
| Municipal | | 28 | 15 |
| Years to Achieve Penetration | 7 Years | 4 Years | 5 Years |

## 4.4 Organizational Profiles

Municipal open access providers are organized either under electric utility divisions or within the information technology divisions for each municipality. Cities generally start small, providing a limited amount of fiber out to key customers and growing their organizations "inside" these divisions. In many cases, these operations remain small and are not developed as enterprise funds of their own to minimize the overhead associated with operating a new fund. This has allowed them to grow at a moderate pace and maintain the benefits of operating within a current utility or general services environment.

## 4.5 Financial Profiles

Financial information for municipal open access providers is more limited than with providers that implemented municipal retail business models. In the three cases, each provider utilized existing enterprise or general fund resources to "startup" the fiber program. In the case of Palm Coast, the annual appropriations were made over a period of five years to arrive at a total funding of $3.2 million. The cities of Burbank and Danville have followed similar practices.

*Figure 7 - Funding Sources for Municipal Open Access Providers*

| | Danville, VA | Palm Coast, FL | Burbank, CA |
|---|---|---|---|
| Investment | $2,500,000 | $3,200,000 | $2,700,000 |
| Funding Source | Enterprise Fund | General Fund | Enterprise Fund |
| Term of Debt | No debt | No debt | No debt |
| Interest Rate | No debt | No debt | No debt |

Evaluating financial performance of this class of municipal providers proves difficult. Less financial information was readily available, and in some cases capital and operating costs were "buried" in other funds and were not easily identifiable in CAFRs or though discussions with city personnel. This is common in cases where broadband programs are not codified as enterprise funds or utilities within each city. High-level summary figures for gross revenues, operating costs, net income, and capital investment were available; however, revenue and cost line items were more obscure.

*Figure 8 – Income Statements from Open Access Providers (Most Recent Year)*

| | Danville, VA | Palm Coast, FL | Burbank, CA |
|---|---|---|---|
| Gross Revenues | | | |
| Commercial | $1,000,000 | $140,000 | |
| Community Anchor | $800,000 | $382,000 | |
| Wholesale | $1,000,000 | | |
| Other Revenue | | | $3,300,000 |
| Total Gross Revenue | $2,800,000 | $522,000 | $3,300,000 |
| Operating Expenses | | | |
| Cost of Services | | $190,000 | $344,000 |
| Sales, General & Administrative Costs | $1,700,000 | $170,500 | $583,000 |
| Total Operating Expenses | $1,700,000 | $360,500 | $927,000 |
| Operating Income | $1,100,000 | $161,500 | $2,373,000 |
| Net Income | $1,100,000 | $161,500 | $2,373,000 |

## 4.6 Open-Access Provider Case Studies

### 4.6.1 Palm Coast, Florida

#### *Community Overview*

Palm Coast is a city of 75,000 residents in northeast Florida about an hour south of Jacksonville. The city provides a wide range of services including development services, fire services, street construction and maintenance, parks and recreational activities. Palm Coast contracts with the Flagler County Sheriff's Office for law enforcement services. The municipality's number one goal is to "Provide quality services, maintaining the city's financial soundness." From this goal emerged several initiatives designed to provide a greater level of service and an expansion of capabilities while reducing the government's costs. Information Technology has been a key driver for innovation and increased efficiencies across various departments.

#### *Development of the Initial Network*

In 2006, the Palm Coast City Council approved a five year fiber-optic deployment project funded at $500,000 annually for a total investment of $3.2 million. The network was developed to support growing municipal technology needs across all public organizations in the area, including city, county, public safety, and education. It was also planned to support key initiatives such as emergency operations, traffic signalization, collaboration, and video monitoring.

Palm Coast utilized a phased approach to build its network using cost-reducing opportunities to invest in new fiber-optic infrastructure. As each phase was constructed, the city connected its own facilities and coordinated with other public organizations to connect them, incrementally reducing costs for all organizations connected to the network. This process delivered a reasonable payback from each stage of investment and allowed the city to continue to fund the future expansion of the network. About $500,000 in annual funding was appropriated from the general fund each year to build various components of the backbone network. The city achieved offsetting cost reductions by disconnecting its current connections with telecom providers in the area.

Through deployment of this network over the 5-year period, the city realized a savings of nearly $1 million since 2007 and projects further create annual operating savings of $350,000 annually. In addition to these savings, the network provides valuable new capabilities that enhance its mission of serving the residents and businesses of the community.

#### *Development of Broadband Services*

Palm Coast experienced staggering population growth between 2000 and 2010, which nearly doubled its size; however, the housing downturn in the late 1990s hit the city particularly hard. Palm Coast's economy suffered from this retraction and the city began a program in 2006 to stimulate economic development. Palm Coast determined that its

network could provide enhanced benefits to economic development and launched a program to take its network commercial. The city evaluated the opportunities to use its network to expand broadband services, particularly focused on retaining local businesses. The city developed a business plan to expand its network in cooperation with local service providers and executed this plan to deploy the network in 2007.

The city employed an open-access business model whereby the city provided the physical fiber-optic network and electronics to connect broadband providers with individual businesses in key serving areas of the community. Broadband providers were charged monthly access fees based on the speed (bandwidth) of the service required by the business. The city builds new connections from its current fiber network to individual businesses, deploys premise equipment to businesses, and interconnects broadband providers to them. Broadband providers are responsible to market, sell, and manage all retail services on the network and pay the city access fees to utilize the system, on a per customer basis.

As FiberNET was deployed, the city realized that its network could become a significant resource for other public organizations in Flagler County. In 2009, the city bid and won a competitive E-Rate contract with the Flagler County School Board to provide Gigabit and 10 Gigabit fiber services to 16 county schools. The city incurred a $250,000 upfront cost to extend the network to these schools and generates about $300,000 in annual revenue from this contract. In addition, the city has connected Flagler County offices and various other public organizations that make use of the competitively priced fiber services. In 2010, the local hospital contracted with the city to provide Gigabit connectivity to its main campus in Palm Coast and upgraded fiber connectivity to eight of its affiliated doctor's offices throughout the community. This provided significant upgrades for each local doctor's office and reduced each office's costs from approximately $750 to $300 per month.

The city manages FiberNET through its internal Information Technology Department. FiberNET is managed by shared staff resources within IT, providing technical expertise, engineering, customer management, provider management, and related services for FiberNET; approximately two full time employees manage FiberNET today. The city outsources operations and management of the physical fiber-optic network to a local fiber contractor who provides design, construction, repair, and maintenance.

### *Impact to the Community*

In a market where local fiber was scarce and unaffordable for all but the largest businesses, Palm Coast FiberNET now provides cost-effective fiber access for as little as $50 per month for a 10Mbps connection. Service providers utilize the network to deliver Internet and business communications services for significantly lower costs than were previously available. FiberNET has reduced the costs of business Internet services across the city by 30%. The city has enabled new competition and introduced a competitively priced fiber product into the wholesale market within Palm Coast. Doing

so has enabled competition among local providers using the network and the local incumbents.

Most recently, the Allier Fiber Backbone, a long-haul fiber network that interconnects Miami to Atlanta has been integrated into Palm Coast FiberNET, and providers connected to Allied Fiber have now entered the Palm Coast market. This further diversifies the competitive landscape in Palm Coast and enables local businesses more choices for their broadband needs. FiberNET has four providers operating on its network to date, two of which are new to the Palm Coast market. Key benefits include:

- Multi-use network connecting city, county, school, healthcare, and support organizations
- Reduced overall government spending by nearly $1 million per year
- Lowered business Internet costs by 30% across the city
- Reduced education spending by $300,000 annually
- Upgraded education services to 1 and 10 Gbps speeds
- Secured future bandwidth needs for the community, 100 Gigabit and beyond
- Financially sustainable, cash flow positive within six years
- Expanded competition, choice, and availability of broadband services for local businesses
- Increased reliability, performance, and availability of fiber broadband across the city
- Introduced two new service providers to the Palm Coast market
- Reinvested system revenues expanding the network to cover more of the city's geography
- Future-proofed local business needs with speeds up to 10 Gig
- Secured future bandwidth needs for the community, 100 Gigabit and beyond

## *Challenges*

Palm Coast has struggled with developing the business case for new fiber connections in circumstances where local businesses are not in close proximity to the network. FiberNET attempts to set rates for fiber services consistently across the city so that broadband providers pay the same wholesale rates across the entire service area of the network. This ensures that Palm Coast businesses pay consistent costs for their broadband services, regardless of location.

The municipality has experienced some issues with its broadband providers in building new fiber connections that may not present a strong business case. In these cases, the costs for fiber connections exceed the city's payback threshold; however, the broadband provider has customers ready to subscribe for service. For example, a new 2,500 foot fiber connection to a business costs the city $20,000 in construction costs with a revenue opportunity of only $1,200 per year, which results in a payback of 16.6 years.

Palm Coast must make the decision whether to build out to this customer in line with city's overall goals of supporting local economic development. In some cases, where the payback has been beyond the city's threshold, it has opted to not build the connections; however, in most cases the city has proceeded with these connections. In other circumstances, the city has declined to build where these connections are infeasible and the revenues generated do not achieve a reasonable payback on the investment. Under most conditions, the city has been successful at building out these connections; however, this has been a recurring issue facing FiberNET and several other municipally owned networks. General connection costs range from $2,500 to $10,000 per business and the city is looking at ways of reducing these costs through alternative construction methods.

### 4.6.2 Danville, Virginia

#### *Community Overview*

Danville is a city of about 43,000 residents in south central Virginia, near the North Carolina border about an hour north of Greensboro, NC, and under two hours from Richmond and Roanoke, VA, as well as Raleigh, NC. Historically a textile and tobacco town, the city hit hard times when those industries and jobs moved overseas, but during the last decade has turned to broadband to revitalize the economy. Hoping for economic diversification through technology, the open-access network has been vital in assisting Danville rise from once being noted as having the highest unemployment rate in Virginia, to now being ranked among the top 10 digital cities in the nation within their population group, according to the 12th annual Digital Cities Survey.[17]

The name of Danville's network is *n*Danville, which simply stands for "Network Danville." From a network growth perspective, the "*n*" could as easily stand for "incremental," which has helped Danville gain notoriety for its sustainable growth trajectory. At the time of *n*Danville's inception, Danville Utilities was the only municipal utility in Virginia that served natural gas, electricity, water, sewer, and telecommunications.

#### *Development of the Initial Network*

In 2004, Danville built the original network to serve government and municipal buildings, along with schools. Starting with a small start-up loan from city's electric fund, 10 years of incremental growth now has nDanville with revenues of $1.8 million in 2014, while contributing $300,000 towards the city's general fund.

Danville schools are separate from the city government, so the need for connectivity fell on the local utilities. The network started with schools, government, and municipal buildings in the early 2000s, and then later expanded to industrial parks and business centers, along with additional City properties and departments.

[17] http://www.virginiabusiness.com/news/article/five-virginia-municipalities-make-digital-cities-list.

A critical key to the network's early success was, and continues to be, the Mid-Atlantic Broadband Communities Corporation (MBC), which provides wholesale middle mile access to the Danville network. The nonprofit MBC covers 26 counties and 1700 route-miles and connects to nDanville to peering exchanges near Washington DC, Atlanta, and Charlotte. The partnership allows nDanville to be sustainable, and allows MBC to reinvest excess earnings into regional economic development efforts.

Danville deploys Calix E7 gear, which includes 10Gbps rings with GPON customer interfaces, 2.5Gbps down and 1.25Gbps up, split between 32 connections, with active Ethernet connections from 50Mbps to 10Gbps. For residential networks, GPON is deployed, but for business connections the network is point-to-point. A colocation facility downtown is central for service providers and businesses to interconnection through the downtown Multi-Service Access Point, which offers direct fiber links to Charlotte, Atlanta, and Washington DC. nDanville employs a staff of three full time employees to manage a network of 175 miles.

## *Development of Broadband Services*

In 2009, the expansion of nDanville into residential areas was heavily debated. At the time, the city wanted to take out a substantial $2.5 million loan to quickly build out the network, but with the down economy and possible competition from incumbents, city council decided then to not take the risk, opting instead for the incremental route of saving money, to build later as they accrue revenue and resources.

Three years later, in 2012, the city determined that the potential market base to be large enough in order to justify video service offerings, and network growth began into residential areas. Now that the network has passed into enough homes, service providers are on the network reaching more homes to offer triple play services.

The city does not directly provide services, but as an open access provider, sells middle-mile service to a local provider, Gamewood, which provides tiered broadband services to Danville customers. Danville also uses its fiber network to provide broadband access for its schools, which now generates E-Rate revenue to the tune of about $1 million annually.

## *Impact to the Community*

Companies from all over the world have come to Danville, from India, China, Sweden, among others, including Cray Supercomputer, which has a supercomputer facility in Danville. A number of these firms have come to Danville based on broadband; while some would be there anyway because of the density of complementary industry, the network certainly is an attraction. This is regarding not only recruiting new business to the area, but perhaps more importantly, retaining the businesses they do have, and allowing others to expand their Danville operations.

Incremental, low-risk strategic investments have paid off, and nDanville services are now expanding into residential areas. Network passes over 2,500 customers in a city of

26,000 homes, and this rate is increasing incrementally as well, as more revenue allows for quicker growth. Current take-rate was 20% during Year 1, and the goal was to add 5% per year after that. The city says that it is doing a good job of hitting those numbers.

Scalable broadband is a wonderful tool for economic development. Several businesses serve as their corporate data center, which helps anchor the branch office in the community. As an attraction for economic development, local leaders say this is "one more thing that can be checked off the list" for site consideration. Zeyuan Flooring International, a Chinese wood floor manufacturer plans to invest $15 million in a 40,000 square foot manufacturing plant that will employ 100 people within three years. Chinese furniture assembler GOK International announced it will invest $12.5 million to establish its U.S. headquarters and showroom in Danville. GOK International plans to employ 300 people within three years.

Both companies above are located in Cane Creek Centre, one of Danville's five industrial parks connected to nDanville's fiber network. nDanville passes more than 1,000 businesses including every parcel in each of the industrial parks. Many businesses take 100 Mbps fiber connections, some take advantage of 1 Gbps connections. And it's not just manufacturing - these recent additions to Danville's thriving commercial sector are just the latest in a steady string of economic development successes for the area that include the likes of Goodyear, IKEA, EcomNets, and CBN Technologies.

Danville is home to one of the first non-government sponsored Cray Supercomputers. The Cray XMT2 supercomputer is part of the Noblis Center for Applied High Performance Computing, which is located in a former tobacco plant. Noblis uses the computer to crunch data for clients in fields such as computational biology, DNA sequencing, air traffic management, fraud detection, and counterterrorism. Clearly, Danville is making the transition from the old to the new economy in the following ways.

- Open-access network connecting schools, government, businesses, and homes
- Upgraded education services to gigabit speeds
- Financially sustainable, and contributing $300,000 annually to the city's general fund
- Enabled opportunities through fiber broadband services for local businesses
- Increased reliability, performance, and availability of fiber broadband across the city
- Reinvested system revenues leading to expansion of the network

## *Challenges*

nDanville's early residential strategy was to attract regional video providers to serve customers with a "triple play" offering. The network needs a TV provider for a video offering, which requires a minimum number of homes passed to make the investment pay off. In Danville, that number was around 1,000 homes. Growth was slow at the start, with a chicken-and-egg scenario playing out between uncertain video providers

and potential customers. Finding the first service provider was the challenge, which took over a year, but soon a local provider gained interest and joined the network as the first video provider on the network. Once that happened, providers and consumers generated positive feedback and now demand fuels growth.

City policies provide for network deployment and growth, and the utility puts in ¾" conduit anytime ground is open for road, water, or sewer projects. The challenge is the coordination with building contractors early enough in the planning, permitting, or construction process to ensure "dig once" practices in the process. So learning about new developments requires substantial effort, but it pays off by being able to quickly light up services when the city doesn't need to dig up a driveway or parking lot. For example, recently a condominium complex of 36 units were built and coordinated with the contractor to install conduit during construction. The city purchased the conduit and all needed equipment that the contractor then installed.

People in Danville typically are not aware of the nDanville service. Marketing is a key component that communities may overlook, and the city has taken a community meeting approach to communications and raising awareness during the planning phases of network extensions. The city and nDanville meet with community groups anytime a new development is planned.

Once the network is operational, marketing challenges are again important to raise awareness of service availability, to let residents know that there are other options beyond incumbents, and to let them know what the offerings include. Of course, some people may not go to public meetings, or may not even check out local news, so it takes a while for word to get out that other options exist. Direct mail of postcards and letters and community meetings all are each effective, but word of mouth seems to be the best method of reaching new customers.

One other challenge reported from nDanville leaders is that Danville's economic development success is slowing nDanville's residential rollout due to overwhelming demand from the business sector. There is a waiting list of businesses eager to connect to the network, which is pushing residential connections back. Many communities in the country would agree this is a good challenge to have.

### 4.6.3 Provo, Utah

#### *Community Overview*

The City of Provo is county seat for Utah County and lies 4,610 feet above sea level. Provo has a population of 114,801 people, which represents 4.07% of the total population of Utah (which has 2,763,885 people), making it the state's third most populous community. Nestled between Utah Lake and the Wasatch Range, Provo has immediate access to excellent outdoor recreational opportunities in the Mountain West.

With a $16 billion economy and home to the country's third-largest private college, Brigham Young University, Forbes has ranked Provo as the best place in America for business and careers. Provo receives consistent national rankings for job growth, entrepreneurship, affordability, and livability. The New Yorker proclaimed that Utah is "the next Silicon Valley," as it claims two of the world's 73 private venture-funded companies with valuations over $2 billion, and is home to Digital Economy companies like Bluehost, Navatek, Novell, Qualtrics, and Wavetronix.

Provo unemployment levels have stayed well below the national average, and the cost of living has remained less expensive than the majority of the nation. Credited with this is the creation of Provo Power which supplies all of Provo with energy, plus it sells power to other cities and states, which offers a revenue stream to the city that keeps taxes low.

With all these national accolades, a large university, many growing businesses, and other positive amenities and opportunities, one would think the chances of success for a municipal network in Provo would be tremendous. However, most view the municipal broadband system in Provo as a failure that cost taxpayers about $60 million, and the municipal network in Provo will perhaps forever be linked with Google, the company that purchased the municipal broadband network in 2013 for one dollar. After selling the network to Google, the city remains responsible for paying off nearly $40 million in debt by 2025.[18]

In short, Provo joins the list of municipalities that have been forced to cut their losses, abandon their municipal network plans, and acknowledge their efforts to compete in the broadband sector did not live up to original expectations and ultimately proved costly to residents.

### *Development of the Initial Network*

The roots of Provo's municipal Fiber to the Home (FTTH) network date back to 1998, when the city started investigating how it might construct a telecommunications system. By 2001, the city successfully built a backbone network consisting of three fiber rings, which connected an array of municipal assets, including electric substations, city buildings, major traffic signals, and schools.

Soon after, Provo explored the feasibility of extending the network directly to residents and businesses, which had the appearance of a retail model and caught the ire of Internet service providers. Soon after, ISPs and state legislators pushed city officials to shift their plan for the municipal network to a wholesale model.

In 2002, Provo embarked on a second phase of network deployment, a demonstration project that entailed the construction and operation of a wholesale FTTH network for

[18] https://xmission.com/blog/2013/04/18/the-1-fiber-optic-network

300 single-family houses and 30 apartment buildings. The city collaborated with retail providers to offer consumers television, telephone, and high-speed data services.

The city council viewed this limited pilot as a success and voted to pursue the entire project in November 2003. The next year, it agreed to issue $39.5 million in tax revenue bonds to finance the network, called iProvo. These funds would be used to build a fiber, open access network that would also be used for an array of internal purposes (control of traffic, electrical and water systems, internal communication, etc.).

The city council estimated that iProvo would be completed by 2006 and be capable of generating positive cash flow by 2008. The projected success of iProvo was tied directly to the ability of its primary ISP, HomeNet, to grow a subscriber base and generate revenues that would cover the costs of maintaining and expanding the network. By 2005, less than a year after the network went live, HomeNet and iProvo ran into trouble. In particular, HomeNet was only able to sign up 2,400 customers at its peak, and by 2005, it had lost one-third of them, dropping iProvo's subscribership to 1,600. Consequently, HomeNet pulled out of its contract in July 2005 and filed for bankruptcy. This sent iProvo into a downward financial spiral where it was not gaining enough subscribers and revenues were down. These troubles would only multiply over the next few years.

In 2006, low revenue and subscriber rates forced iProvo to approach the city and request a loan of $1 million from its electricity reserve fund to cover costs for the next fiscal year. With this, iProvo continued borrowing city funds through 2007. Subscriber and revenue growth, however, remained disappointing. The network had projected it would be able to sign up an average of 60 subscribers per week, but averaged only 16 per week.[19]

By 2008, the year iProvo was supposed to be profitable, the network was on track to cost the city $2 million. It was becoming increasingly clear to the city that iProvo was unsustainable. The city was already investing millions of dollars annually to prop up the network and was on track to lose more than $15 million in subsequent years if it continued to subsidize the network.

As a result, the iProvo network was sold to a private company, Broadweave Networks, in May 2008 for $40.6 million. As a condition of the sale, Broadweave agreed to pay off the $39.5 million bond that had been issued. But less than a year later, after merging with another company to form Veracity Networks, the newly formed entity realized it could not build cash reserves, improve the network, or pay off lingering debt associated with the network. Veracity asked the city to restructure the debt.

Up to that point, Veracity had been drawing on a $6 million surety bond while it attempted to save operating cash. In 2011, Veracity defaulted on its purchase

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[19] http://www.nyls.edu/advanced-communications-law-and-policy-institute/Provo-Case-Study-June-2014.pdf

agreement, and control of the network reverted back to the city. The city settled with Veracity and leased the network back to the company while it looked for a new buyer. Also not setting well with Provo residents, in 2011 the city began charging $5.35 a month on residential power bills to pay the bond payment.

Like many problem municipal networks, Provo had a difficult time finding a buyer willing to purchase the network for the price of the assets, let alone the cost Provo paid to build the network. However, in April 2013, Provo finally found a buyer: the city sold the $40 million network to Google for one dollar.

All told, additional taxpayer subsidization totaled $19.3 million, on top of the $39.5 million bond issues. The sale of the municipal network to Google does not remove the burden of debt from taxpayers. Quite the contrary as the city, and taxpayers by implication, are still responsible for the remaining debt on the original bond, which works out to $3.3 million in bond payments per year for the next 12 years. In addition, the City of Provo will incur additional costs as a result of its deal with Google. It will have to not only retire the debt, but also buy new equipment so it can operate city services independently from Google, and hire engineers to document locations of all the fiber in the system.

### *Development of Broadband Services*

Prior to its sale to Google, iProvo offered triple-play packages to subscribers through contracted private ISPs. As an example of the services offered, in 2004, HomeNet, iProvo's original retailer, offered several bundled packages of Internet access (up to 10 Mbps), telephone, and VoIP service, which ranged from $90 to $125 per month. The services and pricing changed numerous times over the years as the network changed hands between public and private entities. Google Fiber will offer subscribers free 5Mbps service for a $30 activation fee, while 1 Gbps connections will retail for $70 per month. At this time, Google has no plans to offer services to businesses but has committed to providing "free Gigabit Internet service to 25 local public institutions like schools, hospitals, and libraries."[20]

### *Impact to the Community*

In 2004, then-Mayor of Provo, Lewis Billings, talked about the many benefits he foresaw for the fledgling network. These included advanced telemedicine services, interactive distance learning, remote meter reading, and "other things I can't even comprehend that will be enabled by the immense capacity of our network."[21] Over a decade later, few of these goals have been realized as the Provo municipal network transitions to yet another owner. Some have touted the benefits of gigabit connectivity in the city's schools, but there is little evidence that the network itself has generated tangible gains

[20] http://googleblog.blogspot.com/2013/04/google-fiberon-silicon-prairie-silicon.html
[21] http://www.municipalfiber.com/benefits-of-a-community-broadband-network

in outcomes. In fact, much of the excitement around educational technology in Provo schools seems to have stemmed more from the introduction of iPads than anything else.

Over the course of its history, iProvo has been described as an example of government overreach, with residents, journalists, and elected officials all critical of the network. The Utah Taxpayers Association characterized Provo's investment as a waste of taxpayer money. Early on, the group questioned, "Why is the city gambling with taxpayer money on a speculative venture when many private companies and cities have failed while attempting the same thing? Shouldn't we as taxpayers be able to vote before risking $40 million of OUR money?"

The previous Provo Mayor George Stewart, the predecessor and mentor of the mayor responsible for launching iProvo, has also been critical of the network that was built. After a heated exchange during a city council meeting, Stewart concluded that, "if I had been here, I would not have proposed iProvo." The current mayor of Provo, John Curtis, has also been critical and was quoted as saying, "If I could, I would get a plot in the city cemetery and bury it. iProvo is gone, it was sold. I would never like to utter iProvo again."[22]

The total cost of the network, estimated at around $60 million, likely outweighs any benefits to the city up to that point. In fact, the only impact that many Provo residents and businesses see today is the extra $7 per month for all Provo utility customers.

### *Challenges*

The story of iProvo offers several insights that should inform ongoing debates over the efficacy of a city pursuing a municipal broadband network. In just over 10 years, iProvo had become a troubled asset that represented a failed venture into the competitive marketplace by a city government. While little published information can be found that details the performance of Provo's failed partnerships with HomeNet, Broadweave, and Veracity, certainly some lessons can be learned regarding their experience with customer service and the marketing of broadband.

The reluctance of residents and businesses to subscribe to municipal broadband services may hold insight into the decisions of businesses and residents to sign on or retain services. Perhaps the competitive broadband environment satisfactorily met the needs of Provo residents and businesses, and locals were comfortable with existing service providers to not take the chance on a municipal network provider.

While there could be a challenge into changing Provo's prevailing attitudes regarding broadband providers in the past, Provo certainly benefits now from the co-branding as a Google fiber city. While it will cost the city and utility customers several million dollars for

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[22] http://www.heraldextra.com/news/local/provo-mayor-gives-update-on-city-s-economic-development-iprovo/article_e3ace13e-ea4f-51e4-a5d3-ad64adae91e6.html

the next few years, some critics have said the Google save is proof that sometimes it is better to be lucky than financially responsible.

Looking back, iProvo faced some unique challenges in a number of areas and certainly produced some benefits for the community. Because of incumbent-protection legislation from the state, iProvo had the challenge of being required to use a pure open-access model, which means it could not directly offer any services. Though some communities in the US have now found ways to make this work, most do not even attempt the model because offering direct services is generally required to generate sufficient revenue to pay down the debt from the system.

Therefore, aside from using a challenging business model and a fiber-optic technology that most community broadband networks have not used, iProvo made mistakes from which many have learned and few repeat. Although Provo succeeded in its goal of selling the failing network, Google might likely end up benefiting more than the customers it will serve.

Indeed, even though iProvo did not succeed, the sale of iProvo to Google is not the end of the story. While Google has committed to investing in the existing infrastructure to support gigabit connections and build out the network to all homes, it did not assume the nearly $40 million in debt that the City had previously tried to transfer on to its original purchaser, Broadweave. The deal with Google requires Provo to spend upwards of $1.7 million on an array of items related to the transfer of ownership to Google. Moreover, with so much uncertainty surrounding Google's actual motivations for its relatively small-scale gigabit network, Provo residents could find themselves in another broadband experiment.

# 5. Infrastructure Provider

## 5.1 Overview

Cities that provide conduit and dark fiber services to local organizations are generally considered infrastructure providers. They lease these assets to community organizations, businesses, and broadband providers. These organizations use municipal fiber to connect to one another and to data centers to reach the Internet, cloud services, and other content networks. Many municipal providers who have deployed these services began by building their own fiber networks to serve purely municipal functions. As their networks grew, they realized that these networks could provide access to local organizations needing fiber connectivity.

Cities that lease conduit and dark fiber services generally do not provide any retail services over this infrastructure. Dark fiber connections are either leased directly by businesses needing to connect multiple local offices to one another or to connect a local office to a local data center, where the business can purchase Internet services and other content. In other cases, cities partner with broadband providers who market and sell their services to customers and use municipal fiber to connect these customers to their networks. Municipal fiber networks generally become the “last mile” between a provider’s local point of presence and the end customers.

Many cities have seen success in leasing dark fiber to the small and medium business (SMB) market. Since SMBs represent the largest segment of commercial businesses in most cities and contribute significantly to overall GDP, cities focus their fiber products on this market segment. Often SMBs want fiber broadband but cannot afford it. Cities have used their municipal networks to enable SMBs to purchase an affordably priced fiber product.

Cities differ on their policies for dark fiber access. Some cities require customers to pay the upfront costs of the fiber construction to reach their facilities and levy a smaller monthly operational charge to manage the fiber connection. Other cities will finance the cost of the fiber construction and charge the customer a higher monthly fee that includes the amortized amount of the fiber construction, spread over a period of several years. Many cities have realized that financing the fiber construction leads to higher uptake of their services by SMBs in the local market. Generally, an SMB cannot afford the upfront cost of the fiber construction so a city will develop a pricing policy for its fiber service that recoups the investment over the term of the contract. In some cases, the city will take a bet on a longer payback of the fiber construction costs simply to ensure that the SMB is able to afford the service. Cities realize the economic development value of getting their businesses connected to fiber is an important factor to consider along with the payback on their investment.

## 5.2 Services and Rates

Dark fiber is the core product of most infrastructure providers. In some cases, they also offer conduit; however, conduit is generally utilized by wholesale providers or utility companies. Dark fiber is generally utilized by businesses, community anchor organizations, and in a few cases residents. In the most common case, municipalities lease dark fiber strands using mileage-based pricing. Pricing depends on the amount of new fiber that must be constructed to the customer. Leasing existing fibers on a municipal network will not incur construction costs for the municipality, resulting in a simple mileage-based price calculation to the end user. However, in most cases, customers will require new construction to reach their facilities, resulting in construction costs to be incurred by the municipality and which will be charged back to customers to allow the municipality to recoup its investment. Several pricing models exist for municipal dark fiber services.

### *Dark Fiber Leasing*

Dark fiber is leased on a monthly basis for the number of strand miles utilized, including existing strand miles and newly constructed strand miles. A strand mile is a single strand of fiber optic cable over a linear mile in the network. The lease rate calculation for the existing fiber under lease is generally a formula that accounts for the total cost of the network plus ongoing maintenance divided by the number of strand miles available for leasing. New construction costs to extend the network to the customer's location are factored into this calculation as well. Some municipalities charge this cost upfront, others will amortize it over time and include it in the lease. For example, Figure 9 illustrates the City of Palo Alto Utilities' most recent dark fiber pricing policies, which has two pricing components, (1) pricing for dark fiber backbone license fees, and (2) pricing for drop and custom cable management fees.

*Figure 9 - City of Palo Alto Utilities Dark Fiber Pricing Policies*

**C. FEES:**

**1. DARK FIBER BACKBONE LICENSE FEES:**

The values or ranges for each of these price components are shown below:

(1) Price for first fiber on public agency project routes may range between…… $213-$362/mile/month
  a. Additional fibers used in the project on same route, per each ..... $142.00/mile/month
(2) Price for first fiber on non-public agency project routes may range between…. $250-$425/mile/month
  a. Additional fibers used in the project on same route, per each ..... $166.67/mile/month

**2. DROP AND CUSTOM CABLE MANAGEMENT FEES:**

Customer responsibilities and fees for drop and custom cable construction are described in the CPAU Rules and Regulations, Rate Schedule EDF-2, project proposals and other associated documents. In all cases, the Licensee shall also pay the applicable Drop or Custom Cable Management Fees based on the following:

(1) Drop Cable Management Fees for public agencies (per 12 fiber drop)…… $179-$213/mile/month
(2) Drop Cable Management Fees for non-public agencies (per 12 fiber drop)…… $210-$250/mile/month
(3) Custom Cable Management Fees (first 12 fiber cable on a project route) ..... $0.25/ft/month
(4) Custom Cable Management Fees (per additional 12 fiber cable on a project route)…….. $0.05/ft/month

## *Indefeasible Rights of Use*

An Indefeasible Rights of Use (IRU) is a capital lease of dark fiber. Instead of a monthly lease pricing model, an IRU requires a single upfront payment for the term of the lease plus an ongoing operations and maintenance fee for the use of the fiber. IRUs are not generally used when providing dark fiber to commercial customers or community anchor organizations. An IRU is a telecom pricing model that is generally used between wholesale carriers, and as such, municipalities generally enter into these transactions with broadband providers. Broadband providers favor IRUs because their capital leasing structure allows them to record these leases as assets on their balance sheet rather than operating expenses on their income statements. Figure 10 illustrates IRU rates from a range of municipal providers.

*Figure 10 - Dark fiber Leasing and IRU Benchmarked 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 |

## 5.3 Market Penetration

Market penetration among infrastructure providers is challenging to determine due to the varied geographic coverage of each provider's networks in their respective cities. The two providers evaluated in this study reported connecting over 100 businesses to their networks over a period of ten years. Although this represents only a small percentage of their respective markets, the cities' goals were not to achieve a certain market penetration. Instead, their goals were to supply local organizations with fiber connectivity that required it.

In each case, the cities expanded their network "on demand" in areas where there was a high probability of achieving uptake. Rather than incurring sunk costs by deploying large networks ahead of demand, they marketed their services in areas that were in close proximity to existing fiber and waited for customers to sign up prior to building out further. This incremental approach allowed them to deploy capital only with new revenue opportunities that would enable the cities to recoup their investment. For this reason, it is difficult to measure the penetration of these providers' services in their local markets.

## 5.4 Organizational Profiles

Infrastructure providers generally have developed their fiber networks in conjunction with municipal electric utilities, which has allowed them to develop an initial inventory of dark fiber. In many cases, these providers have begun their dark fiber leasing programs using the existing stock of available fiber and have grown into a formalized program of extending their networks for commercial purposes. The following examples demonstrate how municipalities have developed their dark fiber networks over time.

The City of Bartow, FL began expanding the dark fiber network that serves its electric utility substations to also include county and school district facilities in 2009. Today the majority of Polk County School sites are connected to the network, providing direct gigabit dark fiber connectivity to 12 schools in the Bartow area. In addition, ten county facilities are connected to the city's network as well as several public safety functions and other electric utility sites. The city maintains its dark fiber program under the electric utility enterprise fund. Today, the Information Technology department manages the fiber system and all services connected with it. The city uses shared resources from Electric and Information Technology departments to manage the network, consisting of 3-4 full time equivalents that are allocated to fiber services.

The City of Rock Falls, IL maintains a dark fiber network that connects its electric utility substations to one another throughout the town. The city leases a portion of its available capacity to competitive providers in town to reach local businesses and community organizations. The city provides Indefeasible Rights of Use agreements to competitive providers for long-term capital leases of its infrastructure. The Electric Utility department manages the dark fiber network and all customers connected to it.

The City of Hamilton, OH owns an extensive 80-mile dark fiber network connecting municipal facilities and electric utility assets throughout town. The city's Information Technology department manages active services on the network while the electric department manages the physical fiber. Hamilton recently began a dark-fiber leasing program that has attracted multiple providers to the area to use its network. The city also recently extended its network to connect three local schools, and developed a partnership with a new provider to serve local businesses, technology incubators, and business districts through a dark fiber expansion program.

## Infrastructure Provider Case Studies

### 5.5.1 Santa Monica, California

#### *Community Overview*

The City of Santa Monica is a beachfront city in Los Angeles County, California. Santa Monica is home to approximately 91,812 people across 8.3 square miles, giving it a population density of 10,662 people per square mile. The city has approximately 50,192 households with a median household income of $71,400. With a mild and agreeable climate, Santa Monica has long been a resort town and home to many people involved with the Hollywood entertainment industry. The city has experienced a boom since the 1990s with the revitalization of its downtown core, along with significant job growth and increased tourism.

The City of Santa Monica has grown its fiber business steadily over the past five years and in conjunction with technology programs that reduce costs for the government itself.

Connecting community anchors provided Santa Monica valuable anchor tenants that helped build the business case for its fiber expansions. The city accommodated future investment in its network by setting a policy that reinvested any excess revenues and savings that the network generated back into expanding the network. The city successfully markets its fiber services in Santa Monica and provides a list of "lit buildings" where fiber connections are available.

### *Development of the Initial Network*

In 2002, when the city renewed its franchise with the local cable provider, it also included, as a provision to the agreement, a lease of fiber-optic network capacity to connect 43 city sites and a variety of school and community college sites. The city paid upfront construction costs of $530,000 and shared the ongoing costs of the network with the schools and community college. These organizations saved a combined $400,000 in annual telecommunications costs which grew to $500,000 over several years.

The savings were used as seed capital for the development of the city's own fiber-optic network. The city invested in fiber connectivity and 10 Gigabit networking equipment to power the network. The city expanded its own fiber to connect traffic signals, surveillance cameras, smart signs, and other municipal applications to the network. As the network grew, the city built fiber into local data centers for its own Internet connectivity needs, but this quickly became a resource that created demand for business connectivity using Santa Monica's fiber.

### *Development of Broadband Services*

The city began leasing its fiber network to local businesses in 2006. Larger businesses became the first users of Santa Monica's fiber to establish connectivity between their locations within the city. In most cases, these businesses paid the upfront costs for fiber extensions from the city's current network to reach their facilities. The city connected about 15 customers to its network initially between 2006 and 2008. The city started a marketing campaign to determine the demand for city fiber from the small and medium business community. The campaign focused on businesses in close proximity to the city's current network, surveying approximately 3,000 businesses within 200 feet of the current network. The results indicated that there was demand for the city's fiber; however, businesses were looking for a complete solution for their Internet services, rather than just dark or lit fiber.

The city realized the demand for these services warranted the investment in building an Internet infrastructure capable of providing commercial Internet services to businesses. The city leased a wholesale Internet circuit connected to the One Wilshire colocation facility in downtown Los Angeles and purchased equipment necessary to provide Internet services. It chose to enable both direct Internet services and open access services as part of its offering, which allowed other providers to utilize its network to deliver Internet access to businesses in the city. The city now offers a combination of dark fiber, transport, and Internet access services to organizations in Santa Monica.

Today, 126 businesses are currently connected to CityNet and approximately five additional ones are added on a monthly basis. CityNet has also been successful with its MDU strategy. Facing high vacancy rates, the city encouraged property owners to install fiber cabling into their buildings as a way to entice tenants to occupy commercial properties. CityNet heavily discounted the cost of installing, operating, and maintaining fiber infrastructure into buildings if the owners passed that savings directly to potential tenants and aggressively marketed the gigabit broadband service. The city reported increases in tax revenues and commercial property values for parcels that were equipped with fiber. The network covers approximately eight square miles of Santa Monica and soon will be delivering up to 100Gbps per second of symmetrical broadband access. Prices for services are negotiated for each business customer individually.

## *Impact to the Community*

Santa Monica's CityNet fiber network was able to achieve the following goals for the community:

- Lower costs of Internet access for the city and schools
- Centralize or integrate municipal services through core data systems
- Establish free Wi-Fi in 35 public hot zones as well as distribute 375 computers in kiosks and libraries in town for free access
- Nurture existing businesses, attract new businesses, support startups, VCs, and incubators
- Create an environment for other incumbents to invest in city infrastructure. The city has no plans to provide residential service to its 90,000 people

## *Challenges*

Santa Monica faced challenges in providing only dark fiber services to local businesses. As demand for high-speed Internet services grew over the past five years, small and medium businesses desired an affordable Internet solution that was enabled by a single provider. This differed from Santa Monica's model of providing simply dark fiber or bandwidth services to local businesses. While larger organizations had IT staff capable of managing dark fiber and bandwidth, small and medium businesses looked for a solution that was handled directly by the provider, as many of them lacked the sufficient resources to manage dark fiber alone. The struggle Santa Monica faced was maintaining lean operations and a "hands off" approach while still serving a range of business customers. Retail was a new business model that Santa Monica had not encountered yet. This required Santa Monica to "change its thinking" and to have true impact in the small and medium business market. The decision was made to offer direct Internet services as part of its portfolio of services.

## 5.5.2 Palo Alto, California

### *Community Overview*

Palo Alto is a city located in the northwest corner of Santa Clara County, California. Part of the larger San Francisco Bay Area, the city shares its borders with Mountain View, Menlo Park, and includes portions of Stanford University. The city's population of 66,955 is spread across a total land area of 23.8 square miles for a population density of 2,696 people per square mile.

Palo Alto is one of the most expensive cities in the United States to live, and its residents are among the most educated in the country. There are approximately 26,229 households in Palo Alto, with a median household income of $121,465, and a per capita income of $73,329. Almost 80% (79.8%) of people over 25 years have bachelor degrees, compared to the California rate of 30.7%

Palo Alto is headquarters to a who's who of technology companies, including Hewlett-Packard, SAP, VMware, Tesla Motors, Ford Research and Innovation Center, PARC, Ning, IDEO, Skype, and many others. The city has also served as an incubator to several other high-technology companies such as Google, Facebook, Logitech, Intuit, Pinterest, and PayPal. Stanford University is the largest employer in Palo Alto at 11,128.

Unlike surrounding communities, the City of Palo Alto provides electric and gas service within city limits. Services traditionally attributed to a cable television provider were sold to a regulated commercial entity, after previously being operated by a cooperative called Palo Alto Cable Coop.

### *Development of the Initial Network*

The City of Palo Alto Utilities (CPAU) fiber network first began construction in 1997. A dark fiber ring was first envisioned to serve multiple purposes, including commercial telecom services, SCADA communications, and municipal connectivity. CPAU has maintained ongoing operations of the fiber network. The first phase of the network passed the major city facilities and business parks. It consisted of 33 miles of 144-count fiber cable. The original network was funded under the CPAU enterprise fund via a $2 million loan at 0% interest. The loan was repaid ahead of schedule in 2008 and a separate enterprise fund was established specifically for the fiber business.

### *Development of Broadband Services*

The significant number of technology businesses in Palo Alto created demand for fiber connectivity over CPAU's network to reach the Palo Alto Internet Exchange (PAIX). PAIX was one of the first and most important Internet peering exchanges where a large number of Internet and content providers interconnect with one another; a data center

provider, Equinix, now operates the facility.[23] Palo Alto provided businesses with dark fiber connectivity from their locations to PAIX, through which they have their choice of more than 100 Internet providers. This creates value for businesses as they are able to purchase their Internet services in PAIX for very low cost through its local competitive market. The connectivity to PAIX creates a significant economic development opportunity for the city by marketing its community as one of the most connected in the nation.

CPAU provides a number of dark fiber options for businesses, depending on the level of redundancy that businesses desire:

- Point-to-Point - This configuration can be used to directly connect any two points in Palo Alto. The four options below are variations of this basic configuration.
- Route-Diverse Ring/Single Drops - With the proper network equipment, this configuration can be used to enhance reliability. Two diverse paths are available on the backbone to prevent service interruptions even if the fiber backbone is damaged along one of the two paths.
- Route-Diverse Ring/Dual Drops - With the proper network equipment, this fiber configuration can be used to further enhance reliability. Two diverse paths are available end-to-end to prevent service interruptions even if the fiber backbone and/or the drop cable are damaged along one of the two paths.
- Star Configuration - This configuration can be used to establish a single location as a hub from which individual point-to-point connections can be made.
- Hybrid Configuration - Options 1-4 may also be combined for a custom-tailored network solution consisting of a hybrid of the other configuration options.

### *Impact to the Community*

CPAU's network has provided vital fiber connectivity services to the technology industry in Palo Alto. The network has become the network that technology businesses utilize to purchase fiber connectivity into PAIX. CPAU currently licenses dark fiber service connections to approximately 90 commercial customers. The fiber system also serves the following city departments: IT Infrastructure Services, Utilities Substations, Utilities Engineering, Public Works, Water Quality Control Plant and Community Services. CPAU is also in the process of installing dark fiber service connections at 19 Palo Alto Unified School District facilities. The total number of dark fiber service connections serving commercial customers and the city is 222 (some customers have multiple connections). As of the end of fiscal year 2013, the licensing of dark fiber service connections has resulted in a fiber fund reserve of $15.3 million.[24]

[23] http://www.equinix.com
[24] http://www.citiesassociation.org/files/Fiber.pdf

## *Challenges*

Although CPAU's network has provided value to the business community and public organizations, it has struggled with a plan to expand the network to serve any segment of the residential market. Palo Alto's high median household income and residential density favors the development of a fiber to the home network; however, the city has struggled developing a business case to expand the network in a financially sustainable way.

Numerous studies have been completed over the past 10 years to determine the feasibility of fiber to the home and in all cases, they have concluded that the city should not pursue fiber to the home on a citywide basis. The city is in the process of evaluating a range of incremental approaches to accomplish its fiber to the home goals in conjunction with competitive service providers in the Palo Alto area. The city has decided that a practical approach to attracting these providers is to develop a master plan, which includes an engineering study, network design specifications, and a cost model to deploy a citywide fiber network.

# 6. Municipal Retail Provider – Business Only

## 6.1 Overview

Municipalities that provide Internet, phone, and other services to businesses customers are considered retail service providers. Most commonly, local governments provide Internet and phone services to local businesses in their jurisdictions. A common goal for municipalities that deploy broadband networks is to support local economic development needs. Local governments do so by equipping their business and industrial districts with fiber infrastructure through which they can provide cost effective, high-speed Internet, and other services to local customers.

Municipalities that provide these services are responsible for managing business customers at a retail level. They manage all operations necessary to connect customers to the network and provide services. In nearly all cases, they provide Internet access as the primary service but many also provide a range of other communications services including business telephone, business security, and data transport services. Municipalities that offer retail services compete directly with service providers in the local business market, which requires the organization to manage an effective sales and marketing function in order to gain sufficient market share to operate at a sustainable level.

Local governments have been known to underestimate the amount of effort required to successfully market and secure businesses as revenue-generating customers. Many of them have made the mistake of believing that the superiority of their product and pricing alone will result in customers subscribing to their service. Therefore, significant time must be dedicated to pre-marketing, testing products, setting rates, and establishing the competitive strategy to overcome the tactics that competitive providers will use to stifle the government's ability to sign up new customers. The effort does not end with the conversion of a potential customer into a revenue-generating customer. The correct back-office systems, business processes, and operational functions must work in unison to ensure a smooth activation of a new customer and a seamless transition from their former provider.

## 6.2 Services and Rates

Municipal business providers offer competitively priced Internet and communication services that are generally very competitive in the small and medium business market against other provider offerings. They compete on both price and quality, generally focused on the following value proposition to the end customer, all at a lower monthly cost:

- Higher bandwidth, scalable to Gigabit speeds
- Symmetrical service, the same upload and download

- Higher quality fiber connections with less downtime and a stronger service level agreement
- Responsive local customer service

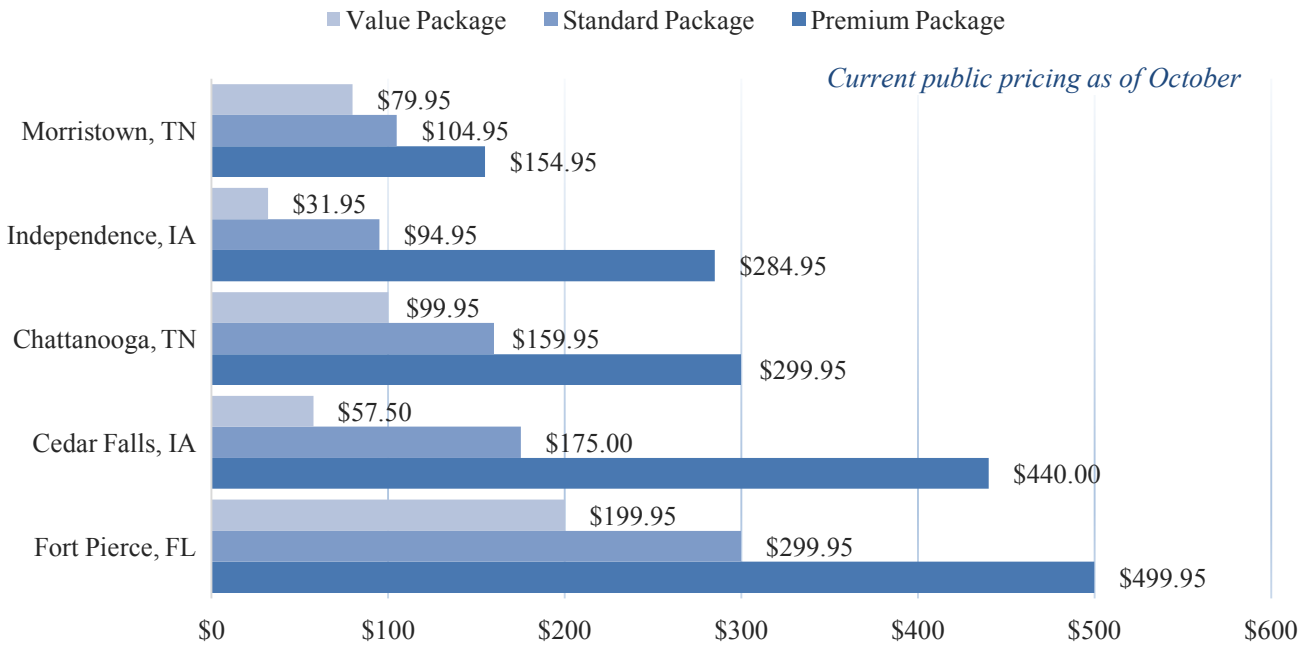
Most municipal retail providers that offer residential services also offer business services, while some providers only offer business services, as shown in Figure 10. Some cities have focused their strategies on providing business services only and others use it as a first phase before moving into the residential market. For example, the City of Hudson has launched business Internet services and plans to offer residential services once it has demonstrated success providing business services.

*Figure 11 - Municipal Retail Provider Service Portfolios*

| | Independence, IA | Fort Pierce, FL | Hudson, OH |
|---|---|---|---|
| Commercial | | | |
| Internet | ✔ | ✔ | ✔ |
| Telephone | ✔ | ✔ | ✔ |
| Data | ✔ | ✔ | ✔ |
| Wholesale | | | |
| Data | | ✔ | |
| Dark Fiber | | ✔ | |
| Community Anchor | | | |
| Internet | ✔ | ✔ | ✔ |
| Telephone | ✔ | ✔ | ✔ |
| Data | ✔ | ✔ | ✔ |
| Dark Fiber | | ✔ | ✔ |

Rates for business Internet services are less “commoditized” than for residential services and vary across markets. Figure 11 illustrates the range of Internet prices for Value, Standard, Premium, and Gigabit Internet service level packages in markets with municipal business providers. Gigabit packages offered in Cedar Falls, IA and Fort Pierce, FL have significantly higher prices than more “standardized” Internet packages offered by these providers at $895 and $999.95, respectively.

*Figure 12 – Business Internet Price Benchmarking for Municipal Retail Providers*




Cost per megabit is an important gauge that describes the cost that a business pays for each megabit of Internet service per month for a residential Internet connection. Since each provider offers unique speeds and prices, this measure allows one to compare costs for Internet services across multiple providers by simply dividing the price of an Internet connection by its speed. Effectively, in these markets businesses get "more for their money," as the cost per megabit is significantly lower. The lower the cost per megabit, the more Internet bandwidth residents get for each dollar spent.

## 6.3 Organizational Profiles

Section 6 covers a range of municipal retail providers that also offer business services and provides organizational profiles for these providers. Limited organizational and financial information was received from municipal business providers and sufficient data was not obtained to assess any benchmarking or trending in the study. For the municipal business providers studied, Fort Pierce Utilities Authority and Independence, IA were structured under municipal utilities, similar to the municipal retail providers covered in Section 6.

## 6.4 Municipal Retail Provider Case Studies (Business Only)

### 6.4.1 Fort Pierce, Florida

#### *Community Profile*

Fort Pierce has been the hub of St. Lucie County, Florida for over 100 years. Situated on the “Treasure Coast,” Fort Pierce is one of the oldest communities on the east coast of Florida. The city’s population is 42,645 and covers 29 square miles. Downtown has retained its old Florida charm and scale, as it has welcomed new development and revitalization. Fort Pierce is home to educational and research facilities, like the top-ranked Indian River State College, Smithsonian Marine Station, Manatee Observation and Education Center, and Harbor Branch Oceanographic Institution at Florida Atlantic University.

#### *Deployment of the Initial Network*

In 1994, Fort Pierce Utilities Authority (FPUA) began to build a fiber optic network to replace the leased data links between its buildings in Fort Pierce. The new network proved more reliable and cost effective, and was built with sufficient capacity for external customers. In 2000, FPUA allocated separate fibers through which it began to offer dark fiber connectivity to other institutions under the brand FPUANet. This soon expanded to include businesses and anchor institutions in the local area. As the general municipal utility, FPUA, maintains ownership of the fiber network and allocates a portion of the costs to FPUANet for the portion of the network utilized to provide communications services. This enables FPUANet to maintain a lean operational structure and offer low cost services to the market.

#### *Development of Broadband Services*

FPUA is in the process of expanding the FPUANet network into adjacent counties. This will enable regional interoffice links, and improve the efficiency of local governments throughout the multi-county area. FPUANet is also expanding its service portfolio and offerings to offer competitively priced fiber connectivity, Internet, and related services to the business market across these counties. Although FPUANet receives many requests to provide residential services, FPUANet does not currently have any plans to enter the residential market.

FPUANet also provides wireless broadband Internet and wireless bandwidth connections, which extend FPUA's fiber through wireless communications in order to reach more businesses in the area. The FPUANet mission statement is "To help promote economic development and meet the needs of our community with enhanced, reasonably priced communications alternatives.”

FPUANet's product portfolio includes the following:

- Dedicated Internet Access
- Fiber Bandwidth Connections
- E-Rate Eligible IP Services
- Dark Fiber Services

### *Impact to the Community*

FPUANet services provide the only affordably priced fiber-optic broadband services available in the City of Fort Pierce. Aging copper infrastructure and a lack of significant business concentration has limited the deployment of fiber infrastructure from competitive broadband providers in the area. With costs starting around $1,200 per month, only the largest businesses and anchor institutions have been able to afford the high price of bringing direct fiber connectivity to their facilities. The small and medium business market in Fort Pierce is forced to utilize existing cable and DSL services from the incumbent providers and many businesses have complained that these services have not been sufficient to meet their needs.

### *Challenges*

FPUANet reported its significant challenges have centered on evolving from its electric utility heritage and operations into a full-fledged telecom company. As FPUANet services have grown to serve more of Fort Pierce's customer base, FPUANet has realized the importance of establishing the right technical infrastructure, equipment and operating procedures to support and manage its services. With that in mind, FPUANet is currently redesigning its network to scale, giving the utility the ability to serve more customers with greater reliability and lower operational overhead.

This process has focused on how FPUANet's physical fiber network grows to support more connections that can provide gigabit services and beyond. The analysis has also determined new access architecture and equipment to provide more cost effective GPON and Active Ethernet services using industry standards and best practices. FPUANet has experienced these "growing pains," common to many municipal utilities and is beginning the implementation of its new network infrastructure this year.

## 6.4.2 Hudson, Ohio

### *Community Overview*

Hudson is a city located in northeastern Summit County, Ohio, with a population of 22,262 and 7,620 households. Hudson is considered a commuter town and is part of the Akron Metropolitan Statistical Area, which is part of the larger Cleveland Combined Statistical Area. The city has a total area of 25.87 square miles, of which 25.60 square miles is land, giving Hudson a population density of 869.6 residents per square mile.

In 2010, Hudson was named one of the 100 Best Communities for Young People by America's Promise. The award was based on the city's "Community First" organization that was developed in the 1990s to promote better choices in the city's youth by providing additional educational and cultural opportunities. In 2007, the median household income in the city was $112,740, with per capita income of $40,915. About 1.3% of families and 1.7% of the population were below the poverty line. Of the city's population over the age of 25, 68.0% held a bachelor's degree or higher.

Most of Hudson's retail is located in concentrated areas. Most notable are two downtown blocks of historic buildings located on North Main Street, which is the original center of business in Hudson, that continue commercial use by retail and office use. As an innovative means of local business support, in November 2002, Hudson was the first US community to launch a citywide gift card. The card was envisioned by the Hudson Chamber of Commerce to help stimulate local business and keep shopping dollars with the independent merchants in town.

Keeping with that tradition of local business support, on July 22, 2015, the city announced plans to become a municipal broadband service provider and serve gigabit connectivity over a fiber network. Launched shortly after in September 2015, business customers in select locations began signing on to service with expansion to the downtown business corridors planned next through a phased citywide growth approach.

### *Development of the Initial Network*

In January 2015, the city conducted a residential and business survey to determine the overall state of broadband in the community. Almost 1,000 residents and 133 businesses answered the survey that revealed that Internet services were lacking in coverage, speed, performance, and reliability.

Through the survey process, Hudson's small and medium business community reported many issues with their current broadband services, often citing poor reliability and performance as negatively affecting their ability to do business in the city. Many businesses wanted to upgrade to a better service but found that they could not afford to do so.

As an outcome of the survey and planning process, and through the 94-page "Broadband Needs Assessment and Business Plan," the city decided it would offer the service comparable to how it offers public power, water, and other infrastructure.[25] Soon after, Hudson City Council approved the initial $800,000 capital expenditure to begin the

[25] http://www.hudsonhubtimes.com/news%20local/2015/02/18/city-takes-next-step-toward-broadband-service

deployment, and the city expects to spend another $1.5 million in 2016 on infrastructure.[26]

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, to be owned and operated by the City of Hudson, 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.

## *Development of Broadband Services*

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. The city is focused exclusively on Internet and voice, and is signing on business customers while the network is being deployed. The city has no definite plans to serve residents but once business services are in place, they will consider a residential service offering.

For now, the focus is on small and medium businesses. Hudson officials realize that connectivity is an essential service for economic development and they understand that businesses have no reservations about relocating to places where they can get the bandwidth they need.

The economic development director in Hudson says, "economic development is 80% retention, and Hudson businesses are unhappy with their current service. They want something like this. And, they anticipate by offering these services, they will attract more businesses to Hudson, and more income tax, and retain more businesses."[28]

## *Impact to the Community*

While just launching at the time of this study's creation, impacts are too early to include here. A local public relations firm will be one of the beta testers as the network progresses. They upload and download large data files on a daily basis and their current 5 Mbps connection is inadequate. The CEO of the company says that their current Internet is constantly going down, and when that happens, staff must leave their offices to find other places in town with available Internet, such as coffee shops. Clearly, improved quality of broadband services will have an impact on this business, so similar business examples throughout Hudson taken in aggregate will have a substantial positive effect on the community.

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[26] http://www.hudsonhubtimes.com/news%20local/2015/06/07/city-invests-800-000-in-broadband-project

[28] http://www.hudsonhubtimes.com/news%20local/2015/07/26/velocity-broadband-coming-to-hudson-as-city-utility

# 7. Municipal Retail Provider – Residential

## 7.1 Overview

Municipalities that provide end user services to residential and business customers are considered retail service providers. Most commonly, local governments offer triple-play services consisting of phone, television, and Internet services. As a retail provider, the organization is responsible for a significant number of operational functions, including management of retail services, network operations, billing, provisioning, network construction, and general management.

Municipalities that compete with broadband providers in business and residential markets must be effective in their sales and marketing efforts to gain sufficient market share to support investments needed to build and operate these networks. Retail providers must carefully develop their market strategy, product portfolio, rate structures, and service packages. The competitive and low margin nature of residential broadband services means that a provider must achieve a significant market share to operate profitably. Residential broadband is a volume business and without sufficient market share, providers are challenged at covering their high costs of operating, investing in network expansion, maintaining reserves, and covering debt service.

Perhaps the most important decision when evaluating a retail business case is whether the municipality should provide linear television services. Television is the “glue” that holds the triple-play service bundle together, and without television, many networks fail to achieve strong market share above 30%. However, the business case to carry television services results in a break-even. In many cases, that does not generally provide contribution margin to the business like Internet and phone services do.

In fact, the cost to provide television services are staggering, including several million dollars for headend equipment, significant monthly per subscriber costs for content, and high ongoing operations and management costs. Moreover, the television delivery model is evolving with more online content and “over the top” programming. The current model is expected to significantly change within three to five years, posing significant technology risk to new municipal providers who choose to invest in the equipment necessary to provide these services. Therefore, municipalities that enter the retail market must be very careful to plan their market strategy correctly, especially in today’s changing technology environment.

## 7.2 Services and Rates

Municipal retail providers have used deployed FTTH to compete on speed, quality, and sometimes price to win market share. Municipal retail providers that provide residential services, in most cases, also serve business, community anchors, and wholesale customers in their markets. This enables them to make greater use of their resources to

serve more customers. Figure 13 provides a comparison of five municipal retail providers.

*Figure 13 - Municipal Retail Provider Service Portfolios*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA | Longmont, CO |
|---|---|---|---|---|---|
| Residential | | | | | |
| Internet | ✔ | ✔ | ✔ | ✔ | ✔ |
| Telephone | ✔ | ✔ | ✔ | ✔ | ✔ |
| Television | ✔ | ✔ | ✔ | ✔ | |
| Home Security | | | ✔ | | |
| Other | | | ✔ | | |
| Commercial | | | | | |
| Internet | ✔ | ✔ | ✔ | ✔ | ✔ |
| Telephone | ✔ | ✔ | ✔ | ✔ | ✔ |
| Data | ✔ | ✔ | ✔ | ✔ | |
| Wholesale | | | | | |
| Data | ✔ | ✔ | ✔ | ✔ | |
| Dark Fiber | ✔ | | ✔ | ✔ | |
| Community Anchor | | | | | |
| Internet | ✔ | ✔ | ✔ | ✔ | ✔ |
| Telephone | ✔ | ✔ | ✔ | ✔ | ✔ |
| Data | ✔ | ✔ | ✔ | ✔ | ✔ |
| Dark Fiber | ✔ | ✔ | ✔ | ✔ | |
| Other | | ✔ | ✔ | | |

In many cases, municipal retail providers maintain pricing similar to the existing market but offer improved quality of services to their subscribers, more bandwidth, and better customer service.

## 7.3 Market Penetration

Municipal retail providers have been known to achieve high residential penetrations in the markets they serve, in many cases over 50%. Figure  illustrates market penetration for five municipal retail providers. In most cases, these providers have achieved their residential uptake over a period of six to seven years. Commercial market penetration has varied considerably among residential retail providers, in part because in these markets, there are additional options for commercial services whereas the options for residential services were limited to one or two. Figures for the City of Longmont are estimated as they are currently progressing through Phase 2 of their FTTH deployment.

*Figure 14 - Market Penetration Benchmarking – Municipal Retail Providers*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA | Longmont, CO |
|---|---|---|---|---|---|
| Residential | | | | | |
| Homes Passed | 14,500 | 140,000 | 16,800 | 15,000 | 4,000 |
| Residential Subscribers | 5,600 | 70,000 | 12,700 | 13,000 | 500 |
| Residential Penetration | 39% | 50% | 76% | 87% | 13% |
| Years to Achieve Penetration | 6 years | 7 years | 6 years | 7 years | 2 years |
| Commercial | | | | | |
| Commercial Premises Passed | 3,200 | 14,000 | 2,800 | 2,500 | 500 |
| Commercial Subscribers | 750 | 4,500 | 2,100 | 1,100 | N/A |
| Commercial Penetration | 23% | 32% | 75% | 44% | N/A |
| Years to Achieve Penetration | 8 years | 10 years | 6 years | 6 years | N/A |

These providers have experienced strong uptake of their services, which they attribute to a combination of leading edge pricing, competitive pricing, and high-quality local customer service. All five providers reiterated the importance of local service to keeping their existing customers and winning new customers. They attributed their electric utility heritage as a key aspect that allowed them to provide high levels of customer service to their customers. Figure  provides a quick community profile of each municipal provider.

*Figure 13  - Community Profiles in Municipal Retail Provider Markets*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA | Longmont, CO |
|---|---|---|---|---|---|
| Population | 29,324 | 173,778 | 17,341 | 40,566 | 90,237 |
| Square Mileage | 20.9 | 137.15 | 13.2 | 28.9 | 26.19 |
| Households | 11,412 | 79,607 | 17,000 | 14,608 | 33,551 |
| Median Household Income | $33,216 | $38,064 | $32,221 | $50,546 | $58,698 |

## 7.4 Organizational Profiles

All five municipal retail providers studied in this study also maintained municipal electric utilities as part of their municipal organization. The presence of a municipal electric utility creates an environment that fosters the development of broadband services for a number of reasons, including:

- Operational expertise managing a critical service for the community
- Subject matter expertise in fiber-optics, in cases where municipal electric utilities maintain their own fiber-optic plants for SCADA communications
- Ownership of pole lines, infrastructure, and facilities throughout the service area
- Ownership of vehicles and equipment needed to maintain fiber-optic networks
- Business process expertise managing sales, marketing, billing, accounting, and reporting
- Access to capital markets and funding programs generally beyond municipality without a municipal electric utility
- Resource and cost allocation techniques that enable the sharing of resources between municipal electric and communications utilities

In all cases, municipal retail providers in this study maintained sizable electric utilities and in each case, an initial fiber network was built to support the electric utility's needs prior to deploying any broadband services. In these cases, the electric utilities built their own fiber networks to support substation communications needs, which catalyzed their expansion to provide broadband communication services.

*Figure 14 - Organizational Profiles of Municipal Retail Providers*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA | Longmont, CO |
|---|---|---|---|---|---|
| City-Owned Utilities | | | | | |
| Electric | ✔ | ✔ | ✔ | ✔ | ✔ |
| Water/Sewer | ✔ | ✔ | ✔ | ✔ | ✔ |
| Gas | | | | ✔ | |

## 7.5 Financial Profiles

All five municipal retail providers studied in this study utilized some type of bonding vehicle to finance the initial municipal retail FTTH network. In the case of Chattanooga and Bristol Virginia Utilities, Federal Department of Energy (Smart Grid) and Department of Commerce (Broadband Technology Opportunities Program) grants provided supplementary funding for portions of their broadband deployments and are not included in numbers provided in Figure 14 below. In these cases, each utility

financed the construction of the outside plant fiber optic network, headend equipment and related capital assets through bonds.

*Figure 15 - Funding Sources for Municipal Retail Providers*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA | Longmont, CO |
|---|---|---|---|---|---|
| Investment | $20,000,000 | $161,000,000 | $32,000,000 | $15,450,000 | $45,300,00 |
| Funding Source | GO Bond | Rev. Bond | Rev. Bond | GO & Rev. Bond | Rev. Bond |
| Term of Debt | N/A | 20 Years | 25 Years | 15 Years | 20 Years |
| Interest Rate | N/A | 4.0% | 3.67% | 3.0% | 3%-5% |

Revenues and expenses for four of the five municipal retail providers are provided in Figure . The City of Longmont, CO was not included in this analysis because the municipality is still in its "launch phase" and has not published financial results to date. Also, 2014 CAFRs from the City of Longmont, CO did not provide financial information that was relevant to use in the analysis.

The four municipal retail providers can be considered mature operating utilities that have been providing FTTH services for at least five years. The revenues represented are for the most current fiscal year and represent a steady "run rate" for each utility. Municipal retail providers generate the majority of their revenues from residential services. For the four providers below, each generates about 70% of gross revenues from residential services consisting of voice, video, and data. The remaining revenues are generated through providing services to businesses, community anchors (schools, hospitals, and others), and wholesale services to other providers.

Costs vary considerably between these providers, which is also generally true for municipal retail providers. Therefore, it becomes difficult to set benchmarks consistently as each provider has a cost structure that differs from its peers. Municipal retail providers also account for their expenses using methodologies that vary from state to state, which is partly due to their statutory reporting requirements and partly due to how they structure their enterprise funds internally. Therefore, we do not advise that a city rely on the performance of other municipal retail providers (or other types of municipal providers) to forecast its own expected performance. Rather, the numbers represented in these analyses should be used as a guide to understanding how other municipal providers have performed in their specific environments anecdotally, rather than quantitatively.

*Figure 16 - Profit & Loss Statements from Retail Providers (Most Recent Year)*

| | Morristown, TN | Chattanooga, TN | Bristol, VA | Cedar Falls, IA |
|---|---|---|---|---|
| Gross Revenues | | | | |
| Residential | $6,103,352 | $67,002,000 | $19,500,000 | |
| Commercial | $1,525,838 | $24,169,000 | $6,600,000 | |
| Community Anchor | | | $2,200,000 | |
| Interfund Allocations | $921,003 | | | |
| Other Revenue | $386,742 | $8,712,000 | | $3,966 |
| Cable System Revenue | | | | $7,913,921 |
| Data Service Revenue | | | | $5,975,439 |
| Access Revenue | | | | $236,407 |
| Private Line Revenue | | | | $179,980 |
| Total Revenue | $8,936,935 | $99,883,000 | $28,300,000 | $14,309,713 |
| Operating Expenses | | | | |
| Cost of Services | $6,181,982 | $34,555,000 | $15,000,000 | |
| Maintenance | $238,941 | $31,168,000 | | $8,009,105 |
| Sales, General & Administrative | | $2,207,000 | $4,800,000 | $2,999,629 |
| Depreciation | $372,067 | $15,073,000 | | $2,190,992 |
| Interfund Transfers | $962,339 | | | |
| Taxes | $87,683 | | | |
| Total Operating Expenses | $7,843,012 | $83,003,000 | $19,800,000 | $13,199,726 |
| Operating Income | $1,093,923 | $16,880,000 | $8,500,000 | $1,109,987 |
| Non-Operating Expenses | | | | |
| Debt Service | $32,011 | | $1,470,000 | |
| Other Income/Expense | | | | $(515,320) |
| Interest & Misc Income | $(1,699) | | | $(270,294) |
| Interest Expense | $32,416 | $1,697,000 | | $502,144 |
| Non-Operating Expenses | $62,728 | $1,697,000 | $1,470,000 | $(283,470) |
| Net Income | $1,031,195 | $15,183,000 | $7,030,000 | $1,393,457 |

## 7.6 Municipal Retail Provider Case Studies (Residential)

### 7.6.1 Bristol, Virginia

#### *Community Overview*

The City of Bristol lies in rural southwest Virginia. Beginning in the 1980s, this rural community of 17,000 residents began to suffer an economic downturn due to legacy industries of coal, tobacco, and textiles becoming less viable on the national and world stage. This led to concerns from community leaders and the local economic development commission on how Bristol would revitalize its business and industrial base.

The City of Bristol and surrounding communities have relied on Bristol Virginia Utilities (now BVU Authority) to provide electric, water, and wastewater services since 1947. Beginning in 2001, BVU realized that in order to economically and effectively manage their electric grid, it needed a better way to communicate with the electric power substations, and the best way to provide that service was to deploy a fiber-optic network for high-speed, reliable communications.

#### *Development of the Initial Network*

By 2003, BVU had built a robust fiber-optic network to provide this platform for its electric substations. The city and BVU soon realized that connecting municipal sites and departments to this network could significantly reduce costs. They were correct and after bringing the city sites online, the city effectively saved $1.5 million over the next three years for taxpayers in the community. This strategy not only reduced costs but also protected the city from future cost increases. As the city's online services grew, so did its needs for bandwidth. BVU's network provided ample capacity to accommodate this growth without increasing cost to the city.

By design, BVU's fiber-optic network passed many of the industrial parks and business areas within the city, and local leaders determined that its network could provide enhanced benefits to economic development in effort to revitalize the community. In 2005, BVU launched a program to take its network commercial. In order to effectively provide a portfolio of services, BVU recruited service providers to use extra capacity on the network to provide their products and services to businesses. After exhaustive searches, no viable service providers were willing to enter the market and make the required investments to service such a rural area.

## *Development of Broadband Services*

The City of Bristol and BVU made an important decision to begin providing services directly to businesses and residents within the community. BVU now provides triple-play services to customers of Bristol and surrounding areas. As a municipal-owned provider, BVU is responsive to the needs of its constituents and has positioned its community for the future.

## *Impact to the Community*

- Reduced government spending by $1.5 million in the first three years
- Lowered and stabilized business and residential Internet costs by approximately 20%
- Reduced education spending by about $750,000 in the first five years
- Independent study showed that the business and residential community saved almost $10 million due to rate reductions the first five years
- Energized the economy by adding over 1,250 jobs, and retaining about 700 jobs
- Nearly $50 million in new private investment, which increased annual payrolls by $37 million dollars
- One of the first communities to offer 1 Gigabit to business and residents
- Network serves nearly 12,000 residential and 2,500 business customers
- Achieved almost 70% market penetration in the city's footprint
- Provides fiber backhaul for Verizon cell towers, enhancing mobility speeds in the region
- Provides transport for multiple service providers, supporting their wholesale needs
- Reinvestment of proceeds back into the network and economic development opportunities for the entire community
- Received BTOP and VTC grants of almost $33 million to extend the current fiber backbone through eight more counties, based on success of the current network
- Connected schools, healthcare, public safety, and community support to significantly reduce taxpayer spend in the region

## *Challenges*

The biggest challenges that BVU faced in launching OptiNet were overcoming outdated Virginia state laws related to municipalities offering telecom services and legal and regulatory issues raised by local incumbents. One of the biggest hurdles was a State of Virginia statute that prohibited municipal entities from offering telecom services. Because OptiNet is government-owned, BVU could not legally provide telephone, Internet, or video services in Virginia. To overcome this obstacle, the utility filed a complaint against the state, pointing out that a more recent federal statute – the Telecommunications Act of 1996 – made the state law invalid. The Virginia General Assembly agreed in 2002 by overwhelmingly passing legislation that reversed the previous ruling.

That same year, as BVU was ready to roll out its suite of services, the incumbent cable operator in Bristol entered an injunction against BVU, claiming the utility wasn't legally authorized to provide cable television (CATV) services. The courts ruled in favor of the cable operator, and BVU was forced to seek a legislative change to its charter and a separate legislation that would allow it to provide the services. In 2003, the Virginia General Assembly once again came to the rescue, passing Senate Bill 875, which reversed the decision.[29]

### 7.6.2 Ashland, Oregon

#### *Community Overview*

The City of Ashland, Oregon rises to an elevation of 1,949 feet nestled in the foothills of the Siskiyou and Cascade ranges, about 15 miles north of the California border on Interstate 5, and about 12 miles south of Medford and about 300 miles south of Portland. Ashland is home to around 20,000 people and 9,400 households, with a total area of about 6.6 square miles, leading to a population density of 3,047 people per square mile. About 21% of the population and 13% of families have incomes below the poverty line. Out of the total population, about 30% of those under the age of 18 and 3.5% of those 65 and older live below the poverty line.

The largest employer is Southern Oregon University (SOU), with a faculty and staff of over 750. Typical of smaller towns, health services (400 employees), and schools (300 employees), are the major employers, while businesses related to outdoor recreation, transportation, technology, and light manufacturing are also important employers. However, income from tourism is important to Ashland's economy, and leads the way for a significant number of restaurants, galleries, and retailers cater to nearly 400,000 visitors that attend the Oregon Shakespeare Festival.

A municipal network commonly cited as a failure is the Ashland Fiber Network (AFN) in Oregon. As a pioneer in the municipal network movement in the late 1990s, Ashland certainly made a number of mistakes, which communities across the country have learned from. However, Ashland itself has learned from those early challenges, fixed many of the problems, restructured its business plan, and the network now provides substantial benefit to the city.[30]

#### *Development of the Initial Network*

The City of Ashland's Electric Department originally presented its case to create Ashland Fiber Network in the mid-1990s. The proposal responded to the regulatory, market, and public environments of the period. The 1990s were an exciting time of growth and experimentation with high-technology industries taking hold, stock markets

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[29] Broadband Communities Magazine. http://www.bbpmag.com/2008issues/aug08/AugSep08_MuniSnapshot.pdf

[30] http://www.ashland.or.us/Files/Proposed%20AFN%20Business%20Plan.pdf

at historically high levels, capital markets flush with low-interest money, the Federal government prioritizing telecommunications services through the Federal Telecommunications Act of 1996, and deregulation of energy markets setting an unknown future for public utilities providers. In that time of innovation, Ashland presented the creation of AFN as an opportunity. A telecommunications utility could meet the new demands for communications services in Ashland while diversifying and bolstering the City's electric business. Electric rates were also pledged in support of the effort.

Ashland's City Council approved the Electric Department's plan to build a fiber optic ring in February 1997 and an AFN Implementation Team was formed. The AFN business plan was presented by the Electric Department to Ashland's City Council in late-1998 and was approved. That plan intended for Ashland Fiber Network to be self-supporting through revenues, with initial construction debt repaid by operating revenues within a ten-year period.

The AFN project experienced financial problems quickly after launch. Charter Communications purchased a local provider and rebuilt their network in Ashland to create an equal alternative. Price competition ensued and AFN construction costs went significantly over budget. The utility failed to generate positive revenues from inception and a critical moment for AFN came in 2004, when the city determined that AFN would never be able to pay its business and intra-fund loans. $15.5 million in bonds were issued to consolidate AFN-related debt and to provide a degree of financial certainty.

AFN continued to struggle to define its business and identity over the ensuing years. Various managers all brought their own strategies and organizational structures to attempt to make AFN viable. Restructurings included staff moves, separating AFN from Ashland's Electric Department, investing in new products to sell that did not materialize, contracting out operation of AFN's cable television business line in late-2006, refocusing on providing wholesale Internet service, and even crossing resources between AFN and the internal city technology division. That lack of long-term clarity has contributed to the mixed results and weak financial performance that exists today.

### *Development of Broadband Services*

Today, Ashland Fiber Network is a decade old and operates primarily as an Internet service wholesaler. Its revenues have not met operating and debt expenses, and capital reinvestments into the AFN infrastructure have been nominal at best. Though on a performance basis, AFN has shown a strong record of meeting standard operating measures, it is not yet positioned to offer the new services that customers demand in terms of planning, resources, contracts, and projects.

AFN struggled during the period when its cost pressures were much lower and net revenues could have been much higher. Internet service provision continues to transform into a commodity, with characteristically low margins and limited growth

potential. Indeed, Internet-based entertainment and communications services carry more value than the infrastructure those services operate on.

### *Impact to the Community*

AFN borrowed its startup funds from the Ashland Electric Utility. After years of city departments covering AFN shortfalls, in August 2004 the city took out $15.5 million in bonds with an annual debt payment of $1.43 million. In October 2005, the city adopted a surcharge of $7.50 on all electric bills to subsidize AFN – a surcharge that was later rescinded after protests from citizens. In December 2005, $500,000 was given from the electric department to help AFN pay its debt.

Between 2005 and 2007, AFN did not contribute anything to its debt service and between 2008 and 2010 it contributed $356,000, with $700,000 in 2011, and $409,000 in 2012. Property taxes now help cover part of AFN's debt. Thus, residents who were not offered system access or who chose not to use it were still required to subsidize the network through higher property taxes.

### *Challenges*

The existence of a municipal network does not assure universal service because there is no guarantee that the network will be built out to reach all residents in a given geographic area. The challenge is related to the cost to build the infrastructure to certain areas that may be prohibitive because of terrain or density of population. This can be seen in the case of the AFN.

In fact, about 1,300 Ashland households did not receive AFN services because it was too costly to build the infrastructure to service certain areas. In this case, the AFN was not willing to provide universal service to the entire geographic area because of the costs of servicing certain areas. In declining to provide service to hard-to-reach areas, AFN engaged in the same business practices as private firms, essentially avoiding high-cost areas. However, unlike a private firm, when a municipal network declines to serve all households in its area, property owners who do not have access must still pay for the system in the form of higher taxes.

## 7.6.3 Morristown, Tennessee

### *Community Overview*

Morristown is the seat of Hamblen County, Tennessee, and has a population of 29,304 across the city's 27.9 square miles, giving it a population density of 1,044 people per square mile. There are 11,020 households in Morristown, with the median household income of $33,217, with per capita income at $17,690. About 26.2% of the population is below the poverty line. It is the principal city of the Morristown Metropolitan Statistical Area, which encompasses all of Grainger, Hamblen, and Jefferson counties. The Morristown MSA is part of the Knoxville Combined Statistical Area.

Public schools in Morristown are operated by Hamblen County Department of Education. There are four middle schools and two high schools. The main campus of Walters State Community College is located in Morristown, with King University and Tusculum College having satellite campuses.

In the post-WWII years, the community evolved from an agricultural economy to a manufacturing based economy, producing such a wide range of products as textiles and furniture to automotive parts and high tech plastics. Located on Interstate 81 at the crossroads of US highways 25E and 11E, and less than eight miles from Interstate 40, with access to major railways, Morristown has now grown into an industrial and manufacturing center for east Tennessee, with 70% of the utility's electricity serving industrial and large commercial customers.

Morristown serves as the hub of the Lakeway Area for employment, manufacturing, healthcare, and educational services. Tourism is a sizeable industry as well, anchored by Cherokee Lake, which has 463 miles of shoreline in Hamblen County that attracts 2.5 million visitors annually, and within an hour of the Great Smoky Mountains National Park, which attracts over 10 million annual visitors.

### *Development of the Initial Network*

Among the first three or four utilities in the nation to develop their own fiber to the home broadband system, the desire to deploy the network was actually born out of the desire to provide better television service. In 2004, a new mayor and some new council members responded to the call from the public to do something about the incumbent cable TV provider, which had consistently increased rates and had terrible customer service. The city tried to negotiate with Charter without success to hold down rates, so they asked the utility to enter the business.

Besides cable TV rates, there was concern to improve broadband capabilities to support existing businesses and recruit new industry. After some surveys of customer interest, Morristown filed a business plan with the state comptroller, and asked for a referendum to be sure the citizens supported borrowing the money to enter the business. The results were overwhelmingly in favor of the Morristown Utility Systems (MUS) proceeding with the plan.

At the time of Morristown's initial deployment in 2004, fiber-to-the-home was not a common practice, and leadership was not comfortable with the investment. However, once they realized that fiber was a way to secure the network investment for the future, it was an easy decision. The decision has certainly paid off, as nearly a decade later the upgrade to gigabit capability did not have to touch the fiber network – the electronics were simply changed on either end.

From a municipal perspective, MUS connects all county libraries, and several of the hospitals, for which it is also developing a new traffic control system in conjunction with the county fire and police departments and the 911 system. All the Board of Education

schools are connected, except for a couple in the county that are not served by MUS, along with two local colleges. All of those organizations are connected with either gigabit or 100 Mbps connections.

### *Development of Broadband Services*

Morristown Utility System (MUS) FiberNet started signing up customers in May 2006, and by late 2008 already had a take rate of 33%, with take rates in July 2015 over 44% of homes passed, and an even greater percentage of businesses. In fact, 100% of Morristown households have access to broadband Internet. Out of the four service providers that Morristown has for broadband, 80% of residents have availability to choose from at least two of those providers.[31]

The leadership of MUS believes that the most important thing they can do is provide superior customer service, so a local call center was established, with technical support, right on Main Street in downtown. With that, response times have been minimized, whether customer equipment needs replacing or a new business is opening, they can react to customer needs quickly.

For business, speed and reliability of Internet are critical. Regarding speed, MUS's perspective is not to sell a customer more bandwidth than they need just to drive profit. Most businesses start out with 4Mbps of guaranteed symmetrical bandwidth, while most commercial service providers start at 12Mbps, best effort. Morristown's gigabit speeds are available should a customer need it, but MUS is not going to sell a gigabit of service simply for the sake of profit grabbing.

For the electric side, MUS uses the network to deploy real-time advanced metering services. This allows MUS to automate demand response, which lowers wholesale power bills, provides better services, and reduces operational costs, by remote disconnect, where trucks aren't dispatched as often. Meters can be checked in a matter of seconds, so the network is really redefining the way MUS provides services and conducts its business.

FiberNet's strong financial performance resulted in MUS becoming cash flow positive just two years after launch, and net income positive after five years. Both of these key milestones were reached significantly quicker than initially projected. In terms of revenue, FiberNet generated $8.6 million during 2013 and $8.9 million during 2014. FiberNet's solid financials have translated into a 35% increase in MUS's payments in lieu of taxes to the city, which now amount to $350,000 per year, up from $150,000 in 2010.

[31] http://www.musfiber.net

## *Impact to the Community*

Morristown businesses and residents are saving $3.4 million annually thanks to MUS FiberNet's introduction of lower prices in the local broadband market. MUS thinks that if the FiberNet service wasn't available in Morristown, cable, and Internet rates would be much higher. Therefore, MUS thinks they act as the salt that prevents the incumbents from taking advantage of the city residents and businesses. Apparently this approach is working because incumbents have not raised cable TV prices since MUS entered the business, and because of MUS pressure, the incumbents have improved their services and their systems. Moreover, it's a win for the community to the tune of $3.4 million every year, which can be spent locally rather than being siphoned out of the community to corporate shareholders.

MUS FiberNet's impact on economic development is also notable. Oddello Industries, a contract furniture manufacturer that relies on FiberNet for its communications, recently announced a $4 million expansion in Morristown, resulting in 228 new jobs. Oddello CEO, Tom Roberts, cited "reliable utilities" among the reasons for investing in Morristown to grow its Morristown presence from 35 to 415 employees in just the past year.

Another sign of FiberNet's impact on economic development is the recent decision by Molecular Pathology Laboratory Network (MPLN), a global leader in personalized laboratory medicine, to locate its primary backup facility in Morristown. As a global provider of diagnostics to hospitals, medical labs and physician groups, MPLN requires ultra-reliable data replication and disaster recovery services, which FiberNet enables.

Local leaders cannot claim that there has been a major industry to locate in the community solely because of fiber. However, today many employees work away from home and it can be important for them to have access to high-speed broadband to complete tasks at work and possibly check on work from home. Increasingly, there are individuals that work solely from their home. Access to high-speed internet can be integral to having a successful work-from-home career. Therefore, it speaks to the quality of life, what fiber can do for employment when you can have 1,000 people working from home instead of working at 1,000-employee factory.

The president of the Chamber of Commerce says, "When site selectors look for something, this is the nugget that sets us apart. You see about six or seven utilities in the state doing this and they knew it was a risk. A lot are unsuccessful at it so that really justifies the commitment our utilities have made here. I think a lot of people who in the community are pleased with their broadband offers and the affordability we have because of healthy competition."[32]

[32] http://www.wbir.com/story/news/2015/05/06/municipal-internet-as-utility/26964309

In looking at cost savings for Morristown's city government, MUS points to $840,000 in total savings from a smart meter program - a combination of lower annual power consumption and operational efficiencies. The fiber, as an electric asset, enabled the utility to receive $4 million in grants from the Tennessee Valley Authority for smart grid development. These developments have further provided a path to lower rates through better technology. Another $20,000 in annual savings is due to the county not having to pay out-of-town contractors to maintain the network because the required expertise can now be found locally thanks to MUS's dedicated network specialists.

### *Challenges*

Although there are many benefits that outweigh the challenges, MUS admits that broadband and telecommunications is a tough business for a small community, due primarily to the economies of scale. The extra challenge for Morristown leaders was to gain the political will to be successful, to battle the telecom lobby and the Tennessee legislature, and to make some good business decisions with vendors. MUS leadership says it takes determination because it is not an easy business.

# 8. Public-Private Partnerships

Public-private partnerships (P3s) are an emerging business model that provides an innovative solution to an ongoing municipal broadband issue: how does a local government invest in municipal broadband without operating a broadband network? Public-private partnerships come in many forms and are a very early stage business model that is still taking shape today.

Generally, P3s bring a local government and one or more private organizations into a partnership to plan, fund, build, and maintain a broadband network within the municipality's jurisdiction. In many cases, P3s are still in development as there are very few cases of networks today permanently using this model. However, there are a number of P3s that are in various stages of negotiation and even a few that are preparing to build broadband networks.

Typically, P3s use the policies, capabilities, and funding of local governments to build fiber infrastructure in concert with broadband provider capabilities to implement and operate broadband networks. At the highest level, most P3s in development use the credit capacity of local governments to finance the construction of fiber networks at a rate lower than broadband providers' cost of capital.

Although many advocates of P3s have claimed that P3s do not require public organizations to contribute capital, the reality is that without public organizations "having skin in the game" the likelihood of attracting a private partner that will assume nearly all of the risk in the project is low. However, Google Fiber has proven that it is possible; the City of Kansas City made significant incentives available that many cities may not be in a position to offer,[33] either from a statutory or organizational perspective.

When a local government brings public funding to a P3, it reduces the financial barrier to entry for the provider and allows the provider to create a more feasible business case to operate in the area. These arrangements also allow local governments to maintain ownership of long-term community assets and significant control in the negotiation of how broadband services are provided to their community.

The "tricky part" in P3s is to find the right alignment between the public and private partner. Each organization must align on a number of aspects of the P3 to make it successful, including:

- Who has rights to access the network and is the P3 exclusive or non-exclusive?
- What are the public and private partners' goals and how are they incentivized?
- What roles and responsibilities does the public and private partner have in the P3?

[33] http://www.wsj.com/articles/SB10000872396390443862604578030671101065746

- What assets are financed through the public and private partner?
- What revenue model is used by the public and private partner to recoup their investment?
- What requirements must the private partner meet, in terms of service availability, speed, price, locations, and timeframes?
- How will the partners determine future buildouts and who pays for them?

## 8.1 Public-Private Partnership Case Studies

### 8.1.1 Westminster, Maryland

The City of Westminster, MD recently developed a P3 with Ting Internet that will bring together the two organizations and build a fiber to the home network to approximately 9,000 homes and 500 businesses. The city recently approved a budget of $650,000 to build out fiber to the home infrastructure in a "pilot" program to reach a subset of the entire community.

Since the city had no desire to operate the network or provide retail services, it recruited Ting Internet to become the operator and deliver all retail services to the community. In the partnership, the city will build and own all fiber infrastructure while Ting will simply operate the network. The city will collect revenues from Ting for lease of the fiber to recoup its initial investment in the network. Based on the success of the initial pilot, the city and Ting may continue the buildout of the network to the remainder of the community. Ting will maintain exclusivity on the network for the first two years, after which time the network will be open to other competitive providers in addition to Ting.

Ting provides only Internet services as of today but plans to offer a competitive television service and voice service to customers in the future. Ting's rates in Westminster follow:

- Residential Gigabit Internet (1000 Mbps Up / 1000 Mbps Down) - $89/month
- Residential Basic Internet (5 Mbps Up / 5 Mbps Down) - $19/month
- Business Gigabit Internet (1000 Mbps Up / 1000 Mbps Down) - $139/month

### 8.1.2 MoBroadband & Sho-Me Technologies

Prior to NTIA's Broadband Technology Opportunities Program (BTOP), south central Missouri relied on copper-based broadband access and needed significantly higher speeds to enable distance learning, telehealth, and public safety applications. NTIA provided a $26.6 million grant to Sho-Me Technologies to deploy a 1,494 mile network connecting 101 anchor institutions across 30 counties. The origins of the project date back to 1997, when Sho-Me Power Electric Cooperative, a public entity, created a technology subsidiary, Sho-Me Technologies, to leverage its existing internal advanced

optical communications network to offer high quality, high bandwidth connections to both internal and external customers, particularly rural communities.

Sho-Me collaborated with the State of Missouri to develop the project's network design and identify the unserved and underserved areas to target its network build. The project forms an integral part of the MoBroadband Now initiative, launched in 2009. For its BTOP award, Sho-Me Technologies contributed 954 miles of existing fiber, valued at $8.8 million, and $2.6 million in cash.

This project reflects a private-sector-led model capitalizing on the expertise and resources of an electric cooperative. Sho-Me Power Electric Cooperative created Sho-Me Technologies as a subsidiary in order to expand and leverage its advanced networks to offer high bandwidth solutions. Sho-Me Technologies expanded broadband and fostered Smart Grid applications in partnership with electric co-ops for more efficient, secure energy use. The company also improved student education by connecting K-12 schools, improved government services limited by budget cuts, and strengthened public safety services by connecting regional law enforcement databases. In addition, by offering last mile broadband providers low interconnection pricing, Sho-Me's middle-mile network enabled them to extend enhanced broadband services to customers at affordable prices.[34]

### 8.1.3 Davenport, Iowa

Magellan Advisors recently completed a broadband feasibility study that determined the City of Davenport's options to expand broadband services to the community using a combination of smart public policy and public infrastructure. Rather than move forward with a municipal option, the city and Magellan believed that it was important to first determine the level of private sector interest that competitive providers would bring to Davenport.

Davenport is one of the larger cities in Iowa with a population of over 100,000 residents. The city believed that the large market size could create interest for existing and new competitive providers if the city developed the right incentive packages to bring them to the table. Magellan developed and managed a competitive RFI that was released publicly in early 2014 to solicit interest from competitive providers. The RFI provided detailed accounts of Davenport's infrastructure and policies that could incentivize providers to build a citywide fiber to the home network to serve residents and businesses.

Eleven responses were received from competitive providers across the country and several within the local area. No incumbents provided a qualified response to the RFI.

[34] http://www2.ntia.doc.gov/files/ntia_ppp_010515.pdf

Davenport has recently short-listed respondents and begun negotiations to determine how each potential firm would create a partnership with the city.

# 9. Glossary of Terms

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| 3G – Third Generation | The third generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web. |
| 4G – Fourth Generation | The fourth generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web. |
| ADSL – Asymmetric Digital Subscriber Line | DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service. |
| AMI – Advanced Metering Infrastructure | Electrical meters that measure more than simple consumption and an associated communication network to report the measurements. |
| Bandwidth | The amount of data transmitted in a given amount of time; usually measured in bits per second, kilobits per second (kbps), and Megabits per second (Mbps). |
| Bit | A single unit of data, either a one or a zero. In the world of broadband, bits are used to refer to the amount of transmitted data. A kilobit (Kb) is approximately 1,000 bits. A Megabit (Mb) is approximately 1,000,000 bits. There are 8 bits in a byte (which is the unit used to measure storage space), therefore a 1 Mbps connection takes about 8 seconds to transfer 1 megabyte of data (about the size of a typical digital camera photo). |
| BPON – Broadband Passive Optical Network | BPON is a point-to-multipoint fiber-lean architecture network system which uses passive splitters to deliver signals to multiple users. Instead of running a separate strand of fiber from the CO to every customer, BPON uses a single strand of fiber to serve up to 32 subscribers. |
| Broadband | A descriptive term for evolving digital technologies that provide consumers with integrated access to voice, high-speed data service, video-demand services, and interactive delivery services (e.g. DSL, Cable Internet). |
| CAI – Community Anchor Institutions | The NTIA defines CAIs as “Schools, libraries, medical and healthcare providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities.” Universities, colleges, community colleges, social service providers, public safety entities, government, and municipal offices are all community anchor institutions. |
| CLEC – Competitive Local Exchange Carrier | Wireline service provider authorized under state and Federal rules to compete with ILECs to provide local telephone service. CLECs provide telephone services by: 1) building or rebuilding telecommunications facilities of their own, 2) leasing capacity from another local telephone company (typically an ILEC) and reselling it, and 3) leasing discrete parts of the ILEC network referred to as UNEs. |
| CO – Central Office | A circuit switch where the phone lines in a geographical area come together, usually housed in a small building. |
| Coaxial Cable | A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this |

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| | technology. |
| CPE – Customer Premise Equipment | Any terminal and associated equipment located at a subscriber's premises and connected with a carrier's telecommunication channel |
| Demarcation Point (“demarc”) | The point at which the public switched telephone network ends and connects with the customer's on-premises wiring. |
| Dial-Up | A technology that provides customers with access to the Internet over an existing telephone line. |
| DLEC – Data Local Exchange Carrier | DLECs deliver high-speed access to the Internet, not voice. Examples of DLECs include Covad, Northpoint and Rhythms. |
| Downstream | Data flowing from the Internet to a computer (browsing the net, getting E-mail, downloading a file). |
| DSL – Digital Subscriber Line | The use of a copper telephone line to deliver “always on” broadband Internet service. |
| E-Rate | A Federal program that provides subsidy for voice and data circuits as well as internal network connections to qualified schools and libraries. The subsidy is based on a percentage designated by the FCC. |
| EON – Ethernet Optical Network | The use of Ethernet LAN packets running over a fiber network. |
| EvDO – Evolution Data Only | EvDO is a wireless technology that provides data connections that are 10 times as fast as a traditional modem. This has been overtaken by 4G LTE. |
| FCC – Federal Communications Commission | A Federal regulatory agency that is responsible for regulating interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia, and U.S. territories. |
| FTTP – Fiber to the premise (or FTTB – Fiber to the building) | A fiber-optic system that connects directly from the carrier network to the user premises. |
| GIS – Geographic Information Systems | A system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. |
| GPON- Gigabit-Capable Passive Optical Network | Similar to BPON, GPON allows for greater bandwidth through the use of a faster approach (up to 2.5 Gbps in current products) than BPON. |
| GPS – Global Positioning System | A space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. |
| ICT – Information and Communications Technology | Often used as an extended synonym for information technology (IT), but it is more specific term that stresses the role of unified communications and the integration of telecommunications, computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information. |
| ILEC – Incumbent Local Exchange Carrier | The traditional wireline telephone service providers within defined geographic areas. Prior to 1996, ILECs operated as monopolies having exclusive right and responsibility for providing local and local toll telephone service within LATAs. |
| ISDN – Integrated Services | An alternative method to simultaneously carry voice, data, and other |

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| Digital Network | traffic, using the switched telephone network. |
| ISP – Internet Service Provider | A company providing Internet access to consumers and businesses, acting as a bridge between customer (end-user) and infrastructure owners for dial-up, cable modem, and DSL services. |
| ITS – Intelligent Traffic System | Advanced applications that, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks. |
| Kbps – Kilobits per second | 1,000 bits per second. A measure of how fast data can be transmitted. |
| LAN – Local Area Network | A geographically localized network consisting of both hardware and software. The network can link workstations within a building or multiple computers with a single wireless Internet connection. |
| LATA – Local Access and Transport Areas | A geographic area within a divested Regional Bell Operating Company is permitted to offer exchange telecommunications and exchange access service. Calls between LATAs are often thought of as long distance service. Calls within a LATA typically include local and local toll services. |
| Local Loop | A generic term for the connection between the customer's premises (home, office, etc.) and the provider's serving central office. Historically, this has been a copper wire connection; but in many areas it has transitioned to fiber optic. Also, wireless options are increasingly available for local loop capacity. |
| MAN – Metropolitan Area Network | A high-speed intra-city network that links multiple locations with a campus, city or LATA. A MAN typically extends as far as 30 miles. |
| Mbps – Megabits per second | 1,000,000 bits per second. A measure of how fast data can be transmitted. |
| MPLS – Multiprotocol Label Switching | A mechanism in high-performance telecommunications networks that directs data from one network node to the next based on short path labels rather than long network addresses, avoiding complex lookups in a routing table. |
| Overbuilding | The practice of building excess capacity. In this context, it involves investment in additional infrastructure projects to provide competition. |
| OVS – Open Video Systems | OVS is a new option for those looking to offer cable television service outside the current framework of traditional regulation. It would allow more flexibility in providing service by reducing the build out requirements of new carriers. |
| PON – Passive Optical Network | A Passive Optical Network consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer's premise. Between them lies the optical distribution network comprised of fibers and passive splitters or couplers. In a PON network, a single piece of fiber can be run from the serving exchange out to a subdivision or office park, and then individual fiber strands to each building or serving equipment can be split from the main fiber using passive splitters / couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared by many customers, thereby dramatically |

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| | lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications. |
| PPP – Public-Private Partnership | A Public–Private Partnership (PPP) is a venture funded and operated through a collaborative partnership between a government and one or more private sector organizations. In addition to being referred to as a PPP, they are sometimes called a P3, or $P^3$. |
| QOS – Quality of Service | Refers to a broad collection of networking technologies and techniques to provide guarantees on a network to deliver predictable results reflected in Service Level Agreements. Elements of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate. QoS involves prioritization of network traffic. |
| RF – Radio Frequency | A rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. |
| RFI (Request for Information) | A request for information (RFI) is a standard business process whose purpose is to collect written information about the capabilities of various suppliers. Normally it follows a format to be used for comparative purposes. |
| Right-of-Way | A legal right of passage over land owned by another. Carriers and service providers must obtain right-of-way to dig trenches or plant poles for cable systems, and to place wireless antennae. |
| RUS – Rural Utility Service | A division of the United States Department of Agriculture, it promotes universal service in unserved and underserved areas of the country with grants, loans, and financing. Formerly known as “REA” or the Rural Electrification Administration. |
| SCADA – Supervisory Control and Data Acquisition | A type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes that exist in the physical world. |
| SNMP – Simple Network Management Protocol | An Internet-standard protocol for managing devices on IP networks. |
| SONET – Synchronous Optical Network | A family of fiber-optic transmission rates. |
| Streaming | Streamed data is any information/data that is delivered from a server to a host where the data represents information that must be delivered in real time. This could be video, audio, graphics, slide shows, web tours, combinations of these, or any other real time application. |
| Subscribership | Subscribership is how many customers have subscribed for a particular telecommunications service. |
| Switched Network | A domestic telecommunications network usually accessed by telephone, key telephone systems, private branch exchange trunks, and data arrangements. |
| T-1 – Trunk Level 1 | A digital transmission link with a total signaling speed of 1.544 Mbps. It is a standard for digital transmission in North America. |
| T-3 – Trunk Level 3 | 28 T1 lines or 44.736 Mbps. |
| UNE – Unbundled Network Element | Leased portions of a carrier’s (typically an ILEC’s) network used by another carrier to provide service to customers. Over time, the |

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| | obligation to provide UNEs has been greatly narrowed, such that the most common UNE now is the UNE-Loop. |
| Universal Service | The idea of providing every home in the United States with basic telephone service. |
| Upstream | Data flowing from your computer to the Internet (sending E-mail, uploading a file). |
| UPS – Uninterruptable Power Supply | An electrical apparatus that provides emergency power to a load when the input power source, typically main power, fails. |
| USAC – Universal Service Administrative Company | An independent American nonprofit corporation designated as the administrator of the Federal Universal Service Fund (USF) by the Federal Communications Commission that manages the E-Rate program. |
| VLAN – Virtual Local Area Network | In computer networking, a single network may be partitioned to create multiple distinct broadcast domains, which are mutually isolated so that packets can only pass between them via one or more routers; such a domain is referred to as a Virtual Local Area Network. |
| VoIP – Voice over Internet Protocol | An application that employs a data network (using a broadband connection) to transmit voice conversations using Internet Protocol. |
| VPN – Virtual Private Network | A virtual private network (VPN) extends a private network across a public network, such as the Internet. It enables a computer to send and receive data across shared or public networks as if it were directly connected to the private network, while benefitting from the functionality, security and management policies of the private network. This is done by establishing a virtual point-to-point connection through the use of dedicated connections, encryption, or a combination of the two. |
| WAN – Wide Area Network | A network that covers a broad area (i.e., any telecommunications network that links across metropolitan, regional, or national boundaries) using private or public network transports. |
| Wi-Fi | Wi-Fi is a popular technology that allows an electronic device to exchange data or connect to the Internet wirelessly using radio waves. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards". |
| WiMax | WiMax is a wireless technology that provides high-throughput broadband connections over long distances. WiMax can be used for a number of applications, including “last mile” broadband connections, hotspot and cellular backhaul, and high speed enterprise connectivity for businesses. |
| Wireless | Telephone service transmitted via cellular, PCS, satellite, or other technologies that do not require the telephone to be connected to a land-based line. |
| Wireless Internet | 1) Internet applications and access using mobile devices such as cell phones and palm devices. 2) Broadband Internet service provided via wireless connection, such as satellite or tower transmitters. |
| Wireline | Service based on infrastructure on or near the ground, such as copper telephone wires or coaxial cable underground or on poles. |

# 10. Disclaimer

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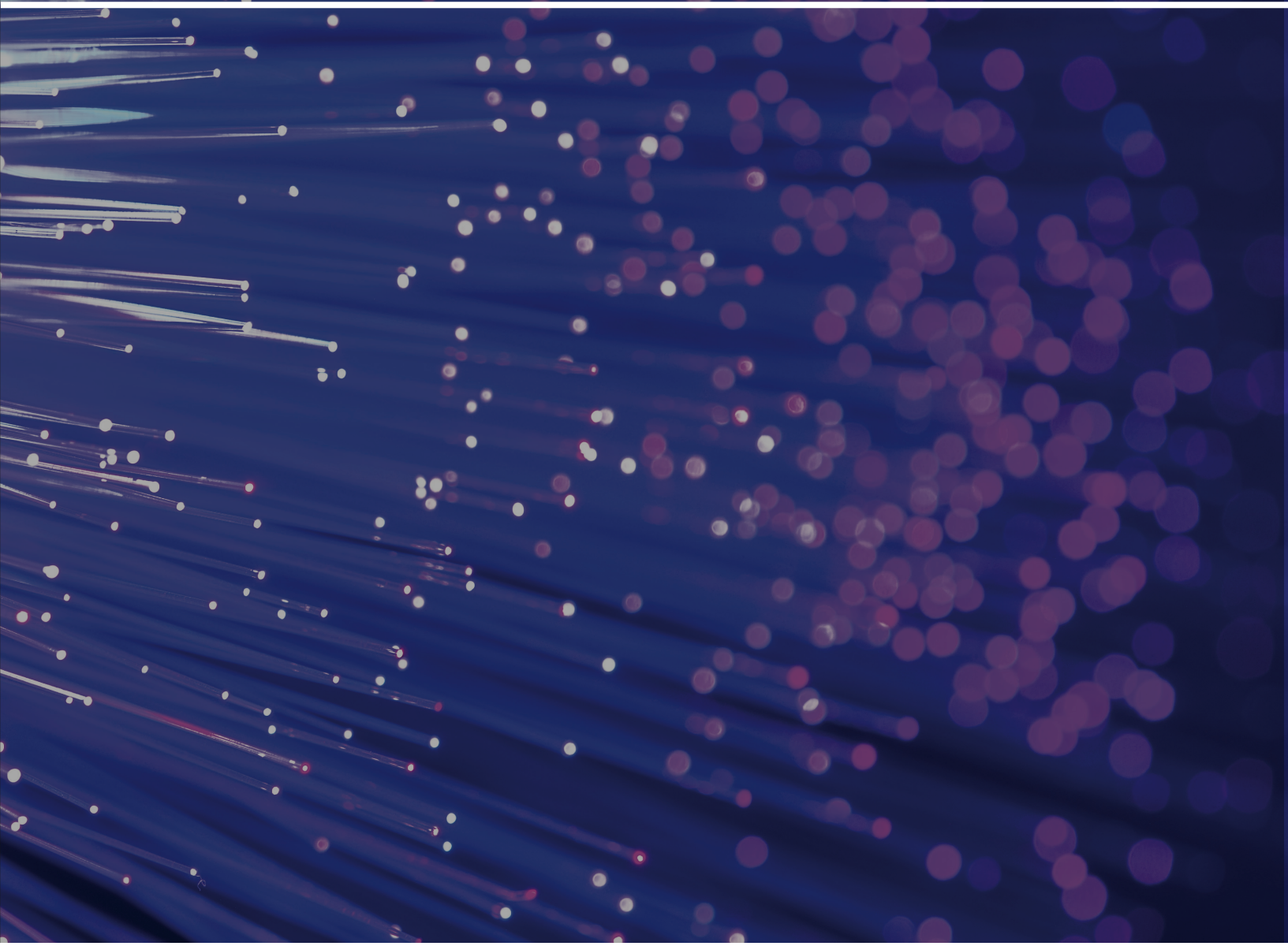

## ABOUT US

Magellan assists communities plan and implement SMART GIGABIT broadband networks to support economic and community needs. We are a results driven, hands-on firm that measures success by the expansion of broadband services in our clients' communities. With over 50 GIGABIT BROADBAND networks deployed in cities nationwide, Magellan is the leading consulting firm for public and private organizations that want to prepare their communities for the future.

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