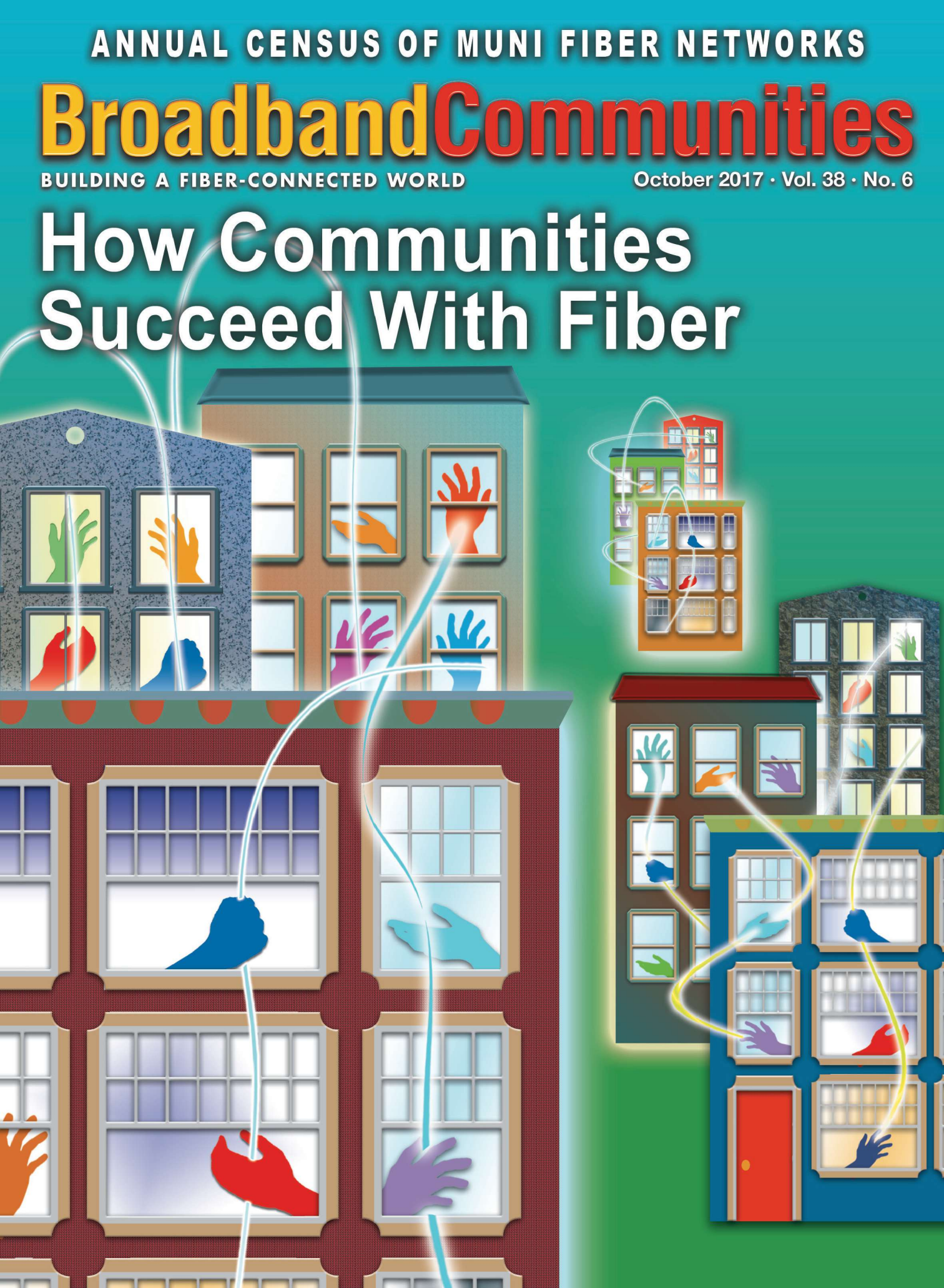
ANNUAL CENSUS OF MUNI FIBER NETWORKS

BroadbandCommunities
BUILDING A FIBER-CONNECTED WORLD
October 2017 · Vol. 38 · No. 6

How Communities Succeed With Fiber



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The show was very productive and we look forward to getting more involved in the magazine.

– James Lightfoot, President/CEO
ACRS

Great conference. I wish I could have spent more time there than just one day.

– Stacy Cantrell, Vice President, Engineering *Huntsville Utilities*

Here's what attendees are saying about the 2017 Summit!

AUSTIN SUMMIT

I loved sharing our story at the Summit. My favorite quote afterward: "I loved your presentation. It gave me hope for my rural broadband expansion project!"

– Cheryl DeBerry, Natural Resources Business Specialist
Garrett County, MD

The Summit is full of energy and offers the best of everything: A great staff, awesome and varied presentations, a tremendous knowledge base that is shared and an opportunity to network with other professionals from across the spectrum of telecommunications. This is my number one event of the year, and I recommend you make it yours!

– Gordon Caverly, Regional Vice-President
Mid-State Consultants, Inc.

We loved exhibiting at and attending the Broadband Communities Summit in Dallas. Not only did we get to meet some of the most interesting people, but a few weeks later, we are already closing deals from people we met at the show! It's a nice balance of education and business connections. We will be back!

– Layne Sisk, CEO
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BPA WORLDWIDE

Community Broadband Is a Local Choice

Citizens and local elected officials should be able to control their communities' broadband destinies.

This issue presents the magazine's annual listing of community fiber networks – a listing that grows longer each year. At least 216 municipalities, or groups of municipalities, are building fiber to the premises of residents and/or businesses.

Many citizens and elected officials don't believe their communities should enter the telecom business. That's a legitimate opinion. There are any number of good reasons not to build a broadband network. But it's a mistake to think that community broadband represents creeping socialism: Nearly 20 of the networks are owned in collaboration with private enterprises, about half engage private companies to operate them or provide services, and nearly all the communities are motivated by the desire to support local businesses. In fact, most of the communities would have preferred private providers to build their networks – community broadband is nearly always a last resort.

ARE COMMUNITY NETWORKS A BAD DEAL FOR TAXPAYERS?

The other criticism leveled at community networks is that they're a "bad deal for taxpayers." Most of these criticisms are spurious. For example, a study published earlier this year by Professor Christopher Yoo and student Timothy Pfenninger of the University of Pennsylvania that claimed several well-known community networks were financial failures received a great deal of press. This report was swiftly debunked by the network owners themselves as well as many independent experts, including Blair Levin of the Brookings Institution and Christopher Mitchell of the Institute for Local Self-Reliance. The UPenn authors made serious factual errors and, more important, did not understand the networks' financial models or take account of many of their community benefits.

It is true that some – not many – community broadband networks failed and proved burdensome to taxpayers. Some were sabotaged by political opposition, and others suffered self-inflicted wounds. Still others, though not outright failures, had disappointing results.

However, private companies fail, too. When multiple financial institutions collapsed in 2008 and had to be bailed out by taxpayers to the tune of at least half a trillion dollars, no one suggested that private companies didn't belong in the banking business. Generalizing from isolated examples is always dangerous.

The community networks that succeed perform an important function: They introduce competition where there was none before. This results in lower broadband costs and better broadband service. In many documented instances, community broadband strengthens local economies and enables more efficient government service delivery.

Because the potential benefits are so great, each community must be allowed to decide for itself whether to invest in this essential infrastructure. Only the community can determine whether it needs a network and has the capacity to build and manage it. ❖

Masha Zager

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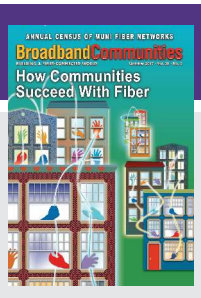

New York artist Irving Grunbaum celebrates the power of communities working together.

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Broadband for Rural Areas and the Poor? Fuggedaboudit!

Economic development in rural areas depends on broadband access – but the FCC's current initiatives won't help.

By Steven S. Ross / *Broadband Communities*

The FCC is seeking to help large national carriers deploy faster broadband networks without requiring those carriers to serve more premises and without providing additional subsidies.

The stakes are enormous. According to the FCC's 2016 Broadband Progress Report, more than half the 42 million Americans living in rural counties lack reliable broadband, and broadband is unavailable or too expensive for tens of millions more in urban areas. The Obama White House directed almost 30 agencies to streamline their regulations to remedy the situation. That process continued into early 2017. The near-silence on that initiative and the current FCC policy are appalling.

As I have documented over the past three years, at least a quarter of all rural job loss since 2010 – and probably more than half – is due to lack of broadband access. As rural counties lost more than 1 percent of their population, many urban areas were overwhelmed by population growth. This strains public services, such as roads and schools, and raises housing costs. Rising housing costs, in turn, reduce families' ability to afford broadband service even when it is available.

The FCC's Broadband Deployment Advisory Committee (BDAC) is due to release its proposals for enhancing broadband access in November. National carriers and the Trump administration also seek to override local rules on what can be attached to utility poles and what rates can be charged. Though pole owners have long delayed access to poles and sought to jack up prices for access in efforts to impede competition, some communities use fees on the poles they own to subsidize or expand digital access. This is particularly critical right now, as the administration considers sending user fees paid into the Universal Service Fund to the Treasury for non-broadband spending.

The most valuable real estate on Earth seems to be the space on utility poles. Carriers that own poles often seek to deny use by competitors. Electric utilities and municipalities that own poles often demand that prospective attachers pay for surveys of the poles' suitability and structural integrity, and they try to collect as much rent as possible. Tentative steps toward sanity the FCC instituted several years ago involved bringing data carriers under the umbrella of federal regulation under Title II of the Telecommunications Act.

The FCC is now about to trample on that weak reed and leave states with most of the regulatory task. As 5G wireless deployments loom, major carriers have become nervous about opposition to microcells on poles near homes. Right now, much of the equipment is huge – the size of a small refrigerator or old-style phone booth. In the next few years, as deployments really start to roll out, the electronics will probably shrink to the size of pizza boxes, along with vertical antennas on top of the poles.

Why should carriers argue with locals, who tend to oppose cell towers and rooftop cell sites anyway, when the FCC leans their way and they can lobby state lawmakers? That strategy usually costs less than paying for legal battles, and the process is faster, although the money adds up – about $25 million in state campaign contributions last year, according to the National Institute on Money in State Politics.

Pole attachment is one issue the BDAC was to address. However, the committee seems to have some internal disagreements. One subcommittee member, Mayor Sam Liccardo (San Jose), signaled his displeasure with what BDAC is likely to announce in November. In an October 3 New York Times opinion piece, he decried the carriers' pole grab and called for customary fees for attachments, which his city would use to subsidize access in have-not neighborhoods. However, he muddled the issue by confusing poles owned by municipalities (which are rare) with poles owned by "public utilities" (phone and electric companies), which historically have obligations to cover entire service areas but are not necessarily publicly owned.

As important to the economy and job creation as any new BDAC policies might be, the FCC need not fear that the public will be informed. Liccardo's flawed opinion piece is the first I could find in the New York Times since 2001 that focused on pole attachments. I could find no article on the BDAC at all in the Times, the Washington Post or any other mainstream media outlet. ❖

Contact the Hawk at steve@bbcmag.com.

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Blueberries or Broadband, Consumer Shifts Are Real

Amazon just upended the grocery industry. Why didn't its competitors see that coming?

By Bryan J. Rader / *UpStream Network*

This past summer, Amazon announced it was buying Whole Foods for $13.7 billion. Industry observers saw this move as an inflection point in the evolution of the grocery business. Every major grocery store chain was caught flat-footed, and they all experienced significant stock value declines. Experts feared the national grocery stores would lose customers to the more convenient, smarter, more nimble Amazon.

One leading broadcaster on CNBC exclaimed, "This transaction is transforming the food business overnight. Amazon Fresh will lower prices for Whole Foods' loyal customers and add same-day delivery to their already highly loved Amazon Prime business." Suddenly, the other grocers panicked and announced lower prices, same-day delivery and new loyalty programs.

But why? What did Amazon's announcement teach them about their own businesses? In all their executive meetings over the past few years, did they not discuss customers' shift to convenience, same-day order and receive, and high-quality organic products? What did they miss? It surely shouldn't have taken Amazon to tell them about the problems with their traditional business model.

Long before Amazon bought Whole Foods, the market had begun shifting. Today's grocery consumers are very busy, and they don't want to spend hours in the grocery store shopping for their families. Single parents and empty nesters with overcrowded schedules coping with traffic, weather and busy everyday lives led to consumer behavioral changes. Why didn't the grocery stores see it sooner?

In the broadband business, we see the same trends. Are we waiting for Amazon to announce it is buying Comcast, Charter or DISH Network to point out what is happening? I hope not.

Broadband consumers are angry about being told what services they must buy as packages. They hate calling after a promotional period expires to force providers to give them lower prices again. They are tired of triple-play bundling. They won't stand for four-hour service appointment windows. And they hate waiting on hold to speak with a service representative who has a limited English vocabulary.

GROCERY SHOPPERS BUY BROADBAND, TOO

The grocery store customers who buy their weekly groceries via smartphone and have them delivered to their houses are the same people as the cable and broadband customers looking for us to change.

We can laugh about the challenges that Target, Walmart, The Fresh Market and Kroger face. Maybe we should stop chuckling and start responding more quickly to this change in our consumers.

Ask yourself these questions: How easy is it for new move-ins to get your services? Do they have to call? What is your response time? Does a new customer have to take a day off work? What happens when services are interrupted? Whom does the customer contact? What is that experience like? Does your packaging force customers to take services they don't want?

Broadband customers have busy schedules, tight budgets, traffic, kids, anxiety. They hate dealing with traditional cable companies. They don't like two-year commitments, drastic rate increases, add-on fees or offshore call centers.

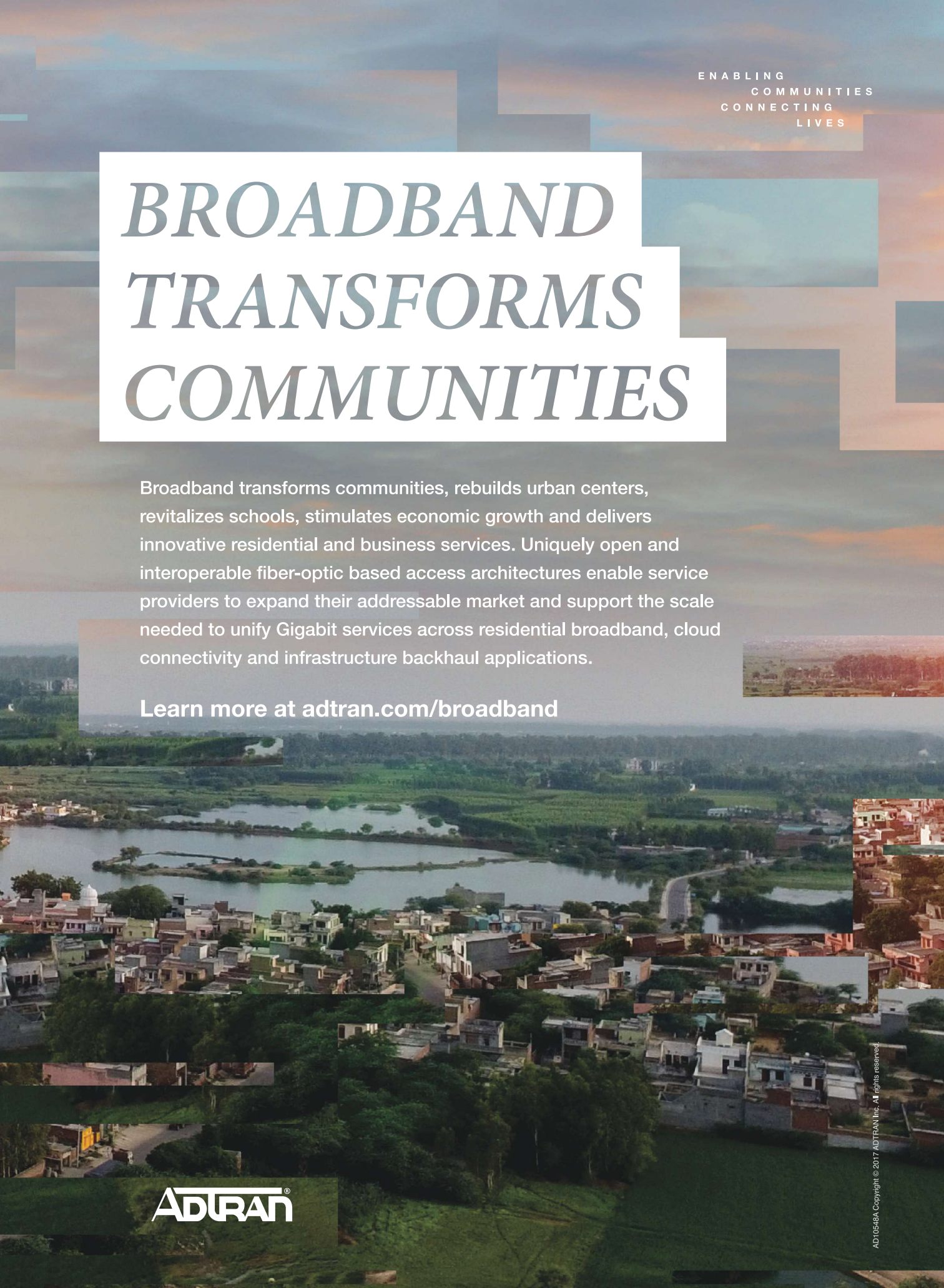
Our customers want convenience, home delivery, smartphone flexibility. Do we provide it?

Sling and DIRECTV NOW do. So does Hulu Plus. Download the app, enter a credit card number and you've got service. Bundle it with always-on bulk broadband, and you can make this an attractive "Amazon" experience. Add actual appointment times. Keep customers apprised of your arrival time. Support them with live customer care. Support all services. Help customers with whatever entertainment devices they use – Apple TV, Roku, and so forth.

Be flexible. Nimble. Quick. Make cable transactions just like ordering organic avocados from Whole Foods to be sent to your office by 5 p.m. today. That's the world we live in. Use this same approach with property managers. One click of a button to create a work order, schedule a tech visit, resolve an issue. Property managers, too, live in this world. We don't need Amazon to teach us about our industry. We already know.

We are selling blueberries and broadband to the same time-starved, traffic-jammed, stressed-out, fiscally worried consumer. Let's do it right, unlike the grocers that weren't ready for Amazon. ❖

Bryan J. Rader is the president of UpStream Network, a broadband provider (formerly Access Media 3). Reach him at brader@accessmedia3.com or by phone at 314-540-1114.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Using Resident and Community Data

Service providers already have what they need to improve connectivity experiences in multifamily housing.

By Bruce Sanders / *Multifamily Broadband Council and Elauwit*

In the words of Steve Jobs, "You've got to start with the customer experience and work back to the technology – not the other way around."

Creating great customer experiences is more than a slogan or buzzword. It is of paramount importance to the success of any telecommunications provider. Customer support can no longer focus on solving day-to-day service frustrations. Being proactive, rather than reactive, is imperative.

The basics of managing resident broadband experiences in multifamily housing include a respectable list of improvement opportunities: collecting resident feedback, analyzing pain points, creating "heat maps" to prioritize major hassles and mapping the customer journey from beginning to end.

However, being proactive requires more than the basics, so newer tools are coming to the forefront. Technology service providers have a vast amount of data from resident activities. They can use this data to create a disciplined, scientific approach to serving residents. In communities with bulk service, broadband service providers can use data to support and enhance the business activities of multifamily owners and managers.

An independent survey by Ian Golding and Customer Experience Consultancy found some common characteristics of companies and brands that earn consumer loyalty. By percentage of responses from highest to lowest, the list includes the following:

- Corporate attitude 15.9
- Ease of doing business 14.9
- Helpfulness in dealing with problems 11.4
- Employees' attitudes 9.4
- Personalization 8.0
- Product or service 8.0
- Consistency 7.5
- Subjective feelings 6.3
- Treatment of customers 5.1
- Reliability 4.4
- Following through on promises 4.2
- Timeliness 2.6
- Employees' technical knowledge 2.3

What stands out in the list is the high ranking of attitude and helpfulness over all else, including product, reliability and technical knowledge. Focusing on these attributes can move a company from firefighting to building a compelling relationship.

Companies that get the resident experience right will create long-lasting customer relationships and earn significant competitive advantages over those that compete solely on product, price or promotion. According to Forbes, 89 percent of customers say they have switched companies because of a poor customer experience.

Multifamily residents have become too savvy and skillful to put up with inferior experiences. They will either try to "adjust" a provider's network equipment to make it work better or, more likely, turn to competitors that deliver a frictionless, helpful, more relevant experience. Service providers will find their focus on customer experience profitable. According to the White House Office of Consumer Affairs, 85 percent of consumers say they will pay up to 25 percent more to ensure a superior customer experience, and acquiring a new customer is six to seven times more expensive than keeping a current one.

DATA ENHANCES PREDICTIVE SOLUTIONS

Smart technology providers learn to use the data they gather from serving multifamily communities to better measure user

and property experiences. This allows for better, more informed decisions in serving residents and community owners. Data allows providers to take a proactive approach to customer satisfaction and enables the prediction of future failures.

For example, new diagnostic tools help service providers determine whether problems originate at the network edge, a switch, an access point or a user device. In many cases, providers can now resolve network problems remotely – and quickly – thus improving resident experiences.

Similarly, data aggregated from wireless access points and sensors can benefit property owners by measuring resident use of various amenity spaces and building access and egress. It also facilitates camera surveillance, energy management, asset tracking, utility leak detection and more.

Fulfilling residents' personal needs and the strategic business needs of community owners depends on analytics that link structured and unstructured connectivity data. This allows agile service providers to quickly modify processes and procedures while anticipating and even preventing the pitfalls that can lead to negative customer experiences.

> Diagnostic tools can help providers determine where problems originate, and analytic tools can help owners manage buildings.

The tools to provide better, more satisfying telecommunications experiences for multifamily residents have never been more relevant and available. Because today's 14-year-olds will expect even more when they become adults, service providers that focus on resident experiences now and in the future will exceed expectations in serving the unique needs of the multifamily industry. ❖

Bruce Sanders is a member of the Multifamily Broadband Council and chief marketing officer at Elauwit. MBC Executive Director Valerie M. Sargent also contributed to this article. For more information on MBC, please contact her at vsargent@mfbroadband.org or 949-274-3434 or visit www.mfbroadband.org.

Disney/ESPN's Risky Streaming Strategy

Has Disney traded the cable TV model for a handful of magic beans?

By Michael A. Kashmer / *Digital Broadband Programming Consultant*

Late last year, Nielsen announced that the October 2016 ESPN subscriber numbers were the worst in the history of ESPN's existence as a cable channel. This was the biggest business story in American sports last fall. The decline in NFL ratings was serious enough, but the ESPN news reflects a larger issue – the collapse of cable subscriptions in general. According to Nielsen, the worldwide leader in sports lost 621,000 cable subscribers – the most subscribers ESPN ever lost in a single month.

After ESPN challenged the subscriber numbers, Nielsen pulled them and conducted a review. The next month, Nielsen stood by the numbers, and ESPN issued a statement, saying in part, "This most recent snapshot from Nielsen is an historic anomaly for the industry and inconsistent with much more moderated trends observed by other respected third party analysts."

No one was surprised by either the content or the tone of ESPN's rebuttal. If future months continue to show subscriber declines, there will be fresh points of disagreement and counterargument.

Until recently, Disney's cable bundle was a great business, largely because of ESPN. ESPN charged every cable and satellite subscriber about $7 a month, more than three times the charge for next most expensive channel. However, analysts such as Trey Travis at outkickthecoverage.com predict that ESPN programming costs are gaining on revenue.

SNL Kagan says that ESPN is on track to pay $7.3 billion in total rights fees in 2017. That is more than any company in the United States. A very conservative estimate puts ESPN's subscriber losses at about 3 million per year, which would leave ESPN with 86 million subscribers in 2017. ESPN makes $7 a month from every subscriber, or $7.22 billion in 2017. Let's add $1.8 billion in ad revenue for a total of $9 billion. Staff costs, facilities, equipment and so forth cost an estimated $1 billion, indicating that ESPN is still profitable.

But how long will it remain profitable as sports rights costs go up and subscriber revenue goes down? At 74 million subscribers (Outkick's projection for 2021), ESPN would bring in about $6.2 billion a year in subscriber fees at $7 a month or $7.1 million at $8 a month. By that point, yearly subscriber revenue will likely be less than rights fees.

DISNEY MOVES TO STREAMING

To combat cord cutting, Disney just announced plans to launch a direct-to-consumer streaming service for ESPN. Further, Disney will cancel its licensing deal with Netflix and launch a Disney-branded streaming service in 2019. That makes two new streaming services. Imagine this: The largest media company in the world decided that embracing a new business model was more important than hanging on to an existing one. Netflix responded with the comment that the impact on its subscriber base would be minimal.

Is the Disney strategy too little, too late, as argued by BTIG analyst Richard Greenfield? He estimates that Disney will lose up to $2 billion a year as it gives up Netflix revenue and spends heavily to build up content and start two streaming services from scratch. Greenfield adds, "Disney simply waited too long to make this critical decision."

Furthermore, if Disney's direct-to-consumer platforms are successful, Greenfield anticipates that will accelerate ESPN's decline. He continues, "The more content consumers can obtain without a multichannel video subscription, not to mention more and more content without advertising, the less interest they will have in subscribing to the big multichannel video bundle."

RBC Capital Markets, by contrast, calls Disney's move "a rare and impressive pivot." Industry sources claim that the Disney cable channels, which include ESPN, have long been seen as the reason many viewers didn't cut the cord entirely. Every cable operator will be impacted by Disney's new strategy, like it or not.

Will other video content providers now make the same move? If they do, will an unintended consequence be the necessity for consumers to juggle a huge number of streaming services? Initially at least, few answers will be forthcoming.

Some pundits accuse Disney of upending the traditional cable TV business in favor of an unproven strategy. This reminds me of the fairy tale about a poor farmer trading the family cow for a handful of magic beans. We all know how that turned out. ❖

Mike Kashmer has worked in cable TV for more than 30 years in distribution, finance and programming. His experience includes network startups and foreign-language programming. Reach Mike at mikekashmer@aol.com.

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Student Housing, Texas-Size: TAMU Park West, College Station, Texas

Faced with a tight deadline and a large student-housing project at Texas A&M University, Servitas Management Group engaged one of its traditional partners, Synergy Fiber, to install and run all IT services. Our thanks to Trey Verbick of Servitas and Doug Karaska, vice president of projects and deployments at Synergy, for gathering the information for this profile.

By Steven S. Ross / *Broadband Communities*

TAMU Park West opened for more than 3,000 students in August. The new development – the largest for student housing in the United States – attracts tenants with a mix of appealing accommodations and many technology amenities baked in. Cooking time was short – about 16 months.

Synergy Fiber handled all the IT integration. "Our partners are often large universities with high standards for quality deployments," says Trey Verbick, vice president and director of market research at Servitas Management Group, which runs the complex for NCCD-College Station Properties LLC, a Texas nonprofit. "We have found Synergy to be an invaluable partner, proving capable of even the biggest projects. It is rare in this industry to find a true IT partner capable of handling all these integrations, in addition to providing world-class, 24/7 support for all their services."

Taking complete responsibility for the technology aspects of the development produced savings, but more important, it was critical given the tight deadlines involved. "Our

PROPERTY OF THE MONTH HIGHLIGHTS
~ TAMU Park West, Texas A&M University, College Station, TX ~

- Largest greenfield student housing build in the United States – more than 3,000 beds
- Gigabit service to every tenant
- One vendor, Synergy Fiber, designed and installed all IT services.
- Additional vendors include Cisco (core distribution), Brocade (access switches, Power over Ethernet), Ruckus (wireless access points), Salto (access control), Sony (surveillance cameras), OnSSI (management system for cameras), DISH (video distribution), G-Hub (energy monitoring) and Seneca (CCTV).

representatives at Synergy are the same people we have worked with from the start of our relationship, and you just don't see that kind of consistency very often in IT," says Verbick. "Their expertise and comprehensive approach have helped us save money on MDUs large and small since 2010."

VITAL STATISTICS

Property Description: TAMU Park West consists of multiple new buildings on a section of a 48-acre tract in College Station. The entire plot is leased by the university to NCCD-College Station Properties LLC, a nonprofit, which engaged Servitas Management Group to develop the property and contracted with Servitas to manage the finished development as well.

Demographics: University students

Greenfield or retrofit? Greenfield

Number of units: 1,320 housing units with a total of 3,406 beds

Style: Mid-rise, garden apartments and townhome units

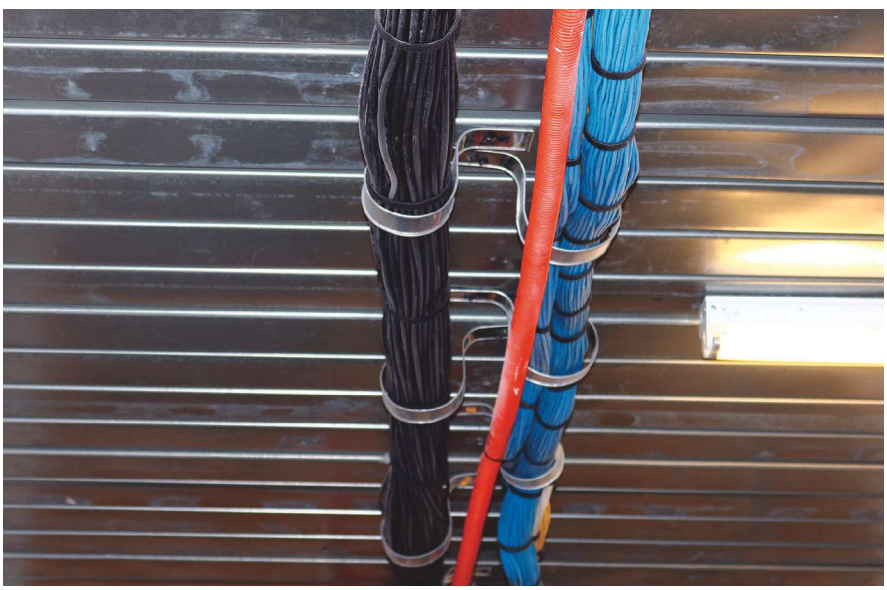
Time to deploy: About 16 months. Network infrastructure began to be installed once the first buildings were ready for it, starting at the end of April 2016.

Date services started being delivered: All services were running in time for the first student move-in, August 16, 2017. Testing started several months earlier.

SERVICES

Services provided over the fiber network include cutting-edge door security and video surveillance, ubiquitous communitywide Wi-Fi, and bulk gigabit internet and video.

Synergy Fiber is the only IT vendor on site and is responsible for video,



A J-hook support system carries data and video cables to the individual units.

data, Wi-Fi, security and access control systems. There are no alternative broadband providers.

Synergy is the sole point of contact for technical support and handles all repairs and maintenance. Residents can contact Synergy's always-open global service desk by calling, texting, using Synergy's mobile app or emailing. Synergy also manages the building IT services, including telephone lines, the door entry system and building access control, wireless and TV delivery.

TECHNOLOGY

Armored fiber runs from the main distribution frame (MDF) to each building. Cat 6 cable is used for vertical connections to intermediate distribution frames (IDFs) and for connections to wireless access points. For horizontal connections from the intermediate distribution frames to the units, a J-hook support system carries Cat 5e cable for data and RG6 and RG11 Quad Shield cables for video.

BUSINESS

Although Synergy manages the network, it is entirely owned by the property owner, NCCD-College Station Properties – everything from the data vertical backbone to the switches on the racks and the surveillance system.

The service provider and owner market the property technology jointly through joint press releases, case studies and trade shows.

LESSONS LEARNED

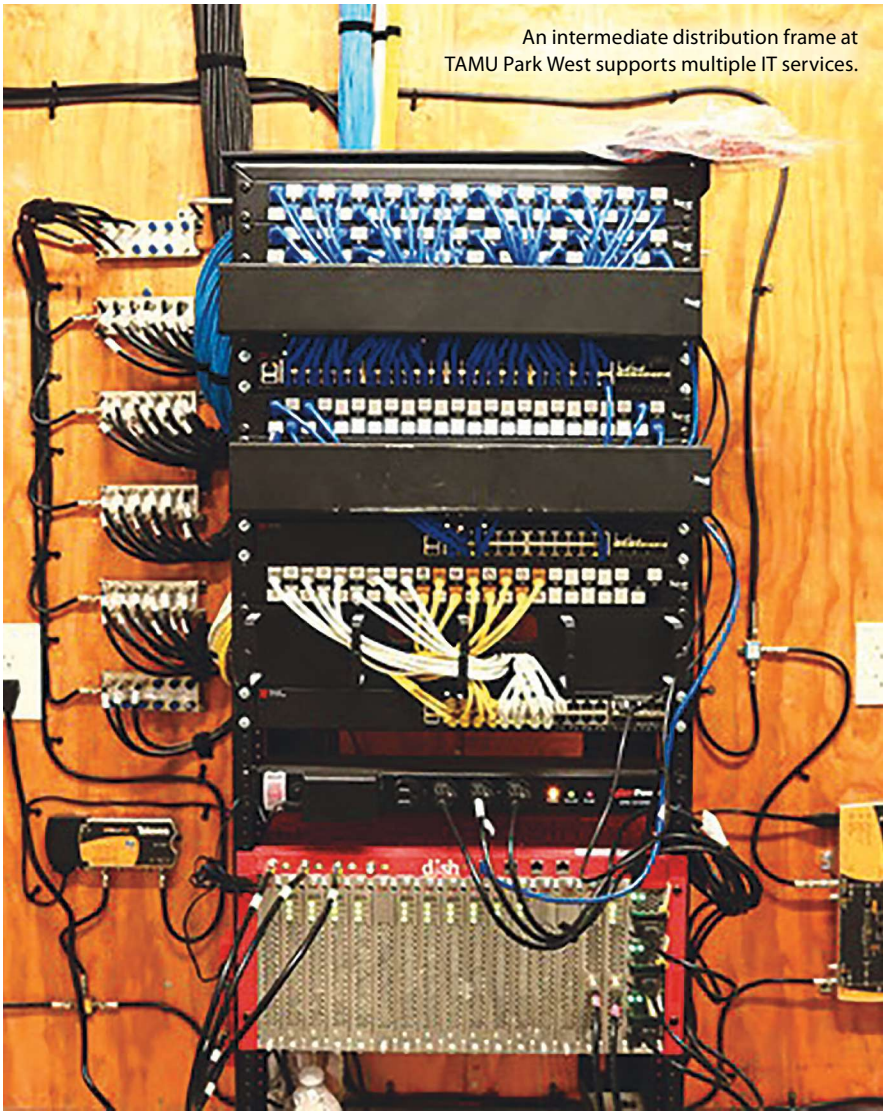
As always, the time spent planning the project execution pays off in improved efficiency and timely delivery. On this large, all-inclusive project, the planning phase was intense. This was the largest, most complex deployment for Synergy to date, but the team overcame all obstacles and challenges and finished the project on time.

The major challenges included

Installation scale: The sheer size of the project and the looming student move-in left little room for slack. The scale of integration was enormous, and Synergy was the only IT vendor on the site.

Temporary MDF: Maintaining a temporary MDF on an active construction site that has frequent power outages is not easy, but it was necessary to accommodate early deployment of the network in the townhome sections and to run tests. Synergy then had to migrate from the temporary MDF to the permanent location with minimal downtime.

Testing: Synergy certified and documented performance of every Ethernet drop, all Wi-Fi coverage, TV services, electronic door locks and video surveillance cameras before the property was occupied.



An intermediate distribution frame at TAMU Park West supports multiple IT services.

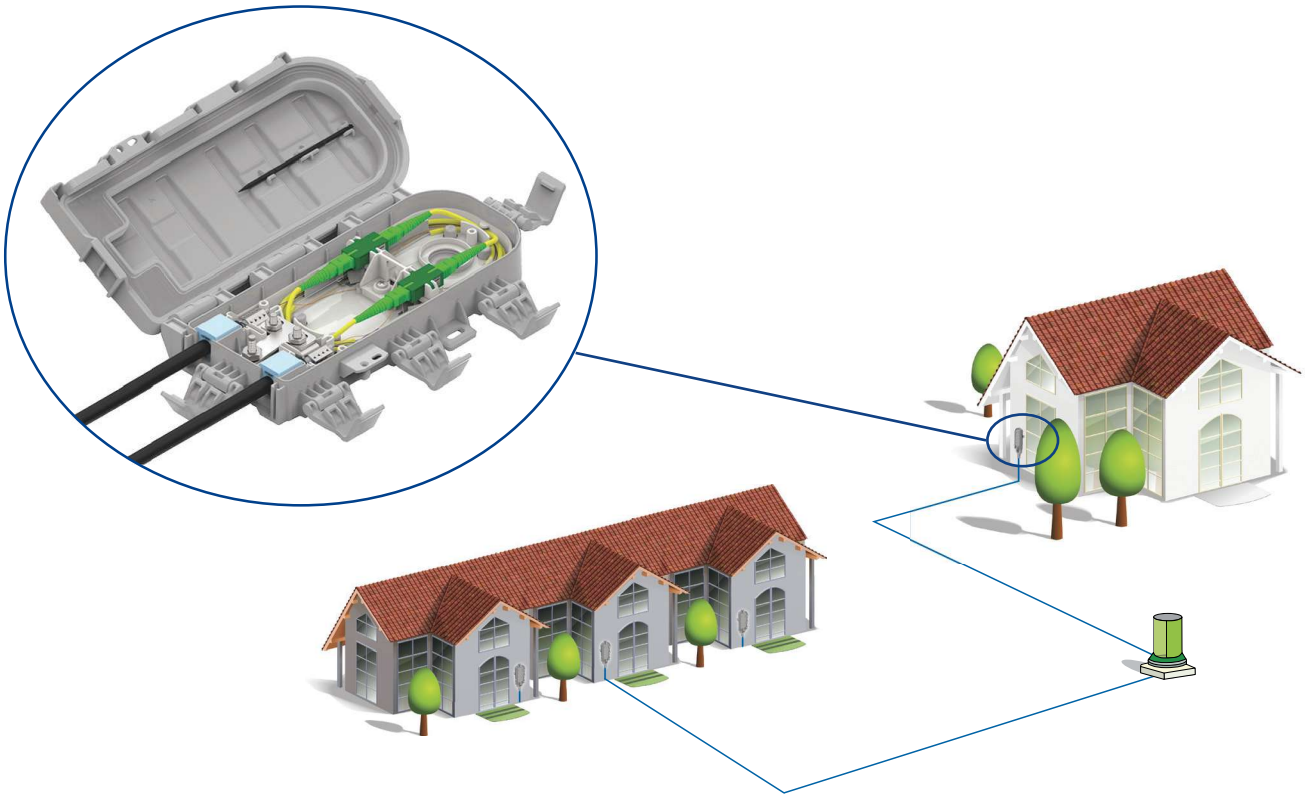
The greatest success was that, because a single IT vendor deployed and manages all the services, Servitas realized significant capex savings and network optimization, balancing user demands while ensuring that each user gets a gigabit when needed. There's energy efficiency in the IDFs and in the buildings' energy management systems. Finally, there are expected savings in future IT support overhead, including reduced maintenance effort for the property manager.

Paying a compliment to Synergy Fiber's comprehensive approach to IT design and management, Servitas now refers to the company as its "total technology partner." ❖

Editor-at-large Steve Ross can be reached at steve@bbcmag.com.

SMALL SCALE
AND COST EFFECTIVE

Fiber-To-The-Home TOP 100 Broadband Communities Magazine 2017



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- It contains a robust latch system, paired with an integrated overmolded cover
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- The STP is ideal for use where the optical network terminal (ONT) is on the inside of a premises.

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A Record Increase In Municipal Fiber Broadband

Broadband Communities' 2017 census of municipal and public-private fiber networks now shows 216 active projects – and many more in preliminary stages.

By Masha Zager / *Broadband Communities*

Broadband Communities' count of public and public-private fiber-to-the-premises network projects in the United States now stands at 216. This is a 21 percent jump over last year's count of 178 and the largest increase in any year. In fact, municipal fiber optic network projects are progressing so rapidly that, by now, there may be several more municipal networks than are listed here.

Fifteen of the new networks are in Western Massachusetts, where the state government promised several years ago to help fund last-mile networks in unserved and partially served towns. The original plan was for the unserved towns to build a fiber network through a coalition called WiredWest; however, the state rejected WiredWest's plan and, after considerable delay and confusion, allocated the funds to the towns separately. Fifteen of the towns are building municipal fiber networks on their own (some may hire WiredWest as a network operator); others are using their funding to subsidize builds by private network operators, including Comcast and Charter. Some towns are still considering their options.

A few networks that appeared on last year's list do not reappear this year. Sun Prairie, Wisconsin, sold its network to TDS, which was in a better position to finance the network's expansion. In addition, several projects that never materialized were removed from the list.

Other networks, though still listed here, are up for sale in whole or in part. For example, BVU Authority of Bristol, Virginia, is about to sell its fiber optic network, OptiNet, to Sunset Digital Communications. Burlington, Vermont, is sorting through bids received for Burlington Telecom (though it expects to retain part ownership of the network). Lake Connections in Lake County, Minnesota, is trying to find a purchaser.

Though some cities, including the three just mentioned, seek to sell their networks because they failed to build, manage or market them effectively, that is not the only reason to do so. Localities sometimes build networks because no other operator will make the investment and are happy to sell these assets if private investors appear on the scene. Ted Chase, chairman of the Sun Prairie Utilities Commission, explains the sale of its telecom network in this way: "By transitioning our network to TDS, more households and businesses will have access to fiber internet at no risk to the utility."

As in prior years, the majority of community fiber networks appear to be self-sustaining or profitable. Despite the controversy attached to a few of them, most are not controversial in any way – rather, they are sources of civic pride. Many continue to expand or add new types of customers and services. (For three examples, see "Slow and Steady Wins the Fiber Race," p. 32.) Often, a municipal fiber network begins in one community and expands by popular demand into neighboring communities, though in some

cases, state legislatures have quashed expansions requested by residents.

Well-run community fiber networks are instrumental in attracting new businesses and retaining existing businesses. The most common rationale for building community networks is to provide businesses with affordable fiber connections; in fact, many networks are built or extended to accommodate specific requests by local businesses. However, community fiber networks do not lead automatically to economic development. They succeed in doing so when network operators understand what businesses – including home-based businesses – are looking for (price-performance, redundancy, reliability, service level agreements) and when economic development agencies can communicate a network's capabilities to prospective businesses.

Similarly, cities use municipal broadband networks to improve

WHAT'S A MUNICIPAL FIBER NETWORK?

There are many ways to define a municipal fiber network. Even state legislatures that want to restrict such networks disagree about what they are restricting. **Broadband Communities** identifies networks as municipally owned if a public agency undertakes most of the investment, incurs most of the risk and exercises most of the control over the network.

All the MUNI network deployers on this list

- Are public agencies, public authorities, public benefit corporations or consortia of public entities
- Own all-fiber infrastructure that connects local homes or businesses to the internet (or are actively developing such networks). In most but not all cases, deployers also own the equipment that lights the fiber. In at least one case, Huntsville Utilities, the service provider owns the drop cable; this network could arguably be classified as public-private, but because the municipality is making the great majority of the investment, we classified it as municipal.
- Make available – directly or through retailers – such services as voice, internet access or video (or are planning such services)
- Are in the United States or U.S. territories.

Excluded are municipalities that provide broadband services exclusively for municipal government facilities, schools and other anchor institutions; those that provide broadband services only over cable or wireless networks; and those that serve private customers only by leasing conduit or dark fiber to them. (A few, such as Circa and Huntsville Utilities, lease dark fiber to retail service providers that serve private customers.)

This list includes only organizations that have either functioning networks or approved plans and funding. However, plans do not always materialize; every year, one or more listed projects fail to survive. Others, although partially deployed, have stalled.

Multiple-municipality projects can achieve economies of scale in construction and operation and, by aggregating demand, can attract third-party service providers more easily. Examples are ECFiber in Vermont, SMBS in Minnesota and OTO Fiber in Maine.

Even a network owned by a single town or city may provide service beyond city limits. For example, EPlus Broadband and EPB Fiber Optics in Tennessee both serve areas adjacent to the cities that own them – areas that were already served by their electric utilities. The city of Williamstown, Kentucky, used broadband stimulus funding to expand its community network beyond city borders. (Its original network was hybrid fiber-coax, but the expansion area is FTTH.) In Washington state, though each public utility district builds and operates its own network, most or all belong to the Northwest Open Access Network (NoaNet), a coalition of public utility districts that linked their fiber optic networks to achieve economic feasibility in underserved areas. NoaNet offers long-haul transport and last-mile access to wholesale communications providers throughout the Pacific Northwest.

Broadband Communities maintains updated information about community fiber networks and other FTTP deployments in the U.S. on a searchable database at www.fiberville.com. The database field labeled "Community Benefits" contains a wealth of information on the economic development and other benefits of these networks.

Community fiber networks are found in 39 states and American Samoa. (Alaska and American Samoa are not shown.)

educational achievement, health care and other quality-of-life measures, but like economic development, quality-of-life improvement doesn't happen on its own. Municipal broadband is an opportunity, not a panacea.

THE CHANGING LEGAL AND POLITICAL LANDSCAPE

About 20 states either prohibit communities from building community networks altogether or impose restrictions that discourage or effectively prevent them from building such networks. State legislatures aren't the only obstacles; often, opposition comes from community members who disapprove of municipal broadband on principle.

A 2015 FCC attempt to preempt state laws on this subject was overturned in the courts, and the current FCC appears unlikely to support municipal broadband. On the other hand, several recent attempts to make state laws stricter were defeated.

Because the pendulum of public opinion shifts constantly, a broadband project that is legally or politically impossible one year may become feasible the next year. In Colorado, for example, the state law that restricts municipal broadband has been effectively nullified in the last few years as at least 68 cities and counties voted to exempt themselves from it. (Most of these localities are still in the planning stages, and not all are expected to proceed with broadband initiatives.) Holding a referendum is an expensive, time-consuming and unnecessary step in building a broadband network, but it does not seem to deter many Colorado cities at this point.

In several cases, city leaders and broadband activists succeeded in changing public opinion by educating citizens about the economic and social benefits of high-speed broadband. Some states – such as Massachusetts, as described above – now actively support municipal broadband projects.

MUNICIPAL UTILITIES

Municipalities have always been more likely to become broadband providers when they are already in the business of providing electric power. Citizens in these municipalities are already used to the idea of government-provided utility services. Many public power utilities were set up in response to the private sector's failure to deliver adequate services, and residents accept that government might set up communications utilities for the same reason.

In most cases, citizens have had positive experiences with their municipal utilities and are prepared to buy additional services from them. In addition, public power utilities already have the outside-plant personnel and back-office operations, such as billing and customer service, that they need to provide telecom services.

Finally, public power utilities, like all electric utilities, are building communications networks for smart-grid applications; once they begin planning these networks, they often realize the networks are suitable for business or residential broadband. Municipal utilities that distribute Tennessee Valley Authority electricity have been in the forefront of combining smart grid and telecom applications.

In some cases, such as Hudson, Ohio, the city operates a municipal

electric utility but set up the telecommunications utility as a separate entity or department.

In the last several years, as the concept of municipal broadband has become more familiar, more cities are embarking on broadband projects without having previously operated a utility. Often, they seek experienced operators to build and manage their networks and provide services. The 15 Western Massachusetts hill towns funded by the state this year do not operate electric utilities; they are all working with Westfield Gas & Electric, a nearby municipal utility that is in the process of building its own fiber network.

WHO ARE THE CUSTOMERS?

The municipal and public-private networks on this list vary widely in terms of the customers they serve. Some are essentially institutional networks that happen to serve a few businesses conveniently located near municipal facilities. Others have made fiber connections available to every premises within their borders – and often to outlying areas. Most are somewhere in between. The smallest network we know of has seven customers, and the largest, EPB Fiber Optics, has about 75,000.

A typical deployment path is for cities to begin by installing institutional fiber networks to serve municipal office buildings or utility substations, then

WHAT'S A PUBLIC-PRIVATE PARTNERSHIP?

Throughout the broadband industry, the term public-private partnership is used loosely – and no two partnerships seem to follow the same model. In the last few years, cities have become much more proactive about working with private providers and offering a variety of concessions and assistance to encourage the provision of better broadband. To keep the list to a manageable size, we restrict the usage to cases in which both public and private partners make significant investments in the access network, incur significant risk and retain significant control. The investments may include contributing pre-existing conduit or fiber.

However, as there is no accepted definition of a public-private partnership, we do not argue for our definition over any other. To make matters even more confusing, descriptions of the details of public-private partnerships are not always precise or complete, and the agreements themselves change over time; in some cases, we are guessing about whether a public-private network meets our definition.

To the best of our knowledge, then, all the network deployers identified on this list as PUBLIC-PRIVATE

- Are consortia of public and private entities, public entities that built networks and later received infusions of private capital, or private entities that built networks with significant investment or participation by local governments
- Own all-fiber networks that connect homes or businesses to the internet (or are actively developing such networks)
- Make available – directly as a partnership, through one of the partners or through third-party retailers – such services as voice, internet access or video (or are planning such services)
- Are in the United States or U.S. territories.

Excluded are publicly owned networks that contract with private retail service providers or operators (those are labeled MUNI); privately owned networks for which public entities have helped raise funding; privately owned networks for which public entities have donated access to rights-of-way, expedited permitting or offered marketing assistance; privately owned networks for which municipalities have committed to be anchor tenants; and privately owned networks that lease backbone fibers or conduit from public entities in arms-length, market-rate contracts.

Public financing for private networks. One of the excluded categories – private networks for which public entities have helped raise funds – deserves special mention both because it fits many people's definitions of public-private partnerships and because it is a rapidly growing category. In these cases, a municipality obtains capital funding that a private operator is not eligible for – either grant funding or low-cost tax increment financing (or "tax abatement financing," as it is called in some states) and passes it through to the private operator. If the funding is a loan, the private operator is obligated to repay the municipality.

Cities entering into these arrangements take on considerable risk (they are on the hook if revenues are insufficient to repay loans or if private operators do not comply with grant terms) without gaining ownership or control. That's why we don't consider these arrangements true public-private partnerships. However, entering into this type of arrangement can still be a reasonable choice for a municipality. Typically, an operator commits to build out a high-quality network throughout the municipality in return for access to the funds. The network may be a "life or death" investment for the community, and if it succeeds and bolsters the local economy, the investment can be well worth the risk.

extend fiber to commercial buildings or business parks, add multiple-dwelling-unit properties and greenfield residential developments, and finally reach single-family households and small businesses. The list shows deployers at various points along this path.

Building an institutional fiber network can also be a starting point for a path to a public-private partnership, as exemplified by Urbana-Champaign Big Broadband, which began as a BTOP project.

Sixty-three community networks, or 29 percent of the total, deliver fiber services only to businesses, and several others serve mainly businesses. (Some of these deliver residential broadband services via cable or wireless; most don't serve residences at all.)

Some fiber networks that began as business-only, such as nDanville in Virginia and Cedar Falls Utilities in Iowa, eventually built out fiber to residential customers citywide. Owensburg Municipal Utilities in Kentucky and Whip City Fiber in Massachusetts recently added residential pilot programs to their fiber-to-the-business networks; the success of these pilot programs encouraged them to commit to larger residential buildouts. Others are beginning to upgrade residential cable to fiber. Still others, such as Chanute Utilities in Kansas, gave serious consideration to building out fiber to residences but failed to gain political support for their projects.

THIRD-PARTY SERVICE PROVIDERS AND OPERATORS

Municipalities are more likely than private deployers to allow third parties to provide services on their networks. There are several reasons for this: State laws or federal funding conditions may require a wholesale model; local political support may depend on a city's following a wholesale model; municipalities may not have the expertise, resources or will to become service providers; some municipalities want to offer a wider variety of services than they can provide on their own.

Forty-eight community fiber networks either allow or plan to allow multiple retail service providers to deliver services. Another 53 have contracted, or plan to contract, with a single third-party service provider to deliver services (in a few cases, just phone or video service). Some of these, such as the city of Westminster, Maryland, plan to transition to a full open-access model in the future.

At least 25 municipal fiber systems contract with third parties – local exchange carriers, other municipalities or other network operators – to operate their networks. Such contracts (which privately owned networks also enter into) can be helpful for municipalities that lack experience operating telecommunications networks.

On the other hand, like any critical outsourcing contracts, they must be intensively managed. Several such arrangements have ended abruptly or even resulted in lawsuits.

TECHNOLOGY

Community broadband networks use a mix of PON and active Ethernet technologies. At this point, active Ethernet is used primarily for business customers, but in earlier years, active Ethernet was preferred even in residential networks for its ease of supporting open access. (GPON can now support open access.)

Municipalities have been leaders in deploying gigabit networks – Chattanooga EPB had the first citywide gigabit network in 2010 – and now lead the way in deploying 10 Gbps networks. Fibrant and EPB were among the first U.S. providers to announce 10 Gbps residential service.

GEOGRAPHIC DISTRIBUTION

Laws that govern municipalities' ability to compete as telecommunications providers vary from state to state. Some states give municipalities a free hand, and others do not. Municipal electric utilities are more common in some areas than others, and some regions are better served by private providers than others are. Considering all these factors, the chances of municipalities' building their own broadband networks are wildly uneven in different parts of the United States.

This census identified community fiber systems in 39 of the 50 states and in American Samoa. There are also about a dozen fiber networks, not listed here, built on tribal lands by tribal governments. Eight states account for a large number of deployments: Massachusetts, California, Florida, Iowa, Kentucky, Minnesota, Tennessee and Washington.

With a few notable exceptions, municipalities that build fiber networks are small to midsized. As broadband improves in large metropolitan areas, smaller, more remote localities are increasingly left to fend for themselves.

TRIPLE PLAY AND BEYOND

Though some municipalities offer only internet access over their fiber networks, many offer the triple play of voice, video and data. Specialized business services are common, as are smart-grid applications. Broadband stimulus funding and encouragement from the Tennessee Valley Authority have made smart-grid applications more prevalent in recent years.

A few open-access networks actively recruit many different kinds of services. For example, on the St. Joe Valley Metronet, providers deliver more than 20 different types of services, including conferencing, disaster recovery and video surveillance. Enabling a wide variety of broadband services could make more community networks financially viable.

In conclusion, there is no single model for public broadband. Each project takes a slightly different approach, depending on the legal and political landscape, the availability of financing, the interest of potential partners, and the skills and assets that public agencies possess. Communities have many options and should explore as many as possible before committing to a plan or deciding that public broadband is not for them. ❖

Masha Zager is the editor of ***Broadband Communities****. You can reach her at masha@bbcmag.com.*

MUNICIPAL AND PUBLIC-PRIVATE FTTP NETWORKS IN THE UNITED STATES

NETWORK DEPLOYER	COMMUNITY(IES)	STATE(S)	MUNICIPAL OR PUBLIC-PRIVATE	DATE PROJECT STARTED	TECHNOLOGY	SERVICES	CUSTOMERS SERVED BY FIBER (all types unless otherwise noted)	SERVICE PROVIDER (if other than network owner)	OPERATOR (if other than network owner)
AccessEagan	Eagan	MN	MUNI	2013	Active Ethernet	Business Services, Data	Businesses only	Multiple	
Albany Utilities	Albany	GA	MUNI			Data			
Alford Municipal Lighting Plant	Alford	MA	MUNI	2017		Data, Voice			
Algona Municipal Utilities	Algona	IA	MUNI	2013	Active Ethernet, GPON	Data, Video, Voice			
ALP Utilities	Alexandria	MN	MUNI			Data	Businesses only		
Altitude Community Broadband	Highlands	NC	MUNI	2016		Data	Downtown area only		
American Samoa Telecom	American Samoa		MUNI	2009	GPON	Data, Voice			
Anderson Municipal Light and Power	Anderson	IN	MUNI	2007	Active Ethernet	Data	Businesses only	Multiple	
Ashfield Municipal Light Plant	Ashfield	MA	MUNI	2017		Data, Voice		Westfield G&E	
Ashland Fiber Network	Ashland	OR	MUNI	2000		Video, Data, Voice	Mainly businesses	Multiple	
Athens Utilities Board	Athens	TN	MUNI	2015		Data	Businesses only	EPB Fiber Optics	
Auburn Essential Services	Auburn	IN	MUNI	2006	EPON	Data, Smart Grid, Video, Voice			
Barnesville Municipal Utilities	Barnesville	MN	MUNI	2009	GPON	Data, Video, Voice			
Bellevue Municipal Utilities	Bellevue	IA	MUNI	2006	EPON, GPON	Data, Video			
Benton County Public Utility District	Kennewick, Prosser and Benton City	WA	MUNI	2002		Business Services, Data	Businesses only	Multiple	
Beverly Hills Fiber	Beverly Hills	CA	MUNI	2017		Data, Video, Voice			
BlakelyNet	Blakely	GA	MUNI	2016		Data			
Blink (Barbourville Utilities)	Barbourville	KY	MUNI	2017 (decided in 2010)	GPON	Data, Video			
Bowling Green Municipal Utility	Bowling Green and Warren County	KY	MUNI	2007	EPON	Business Services, Data, Voice	Businesses only		
Bozeman Fiber	Bozeman	MT	MUNI	2015		Data, Voice	Businesses only (plans to add residential services)	Multiple	
Braintree Electric Light Department	Braintree	MA	MUNI	2008	Active Ethernet	Data	Businesses only		
Bristol Tennessee Essential Services	Bristol	TN	MUNI	2005	GPON	Data, Smart Grid, Video, Voice			
Buffalo Municipal Utilities	Buffalo	MN	MUNI	1996		Data	Businesses only		
Burlington Telecom	Burlington	VT	PUBLIC-PRIVATE	2006	GPON	Business Services, Data, Video, Voice			
BVU OptiNet (BVU Authority)	Bristol	VA	MUNI	2003	GPON	Business Services, Data, Smart Grid, Video, Voice,			
Calnet (Calhoun Utilities)	Calhoun	GA	MUNI	1997	Carrier Ethernet	Data, Voice	Businesses only		
CBPU Telecom (Coldwater Board of Public Utilities)	Coldwater	MI	MUNI	2010	EPON	Data	Businesses only		
CC Communications	Churchill County	NV	MUNI	2004	Active Ethernet, EPON	Business Services, Data, Security, Video, Voice			

NETWORK DEPLOYER	COMMUNITY(IES)	STATE(S)	MUNICIPAL OR PUBLIC-PRIVATE	DATE PROJECT STARTED	TECHNOLOGY	SERVICES	CUSTOMERS SERVED BY FIBER (all types unless otherwise noted)	SERVICE PROVIDER (if other than network owner)	OPERATOR (if other than network owner)
CDE Lightband	Clarksville	TN	MUNI	2007	Active Ethernet	Data, Smart Grid, Video, Voice			
Cedar Falls Utilities	Cedar Falls	IA	MUNI	2006	Active Ethernet, GPON	Data, Smart Grid, Video, Voice			
Chanute Utilities	Chanute	KS	MUNI	2005		Data	Businesses only		
Charlemont Municipal Light Plant	Charlemont	MA	MUNI	2017		Data, Voice		Westfield G&E	
Charles City County	Charles City County	VA	MUNI	2015		Data		Multiple	
Chaska.net	Chaska	MN	MUNI	2004	Active Ethernet		Businesses only		
Chelan County Public Utility District	Chelan County	WA	MUNI	2004	GPON	Data, Video, Voice		Multiple	
Chesterfield Municipal Light Plant	Chesterfield	MA	MUNI	2017		Data, Voice		Westfield G&E	
Chicopee Electric Light	Chicopee	MA	MUNI	2007		Data	Businesses only	Holyoke Gas & Electric	
Circa (Idaho Falls Power)	Idaho Falls	ID	MUNI	2007	Active Ethernet	Data, Voice	Businesses only	Multiple	
City of Ammon	Ammon	ID	MUNI	2011		Data		Multiple	
City of Blackfoot/Optix Media	Blackfoot	ID	PUBLIC-PRIVATE	2016		Data	Businesses only	Optix Media	Optix Media
City of Celina	Celina	TX	PUBLIC-PRIVATE	2017		Data		Multiple	
City of Columbus	Columbus	OH	MUNI	2016		Data	Businesses only		
City of Cortez	Cortez	CO	MUNI	2011	Active Ethernet, GPON	Data, Video, Voice	Businesses only	Multiple	
City of Ellensburg	Ellensburg	WA	MUNI	2015		Data	Pilot project for businesses		
City of Ellsworth	Ellsworth	ME	MUNI	2015		Data	Businesses only	GWI, open to others	
City of Fort Morgan	Fort Morgan	CO	MUNI	2017		Data		Allo Communications (in negotiations)	
City of Grover Beach/Digital West	Grover Beach	CA	PUBLIC-PRIVATE	2017		Data	Businesses only	Digital West	Digital West
City of Hamilton	Hamilton	OH	MUNI	2014	Active Ethernet, GPON	Business Services, Data	Businesses only	CenterGrid	
City of Hudson Oaks	Hudson Oaks	TX	MUNI	2017				NextLink	
City of Jasper and Dubois County/ Smithvville	Jasper and Dubois County	IN	PUBLIC-PRIVATE	2015	GPON	Data, Video, Voice		Smithville	Smithville
City of LaGrange	LaGrange	GA	MUNI	2000	GPON	Business Services, Data, Voice	Businesses only		
City of Leesburg	Leesburg	FL	MUNI	2001		Data	Businesses only		
City of Madison	Madison	WI	MUNI	2015		Data	Pilot project	ResTech	
City of Maupin/LS Networks	Maupin	OR	PUBLIC-PRIVATE	2017		Business Services, Data, Voice		LS Networks, open to other providers	QLife
City of Mishawaka	Mishawaka	IN	MUNI	2012		Data	Businesses only	St. Joe Valley MetroNet	
City of Mont Belvieu	Mont Belvieu	TX	MUNI	2017		Data			
City of Mount Vernon	Mount Vernon, Burlington and Port of Skagit	WA	MUNI	2002	GPON	Data, Voice	Businesses only	Multiple	

NETWORK DEPLOYER	COMMUNITY(IES)	STATE(S)	MUNICIPAL OR PUBLIC-PRIVATE	DATE PROJECT STARTED	TECHNOLOGY	SERVICES	CUSTOMERS SERVED BY FIBER (all types unless otherwise noted)	SERVICE PROVIDER (if other than network owner)	OPERATOR (if other than network owner)
City of Ottawa	Ottawa	KS	MUNI	2013		Data	Businesses only		
City of Pasadena	Pasadena	CA	MUNI	2016		Data	Businesses only		
City of Ponca City	Ponca City	OK	MUNI	2000		Data	Businesses, residential pilot project		
City of San Bruno	San Bruno	CA	MUNI	2015	Active Ethernet, GPON		New condo development		
City of South Portland/GWI	South Portland	ME	PUBLIC-PRIVATE	2014		Data			
City of Union City	Union City	CA	MUNI	2017		Data	Businesses only	Multiple	
City of Vallejo	Vallejo	CA	MUNI	2017		Data	Businesses only	Inyo Networks	Inyo Networks
City of Vernon	Vernon	CA	MUNI	1999		Data	Businesses only		
City of West Plains	West Plains	MO	MUNI	2016	GPON	Data, Voice	Businesses only		
City of Westminster	Westminster	MD	MUNI	2014	GPON	Data		Ting	Ting
Clallam County Public Utility District	Clallam County	WA	MUNI	2002	Active Ethernet	Data		Multiple	
Click! Network (Tacoma Power)	Tacoma	WA	MUNI		Carrier Ethernet	Data, Video	Businesses only	Multiple	
Colrain Municipal Light Plant	Colrain	MA	MUNI	2017		Data, Voice		Westfield G&E	
Community Fiber Network (formerly Goshen Fiber Network)	Goshen, New Paris, Milford, Nappanee, Wakarusa	IN	PUBLIC-PRIVATE	2008		Data, Voice		New Paris Telephone	New Paris Telephone
Community Network Services (South Georgia Governmental Services Authority)	Thomasville, seven other communities	GA	MUNI	1999	Carrier Ethernet	Data, Video, Voice	Businesses only in some communities		
Community Network System (Pend Oreille County Public Utility District)	Pend Oreille County	WA	MUNI	2001	Active Ethernet	Business Services, Data, Video, Voice		Multiple	
Concord Light Broadband	Concord	MA	MUNI	2014		Data, Smart Grid			
Conway Corporation	Conway	AR	MUNI	2011		Data, Voice			
CPWS PowerNet (Columbia Power and Water Systems)	Columbia (also serves Spring Hill)	TN	MUNI	2016		Data, Video, Voice			
Culver Connect	Culver City	CA	MUNI	2016		Data	Businesses only	Multiple	Mox Networks
Cummington Municipal Light Plant	Cummington	MA	MUNI	2017		Data, Voice		Westfield G&E	
DiamondNet (Sallisaw Municipal Authority)	Sallisaw	OK	MUNI	2004	EPON	Data, Video, Voice		Momentum Telecom (voice)	
Douglas County Community Network (Douglas County Public Utility District)	Douglas County	WA	MUNI	1999	Active Ethernet	Data, Video, Voice		Multiple	
Downeast Broadband Utility	Calais, Baileyville	ME	MUNI	2017		Data		Multiple	To be selected
DubLink	Dublin	OH	MUNI	2015		Data	Businesses only	Multiple	
Eastern Shore of Virginia Broadband Authority (ESVBA)	Counties of Northampton and Accomack	VA	MUNI	2016		Data		Multiple	
ECFiber	Consortium of 23 Vermont towns	VT	MUNI	2010	GPON	Business Services, Data, Voice			ValleyNet
EPB Fiber Optics	Chattanooga (also serves surrounding areas)	TN	MUNI	2007	GPON, NG-PON2	Data, Smart Grid, Video, Voice			

NETWORK DEPLOYER	COMMUNITY(IES)	STATE(S)	MUNICIPAL OR PUBLIC-PRIVATE	DATE PROJECT STARTED	TECHNOLOGY	SERVICES	CUSTOMERS SERVED BY FIBER (all types unless otherwise noted)	SERVICE PROVIDER (if other than network owner)	OPERATOR (if other than network owner)
EPlus Broadband (Jackson Energy Authority)	Jackson (also serves part of Madison County)	TN	MUNI	2004		Data, Smart Grid, Video, Voice			
Erwin Utilities	Erwin	TN	MUNI	2014		Data, Smart Grid, Voice			
EUGNet (Eugene Water and Electric Board)	Eugene	OR	MUNI	2014		Data	Downtown area	Multiple	
FairlawnGig	Fairlawn	OH	MUNI	2016		Data, Voice			
FastRoads (Monadnock Economic Development Corporation)	Rindge and Enfield	NH	MUNI	2011		Data		Multiple	WideOpen Networks
Fayetteville Public Utilities	Fayetteville	TN	MUNI	2010	EPON, RFoG	Data, Video, Voice			
FiberCom	Cartersville (also serves surrounding areas)	GA	MUNI	1998	Carrier Ethernet	Business Services, Data, Voice	Businesses only		
FiberNet	Monticello	MN	MUNI	2008	GPON	Data, Video, Voice		Arvig Enterprises	
Fibrant	Salisbury	NC	MUNI	2008	Active Ethernet, GPON, NG-PON2	Data, Video, Voice			
FPUAnet Communications (Fort Pierce Utilities Authority)	Fort Pierce	FL	MUNI	2000	Active Ethernet	Data, Voice	Businesses		
Frankfort Plant Board	Frankfort	KY	MUNI	2009	Carrier Ethernet, RFoG	Data, Security, Video, Voice			
Franklin County Public Utility District	Franklin County	WA	MUNI		Active Ethernet	Business Services, Data, Voice		Multiple	
Franklin Municipal FiberNET (Franklin Electric Plant Board)	Franklin	KY	MUNI	2013		Data, Voice	Businesses, residential pilot project		
GahannaNet	Gahanna	OH	PUBLIC-PRIVATE	2010		Business Services, Data	Businesses only	WOW Business	WOW Business
Garrett County	Garrett County	MD	MUNI			Data	Businesses only		
Get Wired Alabama (South Central Alabama Broadband Commission/Oasis Construction)	17 counties	AL	PUBLIC-PRIVATE	2015		Data, Video, Voice		Multiple	Oasis Alabama Broadband
Glasgow Electric Plant Board	Glasgow	KY	MUNI			Data	Businesses only		
Glenwood Springs Community Broadband Network	Glenwood Springs	CO	MUNI	2002	GPON	Data, Voice	Businesses only	Multiple	
Goshen Municipal Light Plant	Goshen	MA	MUNI	2017		Data, Voice		Westfield G&E	
Grant County Public Utility District	Grant County	WA	MUNI	2000	Active Ethernet	Data, Video, Voice		Multiple	
Grays Harbor County Public Utility District	Grays Harbor County	WA	MUNI	1998		Data		Multiple	
Greenlight	Wilson	NC	MUNI	2008	GPON	Data, Video, Voice			
GreenLight (Greenfield Community Energy and Technology, GCET)	Greenfield	MA	MUNI	2017	Active Ethernet	Data, Voice	Businesses only		
GRUCom Fiber Optics (Gainesville Regional Utilities)	Gainesville (also serves surrounding areas)	FL	MUNI	2001	Active Ethernet	Data	Businesses, MDUs, greenfield developments		
Harlan Municipal Utilities	Harlan	IA	MUNI	2010	GPON	Data, Video, Voice			

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HES (Hopkinsville Electric System) EnergyNet	Hopkinsville	KY	MUNI	1999		Data			
HG&E Telecom (Holyoke Gas & Electric Department)	Holyoke (also serves Springfield and surrounding areas)	MA	MUNI	1997	Carrier Ethernet	Data, Voice	Businesses, some MDUs	OTT Communications (voice)	
Highland Communication Services	Highland	IL	MUNI	2010	GPON	Data, Video, Voice			
Holland Board of Public Works	Holland	MI	MUNI	1990s		Data	Businesses, residential pilot project	Multiple	
Home Net (Hometown Utilicom)	Kutztown	PA	MUNI	2002	BPON, GPON	Data, Smart Grid, Video, Voice			
Huntsville Utilities	Huntsville	AL	MUNI	2016				Google Fiber, open to others	
Independence Light and Power Telecommunications	Independence	IA	MUNI	2013	GPON	Data, Video, Voice			
Indianola Municipal Utilities	Indianola	IA	MUNI	2012	Active Ethernet	Data, Video, Voice		MCG	
Islesboro Municipal Broadband	Islesboro	ME	MUNI	2016	GPON	Data, Voice		GWI	GWI
Kent County Fiber Network (Kent County/FTS Fiber/Think Big Networks)	Kent County	MD	PUBLIC-PRIVATE	2016		Data		Think Big Networks	
Kitsap County Public Utility District	Kitsap County	WA	MUNI	2000	Active Ethernet	Data	Mainly businesses	Multiple	
KPU Telecommunications	Ketchikan	AK	MUNI	2007	Active Ethernet, GPON	Data, Video, Voice			
Lac qui Parle County Economic Development Authority/Farmers Mutual Telephone	Lac qui Parle County	MN	PUBLIC-PRIVATE	2010		Data, Video, Voice			
Lake Connections (Lake County)	Lake County (also serves part of St. Louis County)	MN	MUNI	2010	Active Ethernet, GPON	Data, Video, Voice		Consolidated Telecommunications Company	
LanCity Connect	Lancaster	PA	MUNI	2015		Data, Smart Grid		MAW Communications	
Lenox Municipal Utilities & Communications	Lenox	IA	MUNI	2008	PON	Data, Video, Voice			
Leverett Municipal Light Plant (LeverettNet)	Leverett	MA	MUNI	2012	Active Ethernet	Data, Voice		OTT Communications	Holyoke Gas & Electric
Leyden Municipal Light Plant	Leyden	MA	MUNI	2017		Data, Voice		Westfield G&E	
LightTUBe (Tullahoma Utilities Board)	Tullahoma	TN	MUNI	2007	GPON	Data, Video, Voice			
liNKCity	North Kansas City	MO	MUNI	2007	Active Ethernet	Data			KC Fiber LLC
Lit San Leandro	San Leandro	CA	PUBLIC-PRIVATE	2012		Data	Businesses only		
Loma Linda Connected Communities Program	Loma Linda	CA	MUNI	2005	Active Ethernet	Data, Video, Voice		Multiple	
Los Angeles Department of Water and Power Fiber Optic Enterprise	Los Angeles	CA	MUNI		Carrier Ethernet	Business Services, Data	Businesses only		
LUS Fiber	Lafayette	LA	MUNI	2007	GPON	Data, Smart Grid, Video, Voice			

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MachLink (Muscatine Power & Water)	Muscatine	IA	MUNI	2015		Data, Video	Businesses, expanding to residential		
Marshall FiberNet	Marshall	MI	MUNI	2017		Data			
Marshall Municipal Utilities	Marshall	MO	MUNI	2005		Data, Smart Grid			
Martinsville Information Network (MINet)	Martinsville	VA	MUNI	2009		Business Services, Data, Voice	Businesses only		
Mason County Public Utility District	Mason County	WA	MUNI	2000	Active Ethernet	Business Services, Data, Voice		Multiple	
Mayfield Village	Mayfield Village	OH	MUNI	2012		Data	Businesses only		OneCommunity
Medina County Fiber Network (Medina County Port Authority)	Medina County	OH	MUNI	2012		Data	Businesses only	Multiple	
MI-Connection	Mooresville, Davidson and Cornelius	NC	MUNI	2009	GPON	Data, Video, Voice			
MINET	Monmouth and Independence	OR	MUNI	2007	BPON	Data, Video, Voice			
Montana Economic Revitalization & Development Institute/ Fatbeam	Butte	MT	PUBLIC-PRIVATE	2013		Business Services, Data, Voice	Businesses only		
Morristown Utility Systems (MUS Fibernet)	Morristown	TN	MUNI	2006	GPON	Data, Smart Grid, Video, Voice			
Murray Electric System	Murray	KY	MUNI	2000	Active Ethernet	Data, Video, Voice	Businesses only		
nDanville	Danville	VA	MUNI	2007	Active Ethernet, GPON	Business Services, Data, Security, Video, Voice		Multiple	
Nelson County Broadband Authority	Nelson County	VA	MUNI	2015		Data		Multiple	
New Albany Net	New Albany	OH	MUNI	2010		Business Services, Data	Businesses only	WOW Business	
New Ashford Municipal Light Plant	New Ashford	MA	MUNI	2017		Data, Voice		Westfield G&E	
NextLight (Longmont Power and Communications)	Longmont	CO	MUNI	2012	GPON	Data, Video, Voice		Layer3 TV (video)	
Norwood Light Broadband	Norwood	MA	MUNI			Data, Voice	Businesses only		
NU Connect (Newport Utilities)	Newport	TN	MUNI	2017		Data, Video, Voice		Morristown Utility Services	
Ocala Utility Services	Ocala	FL	MUNI	1995	Active Ethernet	Business Services, Data			
Okanogan County Public Utility District	Okanogan County	WA	MUNI	2002	Active Ethernet			Multiple	
OMU Fibernet (Owensboro Municipal Utilities)	Owensboro	KY	MUNI	1998		Data, Voice			
ONE Burbank (Burbank Water and Power)	Burbank	CA	MUNI	2010	Active Ethernet, Carrier Ethernet	Business Services, Data	Businesses only		
OnLight Aurora	Aurora	IL	MUNI	2012	Carrier Ethernet	Business Services, Data	Businesses only		
OntarioNet	Ontario	CA	MUNI	2015		Data, Video, Voice		Inyo Networks	
Opelika Power Services	Opelika	AL	MUNI	2010	GPON	Data, Smart Grid, Video, Voice			

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Optilink (Dalton Utilities)	Dalton	GA	MUNI	2003	GPON	Data, Video, Voice			
Orangeburg County Broadband	Orangeburg County (serves nine communities in the county)	SC	MUNI	2010	Active Ethernet	Data			
Osage Municipal Utilities	Osage	IA	MUNI	2016	GPON	Data, Video, Voice	Pilot projects		
Otis Municipal Light Plant	Otis	MA	MUNI	2017		Data, Voice		Westfield G&E	
OTO Fiber	Old Town, Orono	ME	MUNI			Data, Video, Voice			
Pacific County Public Utility District	Pacific County	WA	MUNI	2000		Data		Multiple	
Palm Coast FiberNET	Palm Coast	FL	MUNI	2009	Active Ethernet	Business Services, Data, Voice	Businesses only	Multiple	
Paragould Light, Water and Cable	Paragould	AR	MUNI	2017		Data, Video			
Parallax Systems (Richmond Power and Light)	Richmond	IN	MUNI	2000		Data	Businesses only		
PES Energize (Pulaski Electric System)	Pulaski (also serves Giles County)	TN	MUNI	2007	EPON	Data, Smart Grid, Video, Voice			
Philippi Communications System	Philippi	WV	MUNI	2005	BPON	Data, Video			

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Piqua Fast Fiber Network (Piqua Municipal Power System)	Piqua	OH	MUNI	2013		Data	Businesses only	Independents Fiber Network	
Plainfield Broadband Municipal Light Plant	Plainfield	MA	MUNI	2017		Data, Voice		Westfield G&E	
Port of Lewiston	Lewiston and Nez Perce County	ID	MUNI	2016		Data	Businesses only	Multiple	
PowelLink	Powell	WY	MUNI	2007	GPON	Data, Security, Video, Voice		TCT, open to others	
PPS FiberNet (Paducah Power System)	Paducah, McCracken County	KY	MUNI	2004	Active Ethernet, BPON	Data, Security, Video, Voice	Businesses only	Multiple	
Princeton Electric Department	Princeton	IL	MUNI	2003		Data	Businesses only	IVNet	IVNet
Reedsburg Utility Commission	Reedsburg (also serves nearby rural communities)	WI	MUNI	2003	BPON, GPON	Data, Video, Voice			
Rio Blanco Broadband	Rio Blanco County	CO	MUNI	2015		Data, Voice		Multiple	Colorado Fiber Community
Roanoke Valley Broadband Authority	Botetourt and Roanoke Counties, Roanoke and Salem	VA	MUNI	2015		Data	Businesses and some MDUs	Multiple	
Rochelle Municipal Utilities	Rochelle	IL	MUNI		Active Ethernet	Business Services, Data, Voice	Mainly businesses		
Rock County Broadband Alliance (Alliance Communications/Rock County)	Rock County	MN	PUBLIC-PRIVATE	2015		Data, Video, Voice		Alliance Communications	Alliance Communications
Rock Falls FiberNet	Rock Falls	IL	MUNI	2007		Data		Essex Telcom (for business customers)	
Rockbridge Area Network Authority	Rockbridge County, cities of Lexington and Buena Vista	VA	MUNI	2013		Data, Voice		Multiple	
Russellville EPB Smartnet (Russellville Electric Plant Board)	Russellville	KY	MUNI	2010	Active Ethernet, GPON	Data, Smart Grid, Video, Voice			
Sandersville FiberLink	Sandersville (also serves nearby areas)	GA	MUNI			Data			
SandyNet Fiber	Sandy	OR	MUNI	2011		Data, Voice			
SanfordNet Fiber	Sanford	ME	MUNI	2016		Data	Businesses only	GWI, open to others	GWI
Santa Monica City Net	Santa Monica	CA	MUNI	2004	Active Ethernet	Data	Businesses, residential pilot project	Multiple	
Scottsboro Electric Power Board	Scottsboro	AL	MUNI		Active Ethernet	Data, Smart Grid	Businesses only		
Sebewaing Light and Water Department	Sebewaing	MI	MUNI	2013	GPON	Data, Voice			
Selco (Shrewsbury Electric and Cable Operations)	Shrewsbury	MA	MUNI	1999	Active Ethernet, GPON	Data	Businesses only		
Sherwood Broadband	Sherwood (also serves nearby areas)	OR	MUNI	2004		Data	Businesses only	Multiple	
Shutesbury Municipal Light Plant	Shutesbury	MA	MUNI	2017		Data, Voice		Westfield G&E	
Southwest Minnesota Broadband Services	Bingham Lake, Brewster, Heron Lake, Lakefield, Jackson, Okabena, Round Lake, Wilder	MN	MUNI	2010		Data, Video, Voice		Windom Telecommunications	Windom Telecommunications

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Spanish Fork Community Network	Spanish Fork	UT	MUNI	2015	Active Ethernet	Data, Video, Voice			
Spencer Municipal Utilities	Spencer	IA	MUNI	2007	GPON	Data, Smart Grid, Video, Voice			
SpringNet (City Utilities of Springfield)	Springfield	MO	MUNI	1997	Active Ethernet	Business Services, Data	Businesses only		
Swiftel Communications (Brookings Municipal Utilities)	Brookings	SD	MUNI	2006	GPON	Data, Video, Voice			
Sylacauga Utilities Board	Sylacauga	AL	MUNI	1997	Active Ethernet	Data			
Taunton Municipal Lighting Plant	Taunton	MA	MUNI	2003	EPON	Data			
Town of Mount Washington	Mount Washington	MA	MUNI	2016		Data, Video			
Town of Rockport/GWI	Rockport	ME	PUBLIC-PRIVATE	2014		Data, Voice		GWI	GWI
Township of Lyndon	Lyndon	MI	MUNI	2017		Data			
UC2B (Urbana-Champaign Big Broadband)	Urbana, Champaign	IL	PUBLIC-PRIVATE	2010	Active Ethernet	Data, Video, Voice		i3 Broadband	i3 Broadband
UTOPIA	Consortium of 16 cities	UT	MUNI	2004	Active Ethernet	Data, Video, Voice		Multiple	
Velocity Broadband	Hudson	OH	MUNI	2015		Data	Businesses only		
Wadsworth CityLink	Wadsworth	OH	MUNI		Carrier Ethernet	Data	Businesses only		
Washington Municipal Light Plant	Washington	MA	MUNI	2017		Data, Voice		Westfield G&E	
Waverly Utilities	Waverly	IA	MUNI	2016		Data, Voice, Video			
Whip City Fiber (Westfield Gas & Electric)	Westfield	MA	MUNI	2015		Data, Voice			
Williamstown Cable & Broadband	Williamstown (also serves Corinth and parts of Grant and Owen Counties)	KY	MUNI	2010		Data, Video	Communities outside Williamstown		
Windomnet (Windom Telecommunications)	Windom	MN	MUNI	2004	GPON	Data, Video, Voice			
Windsor Municipal Light Plant	Windsor	MA	MUNI	2017		Data, Voice		Westfield G&E	
Wired Road Authority	Carroll & Grayson counties, city of Galax	VA	MUNI	2009		Data		Multiple	WideOpen Networks
Zing (St. Joe Valley Metronet)	Mishawaka, South Bend, St. Joseph County	IN	PUBLIC-PRIVATE	2005		Many	Businesses, MDUs	Multiple	

Slow and Steady Wins the Fiber Race

Three communities find success in incremental fiber network builds.

By H. Trostle / *Institute for Local Self-Reliance*

Any city can improve its connectivity without breaking the bank – but it takes foresight, planning and relationships. From a small town of 6,000 to a city of more than 160,000, municipalities across the country have built state-of-the-art fiber optic infrastructure with common sense, creative financing and community support. Holland, Michigan; Eugene, Oregon; and Erwin, Tennessee, provide blueprints for successful incremental approaches to municipal fiber optic networks.

HOLLAND, MICHIGAN

Population: 33,543 (2016 est.)
Area: 17.35 square miles
Claim to Fame: Tulips

> *"One of our key strategies is [that]we are building fiber for our community. Does our community want it or not? We're not going to build fiber to the community if [people] say, 'You know what? We're good.' You need to have that relationship with your community. You need to be open."*
>
> *– Pete Hoffswell, Holland Broadband Services Manager*

On the shores of Lake Michigan, what began as a Dutch outpost is now a tourist town of 30,000 that has spent more than 20 years steadily building out a fiber network.

The state of Michigan placed some restrictions on building municipal networks in 2005, but Holland was grandfathered in. The city's municipal electric utility had provided wholesale internet service to some businesses since the 1990s.

Holland Board of Public Works (BPW) built its first fiber optic loop in 1992 to better manage its electric and water systems by remotely operating the electric switches and water pumps. The loop was only 17 miles of 48-count fiber optic line, but it provided the foundation for later development.

For years, when a property owner wanted to connect a building to the network, BPW charged the owner the total cost of the new build up front. This connection fee of $2,000 limited the number of customers. Because BPW thought more local businesses could benefit from the network, it introduced a new cost recovery model in 2013 – applying the revenues it expected to earn from the new connection toward the build cost. By building out carefully at first and managing its finances well, BPW was able to grow the system quickly. By the end of 2016, the city had at its disposal 76 miles of fiber backbone with more than 150 total route miles and 288-count fiber.

Six small ISPs lease dark fiber from the city for a monthly fee of just over $.01 per foot per strand. The city also offers an active Ethernet service for large businesses. Because the network was built out at their request, it mostly reaches large commercial customers today.

However, in the summer of 2017, Holland launched a new pilot project aimed at residential and small business subscribers – a GPON that covers 158 buildings and 450 potential customers. For this service, BPW has decided to offer services directly but is still designing the network to be open access in the future.

A municipal utility needs the community to build and maintain support for projects of this kind. In this case, the Holland Fiber group urged

Not just tulips anymore: Holland, Michigan, reaps the benefits of a municipal fiber network.

BPW onward. Composed of activists and business leaders, Holland Fiber educated the community, highlighted public support and encouraged the city to explore all its options. It maintained the HollandFiber.org website as a centralized location where residents could learn about the potential benefits of the city's decisions.

This tangible community support encouraged the city to look at innovative ways to finance the project. The city eventually settled on an incremental approach and is considering other approaches for further expanding the network across the community. As it rolls out fiber, public excitement is building as well.

EUGENE, OREGON

Population: 166,575 (2016 est.)
Area: 43.74 square miles
Claim to Fame:
University of Oregon Ducks

"It's busier downtown. There's more stuff happening; there's more business in those office buildings. They're here because of the fiber, which then has a positive feedback loop. There are more restaurants, there's more other activity. So, it just keeps growing and growing and growing. But it wouldn't be happening without the fiber."

– Anne Fifield, Economic Development Planner

Just a few hours from Portland, Eugene is home to the University of Oregon and a center of commerce in Lane County. Downtown Eugene is running out of parking spots, and many buildings have zero vacancy because of the fiber network the city only recently began to take full advantage of.

Back in the 1940s and 1950s, the Eugene Water and Electric Board (EWEB) built a series of underground electrical conduits in the downtown area and included a space for communications lines. Now, EWEB can pull microducts through this ancient system and quickly deploy fiber to each building.

Like many community utilities, EWEB installed fiber in the 1990s for internal communications. It connected county agencies and the school district on a fiber loop that had spare capacity and now leases some dark fiber in the downtown area to ISPs.

The utility charges building owners about $2,000 to install fiber to a property. In the pilot area downtown, 16 buildings are fully connected. Some businesses have already expanded, including one that landed a contract it won only because of the fiber network. Eventually, 120 downtown buildings will have the opportunity to connect to the network, and eager residents and businesses are asking when EWEB will expand beyond that initial area.

Eugene is financing the network through connection fees, urban renewal bonds and a federal grant. About 50 percent of the pilot area lies within two urban renewal districts, which are similar to tax increment financing zones in other states. They enable the city to encourage economic development within the zones by borrowing against future tax revenue increases. A small grant of $1.9 million came from the federal Economic Development Administration.

Eugene's project is part of a larger effort to improve connectivity throughout Oregon. EWEB is working with the Lane Council of Governments and the Technology Association of Oregon to ensure that the city has a robust connection to the rest of the region. The council previously deployed a dark fiber network throughout Lane County, using a federal stimulus grant. The expertise and institutional memory of the Lane Council of Governments has been helpful to EWEB in pursuing the pilot project.

A priority for Eugene in coming years is to share its fiber network with nearby, smaller communities to ensure the entire region, not just downtown Eugene, thrives.

ERWIN, TENNESSEE

Population: 5,920 (2016 est.)
Area: 3.6 square miles
Claim to Fame:
Citywide FTTH network

"We've looked at this for many years, and finally the time was right, and we acted. A lot of things go into making the decision to build a fiber-to-the-home network: the system, the demographics, the customers per mile. I just really feel like we're in the greatest place of all times in being able to make that decision and do what's right for our community."

– Lee Brown, Erwin Utilities General Manager

Erwin, Tennessee, is not the first place anyone would think to look for world-class connectivity. Tucked between the Blue Ridge Mountains and the Cherokee National Forest, Erwin relies on tourism as its economic base. However, this small Appalachian town built a citywide FTTH network that outperforms most networks in large urban areas. The town is expanding the network to serve people outside city limits who are otherwise without broadband internet access.

Like Holland and Eugene, Erwin began its fiber story around 1999, but this little Tennessee town wasn't thinking about the internet at that time. Erwin's residents wanted better television service. The town considered three types of networks: a traditional cable coax system, a hybrid fiber-coax system and a full fiber-to-the-home network. After studying the issue, the town decided not to build anything immediately but to keep in mind the fiber-to-the-home plan for the future.

About 10 years later, Erwin decided to revisit the idea. A new study put the cost of building out fiber to the whole town at an out-of-reach $27.5 million and estimated a 17-year payback period. The town's utility took a different approach while staying well within the restrictions the state imposed.

In 2012, Erwin built a fiber network to support communications among the electric, water, and wastewater systems and connect six county schools. In 2014, using that backbone, it built a pilot FTTH project to see whether residents were interested in a full fiber-to-the-home system. It connected the first customers in early 2015, offering only broadband and voice services.

The network most certainly piqued residents' interest – so much so that, between connecting residents and leasing excess capacity, the town's utility found bankrolling a network expansion easy. About 1,200 customers were involved in the pilot project. Each network phase paid for further development. Erwin's electric system owns the fiber, and the fiber optic division leases it from the electric system, as is common with municipal electric utilities. The fiber division continues to pay its own way and is not subsidized by the other utilities.

Erwin Utilities' fiber engineer, John Williams, thinks the incremental approach helped the project succeed. "I think one of our biggest advantages is the efficiency we can do on a small scale, so if we already know what we need to do … if we start out small, it was just an easier sell to make. It was not quite as big an investment, and then it gave us the opportunity to kind of learn as we went, too, because every day that goes by, you learn something new, and make it better."

Now most residents can get a gigabit on an FTTH connection inside city limits, but Erwin has continued to expand beyond city limits. Its goal is to make sure the entire electrical system's footprint, which extends to some outlying communities in the mountains, has access to the network. Erwin expects to finish this by the end of 2018.

CONCLUSION

These communities are vastly different in population, geography and finances, and each city developed its own incremental build strategy. Erwin is the smallest but also the furthest along in ensuring that its residents have full access to the 21st-century economy. Eugene is transforming by redeveloping its downtown, relying on a 1950s electric conduit system and urban renewal districts. And Holland found success by building on grassroots community support. These are only three of many communities that have built networks using this incremental approach.

From Santa Monica, California, to Auburn, Indiana, cities across the country have developed strategies to build out high-speed fiber networks in small phases. These networks serve different needs, such as providing business connectivity or home internet service, but they all have grown over the years. In every one of these communities, some citizens wanted to deploy more quickly. But these decisions are made collectively, by communities or at least city councils.

In more than 10 years of working with communities, ILSR has seen ambitious local activists and leaders push for a citywide network and refuse to compromise. Sometimes that strategy has led to success, but more often it has led to nothing. An incremental build may have periods of rapid deployment followed by decades of inaction, or it can be simply a slow, steady expansion of an existing fiber network. Either way, it is approximately "a gajillion" times better than doing nothing. ❖

H. Trostle is a writer for MuniNetworks.org, a publication of the Institute for Local Self-Reliance. This article is based on research and interviews conducted by Lisa Gonzalez and Christopher Mitchell of the ILSR.

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Why Municipal Networks Should Be Disruptive

The traditional telecom model is not working. For a locality to succeed with a municipal broadband alternative, it can't just duplicate the incumbent model.

By Jeff Christensen and Robert Peterson / *EntryPoint*

A city considering a municipal broadband project should start by thinking about strategy, not feasibility. Today's feasibility studies tend to be lopsidedly tactical. Typically, studies start with handwaving toward strategic issues and then dive into such tactical matters as assessment of the local market, network requirements, network design, cost estimates and financial projections.

Source: Sales Benchmark Index

Table 1

It is possible to do an excellent job building a functional network (tactics) and still do the wrong thing (strategy) by building a network that never gets broad adoption. A feasibility study that leads a city to do things the right way but not to do the right things will result in a network that cannot evolve in the rapidly changing future.

A strategic mindset focuses on the future, articulates a vision, embraces change, scans the external environment, invites innovation and creativity and wonders what can be. By contrast, a tactical mindset focuses on immediate needs, sets achievable goals and objectives, prefers stability, focuses internally, has a bias toward reliability and aims to improve the way things currently work.

THE THEORY AND PRACTICE OF DISRUPTION

Any industry that fails to build its strategies around serving its customers' interests should be disrupted. To disrupt means to redefine the way things are done. Whether cities articulate this or not, municipal broadband is about disrupting the dominant telecommunications model. Municipal broadband can – and should – redefine the technologies and business models used to deliver broadband.

Many cities that have pursued municipal broadband projects have been weak on strategic planning as they focused on tactical

implementation. Too many cities adopt legacy telecom methodologies rather than redefining the market with new technologies and a new business model. A focus on tactics makes a city vulnerable to simply trading seats with the incumbent within the same broken business model. Cities can completely disrupt the dominant incumbent control business model by shifting to an emphasis on strategies – specifically, strategies that will give consumers what they want from broadband networks.

To create a strategy, a city should give some attention to disruption theory. For the past 20 years, Clayton Christensen, a professor at Harvard Business School, has been writing about disruption and innovation. His key ideas include the following:

1) Disruption always happens from the bottom of the market. This is the part of the market that is unattractive to dominant industry powerhouses.
2) To disrupt means to redefine or reconsider the job to be done or the problem the customer is trying to solve.
3) Redefinition of technology often involves turning previously complex tasks into "brain-dead simple" tasks.
4) Redefinition of the business model generally drives disruption even more than the introduction of a new technology.

In addition to paying attention to Christensen's theories, cities should look for case studies that may be helpful as they develop their strategies. To start with, cities should become familiar with successful municipal broadband projects, particularly those from the part of the market that is unattractive to dominant industry powerhouses.

Underserved and unserved communities are forced to become creative in embracing technologies and business models that ultimately will redefine the way broadband networks operate. The "job to be done" in municipal broadband must be different from the primary job of incumbent-controlled broadband, which is to maximize return on investment. Technologies that will fuel the redefinition of broadband networks will likely turn previously complex tasks into "brain-dead simple" tasks. Most important, cities should look for business models that incumbents cannot or will not replicate because these business models will undermine the incumbent's strategies and objectives.

> Market disruption starts from the bottom of the market – the part that is unattractive to dominant industry powerhouses – and proceeds by redefining the job to be done or the problem to be solved.

An example of a municipal broadband project that checks all these boxes from Christensen's disruption theory is the Ammon Fiber Network.

- The city of Ammon is at the bottom of the market – it has a population of 16,000 and is located in southeastern Idaho, far from any major metropolitan areas.
- The job to be done, as described by Ammon's mayor and city council, was to "create an open, software-defined fiber optic infrastructure with the goal of reaching every address over time."
- From a technology perspective, the Ammon network is the first municipal network to implement a software-defined network (SDN) that is virtualized and automated, delivering networks on demand while moving services to the cloud.
- For its business model, Ammon implemented a local improvement district for broadband infrastructure, in which residents pay $17.00 per month for a gigabit fiber optic connection and $16.50 per month for maintenance and operation of the network. The city provides open infrastructure and allows service providers to openly compete and innovate across that infrastructure.

Is there evidence that Ammon's model has the potential to be disruptive and redefine broadband networks? Though Ammon is celebrating the official opening of its network this month, it actually launched its ISP Cloud in September 2016 to serve the first phase of its rollout. Think of the cloud as a marketplace for ISPs or open access for a cloud world. In Ammon's cloud, a subscriber can change ISPs in 20 seconds. Point – click – subscribe. Point – click – unsubscribe. No customer service calls, no waiting, no truck rolls.

Since the municipal network went live, ISP prices in Ammon fell from $44.95 to $9.99 per month for a 100 x 100 Mbps ISP connection. The timeline is shown in Table 2. In the first phase of its network implementation, Ammon achieved a 70 percent take rate, and that number continues to climb.

TABLE 2: ISP PRICES ON THE AMMON FIBER NETWORK

ISP	DATE	SPEED	PRICE
ISP 1	September 2016	100 x 100 Mbps	$44.95
ISP 2	October 2016	100 x 100 Mbps	$39.99
ISP 2	July 2017	100 x 100 Mbps	$9.99

Wealth can be understood as a function of the number of rewarding choices an individual can make. The lack of choice and control over high prices and poor service makes customers angry.

A WEALTH OF CHOICES

What Ammon and EntryPoint have done together has significance beyond the falling prices for ISP services.

Rory Sutherland, advertising and social media expert, argues that wealth is a function of the number of rewarding choices that an individual has the power to make. New technologies and business models that are valuable allow people to do meaningful things that were previously not possible.

Under the dominant telecommunications model, customers have a poverty of choices. An internet search on the "most hated companies in the United States" shows a dominant telecommunications provider listed as No. 1. A search on companies with the worst customer service in 2017 shows several telecommunications companies high on the list.

Is this anger and dissatisfaction solely a function of poor customer service, or is something bigger going on? It is one thing to be on the receiving end of poor customer service. It is another thing to be unable to do anything about it because there is no option to move to something better. The lack of choice and control over high prices and poor service is what makes customers so angry.

Rideshare companies such as Uber and Lyft understand the value of a business model that moves control to the customer. Customers who want to get from point A to point B know what the cost of the ride will be before they request a ride and can compare this cost to alternative modes of transportation. Customers also know they can rate the driver if the car is not clean or the driver is not polite.

The Ammon model, which runs on EntryPoint's cloud orchestration platform, restores choice for choice-starved customers. Because customers of the Ammon Fiber Network can easily change ISPs, real competition can take hold and create a dynamic marketplace for ISPs that fundamentally changes the value customers get from ISPs. The barriers to entry are lowered as new service providers can be provisioned in less than 24 hours for a monthly fee of $50.

We predict that prices will continue to fall, speed will continue to rise and service quality will continue to increase. Additionally, residents are not forced to sign up, and taxpayers are not taxed to build the network.

Table 3, which shows basic data about the Ammon Fiber Network and its competition, illustrates how the network restores choice to consumers.

In summary, cities should focus on the unique value municipal broadband can provide that traditional broadband incumbents won't or can't provide. If a city defines the problem it is solving as a "fast internet" problem, that city will then be willing to accept any solution to that problem. That is not to say that fast internet is not important. Ammon and EntryPoint argue that if the big problems with internet access can be solved, fast internet will happen naturally. Ammon's answer to the question of value from municipal broadband has been to focus on giving customers the solutions they seek through robust infrastructure owned by the city on behalf of residents and an open marketplace for services. ❖

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TABLE 3: AMMON FIBER PHASE 1 DEPLOYMENT DATA

Residential take rate	70%
Number of ISPs signed up to provide services	4
Infrastructure allocation per homeowner	$3,000
Infrastructure finance term	20 years
Monthly infrastructure expense (fiber optic connection)	$17.00
Monthly maintenance and operations expense (1 Gbps connection)	$16.50
Monthly ISP - best value (100/100 Mbps)	$9.99
Total monthly cost	$43.49
Incumbent monthly ISP offering (50/5 Mbps) + data caps	$75.00+

The Ammon model restores choice and control for choice-impoverished consumers.

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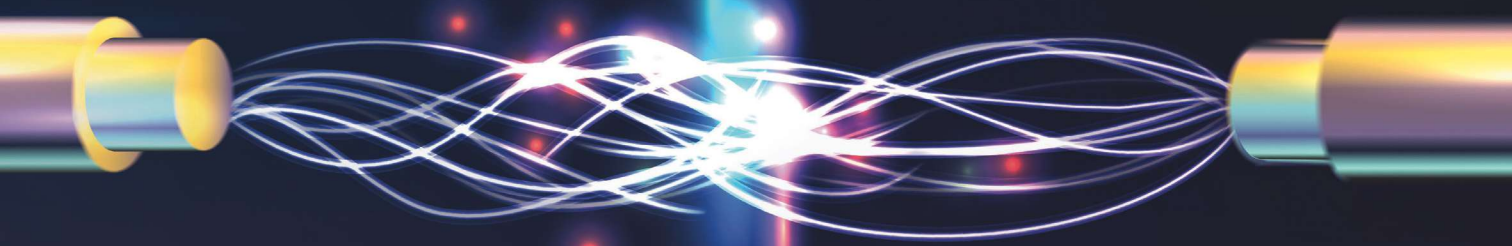

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Huntsville Becomes a Gig City

Huntsville Utilities in Alabama is pioneering a new model for community broadband. So far, all the signs look good.

By Masha Zager / *Broadband Communities*

Huntsville, Alabama, long called "Rocket City" for its association with the space program, is on its way to becoming "Gig City," thanks to its municipal fiber network. With a population of about 195,000, Huntsville wasn't overlooked by broadband providers, as some smaller towns and cities were. But private broadband offerings weren't robust enough to support the city's tech sector, which now includes a burgeoning biotech industry in addition to the traditional space industry. And with the highest concentration of engineers in the United States, Huntsville has a sophisticated and demanding broadband market.

Mayor Tommy Battle, announcing a Gig City initiative, said conversations with the city's Economic Development Advisory Council convinced him of the increased need for ultra-high-speed connectivity and big data portals. He noted, "If Huntsville is to remain a technological leader in this hyperconnected global world, we must be able to offer broadband access that can accommodate the growing demands of business, research institutions, entrepreneurs, residents and public safety."

At the same time, Huntsville's municipal utility, which had maintained a fiber network since 1999, was planning a major network expansion to better manage its electric grid. The expanded network would support energy information services, real-time pricing, SCADA, substation control and other fiber-centric requirements. Adding extra fiber strands would not add significantly to its cost, so the city decided to leverage this asset for the benefit of residents and businesses.

According to a 2016 presentation by Jay Stowe, former president and CEO of Huntsville Utilities, the utility concluded that providing fiber to the home directly would be too expensive and, more important, too risky because "it was not a business that we are in." So in December 2014, the city issued a request for information seeking one or more partners to provide high-speed internet services through the utility's fiber network.

In February 2016, the city and Google Fiber announced that Google Fiber had signed a 20-year lease on Huntsville's dark fiber and would offer triple-play services to all Huntsville residents and small businesses – about 105,000 addresses altogether. The news made a splash, not because Huntsville was the first city to use a wholesale model – at least 100 other municipal networks do – but because Google Fiber was the first high-profile provider to sign on with a municipal network.

Typically, retail providers that deliver services on municipal networks are small and have little or no infrastructure of their own. Large incumbent U.S. providers, which are vertically integrated, have declined to use networks they don't own, expressing concern about being blamed for service glitches they can't control. Google Fiber, a competitive provider that now offers services in parts of 18 metropolitan areas, has substantial fiber assets and began as a vertically integrated provider. (It does use existing fiber to deliver services to some MDUs in Atlanta and San Francisco.) Huntsville was the first city in which it committed to provide services over fiber owned by a public entity.

Huntsville, Alabama, has been the Rocket City for years. Now it's a Gig City.

A WIN-WIN FOR GOOGLE AND THE CITY

The deal enabled Google Fiber to start serving Huntsville faster and at a lower cost than if it had built out the network itself. At the **Broadband Communities** Summit in April 2017, John Burchett, head of public policy for Google Access and Google Fiber, said, "It's a win-win for us and the city. There's less capital up front for us, and the builds are much faster because they already have access to poles and rights-of-way and can do the make-ready faster than we can. They have crews they can deploy. We've found they are able to build much faster than we can."

Burchett added that other communities could use the same or similar approaches to attract Google or other providers. He said, "The more that communities can put in dark fiber, the more it speeds the whole thing up. At this point it's almost all about time. The sooner you can light up a person, the more the numbers start making sense."

Recently, a Google Fiber spokesperson explained to **Broadband Communities**, "By working with Huntsville Utilities and the city of Huntsville, we're able to bring more people access to ultra-high-speed internet, and we've been able to further the city's vision for a more connected community. Huntsville and its leaders are building a community energized by gigabit speeds. We are now able to help make their vision a reality. This city-led, long-term investment will allow both Google Fiber and future providers to more easily deliver ultra-fast internet to Huntsville residents."

From the utility's point of view, locking in a 20-year revenue stream from the fiber asset enabled it to speed up its network deployment. The network will be built out in three years at a cost of about $70 million; the build might have been slower if the network were used only for utility and government purposes. And, of course, the city gets gigabit service for all its residents.

THE HUNTSVILLE MODEL

Leasing excess fiber from a utility grid network has become common. However, Huntsville's model has several unique features.

Municipalities that lease fiber to third-party providers generally use one of two models: They own only the fiber ring, or they own the entire network. Even where a third party builds the connections to the premises (as in Rio Blanco County, Colorado, whose network was profiled in the November-December 2016 issue), the municipality usually ends up owning all the fiber.

Huntsville follows a third, middle-ground strategy: It builds fiber to the curb, installs a multiport service terminal (MST) that can serve several customers, and lets service providers build and own the final drops to the customer premises. This way, it can fund the network through electric rates without borrowing (all the infrastructure is used to operate the electric distribution system), it controls the buildout schedule to the various neighborhoods, but it does not have to get involved in customer connections.

Google Fiber – or another provider – markets services to customers, secures permission for drops and installations, plugs its cables into the MSTs and gets customers connected.

Daniel Kaufmann, a lawyer from Bradley Arant Boult Cummings who helped the city negotiate the lease, explains that the utility sets rate structures that apply to all lessees (its only other legal option would be to open the network to competitive bidding, which would be impractical). Thus, Google Fiber pays the same rate as any other retail service provider offering the same type of service. A point-to-point fiber lease, such as a provider might want to serve a financial or research institution, would fall under a different category and pay a different rate, as would a low-volume lease.

Huntsville Utilities invested in its network primarily so it could manage its grid better. A small additional investment makes possible gigabit services for all residents and businesses.

Exclusive contracts are illegal – "You can't give a special privilege to any one citizen," Kaufmann says – which means that, as the city is not the ISP, multiple ISPs must be allowed on the network.

As of now, no other providers have leased fiber from the utility. However, the city is eager to attract additional providers, and it took account of the potential for multiple providers both in the contract with Google Fiber and in the network design. Tom Reiman, CEO of The Broadband Group, which helped the utility plan the network and negotiate the contract, says that Google Fiber's control over drop cables does not equate to control over customers. A customer unhappy with Google Fiber could switch to a competing provider, if there were one; the utility could easily install another terminal, and the competing provider could easily install a drop cable.

However, Reiman adds, although the network can support a second high-volume provider from a technical standpoint, the chance that a second provider would want to serve the whole city is "economically remote." He expects to see additional providers carve out niche markets – multiple-dwelling-unit properties or enterprises or schools – but would be surprised if Google Fiber had a competitor for general residential service.

According to Stowe, in the future, the utility might lease fiber in other parts of its electric service territory, and other broadband providers might want to serve customers in those smaller cities.

CONTRACT PRICING

Huntsville's pricing model also has unique aspects. Variable revenue, rather than being based on route distance (dollars per foot of fiber), is based on the number of terminal ports available – in other words, on the number of potential customers. Kaufmann explains that the value of a network for service providers depends not on route miles but on how many customers they can connect. The cost to the utility, however, depends largely on the number of route miles, so to develop a price per port, it had to calculate the number of ports it was likely to install per mile of fiber. (The provider also pays for space in fiber huts and for miles of backbone fiber, costs that will change little over the years.)

Yet another difference is this: Although most fiber owners employ indefeasible rights of use (IRUs) for long-term fiber leases, Huntsville chose not to use that method. Kaufmann says, "An IRU gives an ownership interest to the tenant. Under our state statute, the better course of action is for the utility to own the network. As it's operating an electric system, it needs to be in sole control of the network. … The utility's customers are going to be dependent on the network's working, so it didn't want multiple owners."

GOING LIVE

Huntsville Utilities started its fiber expansion shortly after signing the contract with Google Fiber. According to Stacy Cantrell, vice president of engineering, it is already building out the second of its six phases, with a goal of completing the final phase by October 2019. To allow Google Fiber to market and install drops continuously, Huntsville is turning over the network in small segments as they are ready rather than waiting for the completion of each phase.

In May 2017, Google Fiber announced that residents and small business owners in North Huntsville could sign up for internet, video and phone services, with a choice of 100 Mbps or 1 Gbps speeds. It announced a second neighborhood in September. Customers began signing up immediately, and many are already receiving services. A Google Fiber spokesperson told **Broadband Communities**, "We have been extremely pleased with the response in Huntsville. The service has been well-received, and we are encouraged as we consider other service areas in the market."

Eschewing the "fiberhood" approach that Google Fiber made famous, Huntsville Utilities decided to prioritze its build based on construction needs rather than customer demand. It started in North Huntsville because that area needed the least make-ready work on its poles. This enabled Google Fiber to start delivering services as soon as possible. However, Cantrell notes, the city was excited to be able to bring gigabit service to North Huntsville, an area that would benefit economically from those services.

Google Fiber is also bringing fiber to a number of community organizations in Huntsville. The Google spokesperson told us, "In Huntsville, our community impact efforts are focused on three priority areas: digital inclusion, STEM education, and supporting entrepreneurs and nonprofits. We pursue partnerships that support these three efforts – giving nonprofits the tools they need to increase their digital presence and create more efficient workstreams so they can focus on their missions. Each organization and its needs are different. In certain cases, we will provide tools and services – such as a free computer lab for the kids at Harris Homes for Children."

LESSONS LEARNED

Building out fiber to an entire city in three years is an ambitious undertaking, and Huntsville Utilities faces several challenges – among other things, at the time it started the project, it had no separate fiber department and had fallen behind on pole maintenance. Six major contractors (some of whom have subcontractors) are performing

various design and installation tasks, overseen by TBG Network Services, a subsidiary of The Broadband Group. TBG Network Services leads all aspects of the construction oversight, build metrics and turnover to Google Fiber.

Based on her experiences during the first year of the project, Cantrell offers some thoughts for other municipalities to keep in mind:

- The quality of GIS data is crucial because that data forms the basis for the design. Clean up the GIS data well before you get started on a fiber project.
- Be prepared for the incumbents to jump into action as soon as a municipal project is announced, and don't be surprised if they get started faster than you can. Make sure you have well-defined processes and enough personnel to handle the locates, pole attachments and other events that create work for your utility. Sometimes there's no way to escape doing the same work twice – for example, if you move facilities on a pole to make room for two new attachers and a third one puts in a request a month later, you may have to replace the pole and waste the first make-ready.
- Encourage the locating team to develop good relationships with contractors so contractors will call the team to answer any questions. Some utility lines will inevitably be cut, but good working relationships can minimize these problems.
- Continual field inspection is necessary to train contractors about building to standards. Don't wait until the job is complete and then hand them a long list of problems to fix. Having inspectors in the field also helps validate invoices and construction progress, and inspectors can interact with homeowners to make sure any damages are noted and repaired.

From his perspective as project adviser and overseer, Reiman offers an optimistic assessment of the Huntsville model and its future: "The Huntsville or utility lease model completely changes the metrics of competitive broadband investments. Unlinking terrestrial infrastructure funding from the delivery of world-class, high-speed internet access addresses the challenges that have failed so many important initiatives. Investing in more 'single industry use' fiber is perhaps not solving the universal access objectives of municipal broadband. We believe this model is both replicable and relevant in many future markets." ❖

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Topics in Community Broadband

Q&A with Cheri Beranek, CEO of Clearfield

Clearfield's fiber management equipment is used in many community broadband networks, and the company is known for working closely with small deployers – municipalities, telcos and others – to solve specific problems. Recently, **Broadband Communities** had an opportunity to speak with Cheri Beranek, CEO of Clearfield, about current challenges and strategies for municipal fiber deployments. Following are highlights of that discussion.

BROADBAND COMMUNITIES: *What's driving the current boom in municipal fiber deployments?*

CHERI BERANEK: We're seeing broad interest from municipalities that are not getting the service they believe their communities deserve – and require – for quality of life or economic development that will let them compete in national and global markets.

BBC: *What challenges do they face?*

CB: There are many obstacles keeping them from making the leap forward from the "kicking the tires" stage. Two examples are financial obligations and technical competency. Even broadband service providers that are currently operating telephone or cable networks are not experts in this climate, and novices in the marketplace are definitely looking for help and assistance. They're being cautious; they're not just jumping in with both feet.

Clearfield actually views municipalities as similar to telephone companies, especially if they already operate utility infrastructure. Those that do are the best structured to build and operate networks.

BBC: *What does Clearfield offer in the way of "help and assistance"?*

CB: Clearfield College, which we offer at no cost, is a technical program run by some of our application engineers, who have built networks for telcos, cable companies or the military.

We also have a program in which we sit down with municipalities and draw a small subdivision – say 288 homes – and show them how we would build an optimal network. We pay engineering firms to provide models as proofs of concept for the municipalities to work through viability and feasibility studies. Then they can work with consultants to develop more specific plans and learn what they're doing without having to put out a lot of money up front.

BBC: *How does a municipal build differ from a telco build?*

CB: Really, building a network isn't very different for a municipality and a private enterprise. Municipalities sometimes get caught up in the idea of having to treat everyone equally, but we encourage them to think about it the way a private business would, by proving it out first. They've received the idea of stepping stones really well. They're much more viable entities if they can take it slow and prove it out. In fact, as long as a municipality owns the rights of way and controls the permitting process, it has an inherent advantage.

The difficulty isn't so much how to build the network but how to operate it with all the nuances – and that information is more difficult for us to offer.

BBC: *Is that why so many municipalities are exploring public-private partnerships?*

CB: Yes. The limitation for private carriers is that there's only so much capex to

go around, so they will deploy networks in the most profitable communities. But if the localities can do the financing, manage the rights of way and permitting, and then open up the networks for private operation, we believe that can be the best of both worlds.

We work with national carriers, too, and we see that they want to dictate the terms of these partnerships. Municipalities have to stick to their guns a little bit. When a private carrier wants to be the sole provider on a municipal network, that's the line that needs to be defined. That's the challenge in front of us.

There will be different models for partnerships, but there still have to be general standards. For example, Seattle did a study about whether it should have a municipally funded network and came back with a recommendation of "No" because the municipality would not get the take rates to be viable. … Sometimes a municipal network is appropriate, and sometimes it's not. There has to be a responsible assessment of how these networks can be profitable.

BBC: *How can municipalities encourage competition on their networks?*

CB: Personally, I believe that putting separate fibers in the same trench is the best model because it allows providers to have control over their planning. The most expensive part of the build is connecting homes … but even there, a city can lay 1-inch conduit in the ground all the way to the premises and allow multiple providers to use it. Service providers can lay pushable fiber or additional microduct inside the conduit to leverage the city's deployment.

If you can separate the network builder from the operator, that expands the pool of operators beyond utility providers. Cities are good at building infrastructure and at tax financing – those are advantages they can leverage. By laying separate fibers, they avoid the other challenges of open access. Providers don't have to share fiber, and they have autonomy.

The biggest challenge is with video service, because without scale it's difficult to be competitive. … There are two ways to deal with it: Either be a renegade and work with over-the-top video, or be transparent about programming costs and help create a consumer backlash. A lot of municipal providers find they can't compete without a bundle that includes video.

How FTTH Helps Communities

The FCC asked, in a recent inquiry, whether communities that have wireless access of 10 Mbps/1 Mbps should be considered well-served in terms of broadband. Though this new approach could "solve" the rural broadband problem at the stroke of a pen, communities have not responded positively. The town of Leverett, Massachusetts, submitted the following comment to the FCC (edited slightly):

Leverett is a rural community in Western Massachusetts, with a population of nearly 2,000 in about 800 households in 22.7 square miles, approximately 88 persons per square mile.

The town owns LeverettNet, a last-mile, gigabit, fiber-to-the-home network it constructed to connect all residents to the internet. The town contracts with third parties to provide network operator, internet service provider and maintenance services, the costs of which are borne by subscribers.

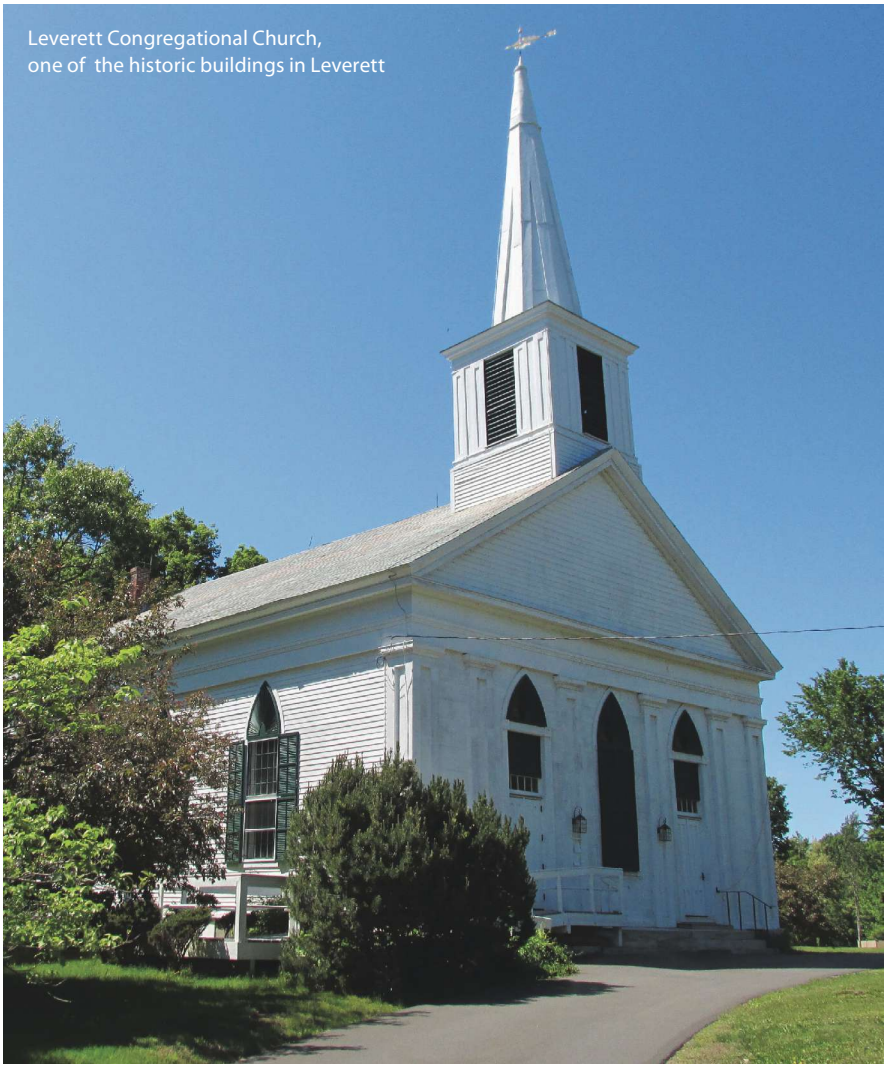
Prior to construction of LeverettNet, Leverett residents had only limited internet access via satellite and DSL, both of which impose severe limits on connection capacity and speed. These limits constituted a serious impediment to public safety – police, fire, and highway – as well as to the town school and library. LeverettNet greatly enhanced public safety and educational operations.

The availability of LeverettNet also improved the business climate in town, allowing existing businesses to expand and new businesses to open. Further, the availability of high-speed broadband improved real estate and rental markets. In short, the deployment of advanced telecommunications technology through a public-private broadband partnership transformed the Leverett community.

"Advanced telecommunications" – as the statutory definition states – "enables users to originate and receive high-quality voice, data, graphics, and video telecommunications." In our experience, the emphasis on "originate and receive" has special importance for businesses – home-based and telecommuting – that work with large data, graphics, and video transmissions. Mobile access, especially as subject to throttling of download speed, limited upload speed and data caps, cannot provide sufficient internet access to sustain information entrepreneurs.

A telecommunications system deserving the label "advanced" provides symmetrical speeds so that uploads and downloads receive equal treatment. A system that prioritizes download, though it may currently suffice for consumers of information, will not serve those who *produce* information. Information producers working in Leverett, including CGI services, authors, software engineers, graphic artists, etc., require *symmetrical* high-speed internet access. Indeed, LeverettNet makes it possible for these entrepreneurs to work in Leverett at all.

In short, an equation of mobile and fixed telecommunication technologies fails to recognize needs of information producers and restricts future development of information work and businesses. Encouragement and support of network technologies adequate to the needs of information producers have special significance in ensuring economic and demographic viability of rural areas like Leverett, where "brick-and mortar" businesses cannot be sustained.



Leverett Congregational Church, one of the historic buildings in Leverett

(Photo credit: John Phelan)

Fort Morgan, Colorado, Launches Fiber Project

"The city government has always operated on exceptional customer service," says Brent Nation, water resources and utilities director for Fort Morgan, a city of 11,000 in northeastern Colorado. That's why the city council didn't like what it heard when it began renegotiating its cable franchise agreement in 2015. Citizens were unhappy – and vocal – about the poor quality of the service and the low internet speeds that incumbent providers offered.

Fortunately, Fort Morgan had options. An institutional fiber network was already in place, started about 15 years ago under a state program called the Beanpole Project. By 2015, the network reached all the city offices and utility substations, providing gigabit speeds internally. In addition, the city was one of the first to vote to exempt itself from Colorado Senate Bill 152, a 2005 law that prevents municipalities from creating their own broadband networks; that vote authorized it to take matters into its own hands. It had even studied the feasibility of providing broadband to residents.

During the cable franchise negotiations, the city council heard about the fiber-to-the-home network that Longmont, a larger city about 80 miles away, had installed, and dispatched Nation to meet with and learn from the Longmont team. After visiting Longmont, attending trade shows and researching fiber optics, Nation recommended that Fort Morgan build a citywide fiber-to-the-home network. The city engaged Manweiler Telecom to begin designing the system in 2016, and in 2017, it budgeted $2.3 million for the backbone phase of the project, which is now complete.

However, unlike Longmont, which operates its own network, Fort Morgan preferred to contract out to a private provider. While it built the fiber backbone, it issued an RFI looking for a private partner. Its preferred model is similar to Huntsville's (see p. 40), in which the city owns the infrastructure up to the property lines, and the private partner installs the drop cables and provides services. However, Fort Morgan expects to have only a single private partner under a time-limited contract.

A FAST-MOVING PROJECT

Six companies responded to the RFI, and in August, the city announced it would begin negotiations with Allo Communications, a company that provides FTTH services in Nebraska. Negotiations are still ongoing. If the city can't reach a satisfactory arrangement with Allo or another company, it is willing to become the network operator and ISP, Nation says.

Like Huntsville, Fort Morgan plans to allocate funds from its debt-free electric utility to pay for the entire network (or whatever portion of it is not funded by the private partner). The city council could opt at a later date to pay back the electric utility, but because the network is used primarily to manage the electric grid, it isn't required to do that.

Once Fort Morgan has a contract with a service provider, it will work with the partner to promote the network to potential customers. That shouldn't be a hard sell. Businesses, especially, "are just dying to get hooked up to something faster than what they have right now," Nation says. The city will prioritize connecting business districts, to the extent that that makes sense from a construction standpoint. However, Nation points out that many businesses are as concerned about the connectivity their employees can get at home as they are about the connectivity to their offices. "So many people want to telecommute," he says.

The city hopes to have its first customers online in six to eight months. "I'm getting very excited about this as we start to see the finish line," Nation says. "I hope it will go along as smoothly as it has so far." ❖

Engaging the Community

Generating community support for a broadband project is critical for its success.

By Bob Knight / *Harrison Edwards*

Americans love their internet. They want to be connected at home, at work, in stores, in their cars, on farms and even in the subway. They want to connect the things they use – cars, appliances, roadways and pacemakers – to the internet, too. The future depends on it. Continuous connectivity breeds innovative technologies that can make life better, safer and more fruitful.

Why, then, is there public resistance to broadband deployment?

Communities tend to object to broadband projects because they don't want their tax dollars to fund them; they are fearful of seeing more wires, boxes and cells in their towns and neighborhoods; and they feel like pawns with no say in what will happen.

Simply put, communities need to be educated about broadband projects to achieve buy-in and political will. But educating a community is not so simple. Engineering consent requires perseverance and a strategic communications plan, but the payoff is big. Public support puts wind in the sails of broadband projects, as officials and regulators are influenced by the people they answer to – the public.

Though each strategic communications plan needs to be tailored to its specific community and circumstances, certain basics should be followed, no matter whether the deployer is a private company, a government entity or a public-private partnership.

1. **Identify your stakeholders.** The "public" is a broad term that includes multiple subgroups. Stakeholders may be public officials, business leaders, educators, parents, community activists, veterans and senior groups. Identify the groups that make your community tick. Remember, stakeholders can become your champions!
2. **Identify stakeholders' concerns and issues.** Doing this helps you know how broadband deployment will specifically benefit each group. How will you know what they're thinking? Just listen. Are you speaking at people or are you listening? Find out each stakeholder group's pain points and hopes. A strategic communications plan is based on that information.
3. **Create a message map.** This is where the rubber meets the road. Now that you've heard what your stakeholder groups have to say, create messages and marketing tactics that will resonate. The success or failure of the project can hinge on communicating the right messages.
4. **Choose your tools.** There are many marketing tools – meetings, press releases, ads, social media, digital marketing, events – and they all work. Which tools you should use depends on your overall strategy. Remember to lead with your strategy, not with your tactics (tools). Too many communities take tactical approaches, such as producing a one-off event or issuing a press release, and ignore the bigger picture. Then they wonder why they have trouble driving broadband projects forward.
5. **Promote continual, two-way conversations.** Do you have a project website? A Facebook page? Do you have key details and FAQs that are easily accessible?

Do you measure social sentiment? Do you provide enough information about the project in a timely fashion? The key is to keep people engaged.

6. **Counter opposition messaging.** This is a biggie. Every project has naysayers. Whenever public funding is considered, public rights of way are in play, or there are obvious winners and losers, there will be opposition. And the opposition can have some sharp, effective messaging, so be prepared. Tell your story positively, and arm yourself with facts. In times of trouble, ask these questions: Is your message clear? Is your message timely, especially in the social media era? If you are gun-shy about speaking to the media to tell your story, are you prepared to allow others to tell it for you? You can be sure that if the opposition is well funded, it will work with sophisticated communications teams to sabotage your chances of success.
7. **Continually measure, evaluate and adjust.** Set a timeline and project benchmarks. Ask yourself whether your messages are landing. How's your social media sentiment? Is your project receiving positive media coverage? Is your project moving forward? Communications firms have sophisticated analytics to measure these things. If your tactics are not working, then it may be time to sharpen the message or update it altogether. Build on what's working well, and revise what isn't.
8. **Share Your Success!** Once you've sold the project internally and things are moving forward, let the world know. By upgrading your digital infrastructure, you are positioning your community for tremendous economic, social and civic success. When you share the news, you will reach those who may want to collaborate with your community or, better yet, invest in your community. Chattanooga, Tennessee, is an example. Since launching its citywide gigabit-speed network, the city has attracted $11 billion worth of economic development to its downtown. That could be you! With a fiber network, your community is now attractive to companies such as Amazon, which is seeking to site offices in communities with high-speed broadband. Don't keep your success a secret!

Essentially, deployment of high-speed broadband depends on two things: funding and regulatory approval. Because many projects these days involve some form of public financing and all require some form of public approval, how public officials look upon your project will be influenced, in large part, by the people they answer to – the public. How you engage the public can make or break a project.

Remember, most community members don't focus on digital infrastructure or the need to compete in the new economy. They focus on what's important to them. By engaging the community, you help bridge the community's interest with the very digital infrastructure you seek to grow or create. The right strategic communications plan and its execution will provide education and awareness to help move your project forward. Community stakeholder engagement will build demand and generate strong political will and support. Deployment will improve one aspect of communication, but before that happens, another kind of communication has to take place. ❖

Bob Knight is executive vice president and chief operating officer of Harrison Edwards, a strategic communications firm based in Armonk, New York, that specializes in economic development, government, health care and fiber/small-cell deployment. Contact Bob at bknight@harrison-edwardspr.com.

Planning for Poles

Too many fiber network projects fail because deployers make unrealistic assumptions about pole attachments. Don't let that happen to your project!

By Ken Demlow / *NewCom Technologies*

Every potential fiber project has many critical steps, and each step has many important details. Before construction starts, there can be months of activity – surveys, current provider analysis, meetings, needs analysis, peering option exploration, data gathering, cost estimation, vendor input, financial modeling, operational decisions, open access decisions, legal opinions, political will determination, funding options and more. Doing the work necessary in each step is important to the success of the project.

However, one subject has been overlooked in so many projects NewCom has seen that it needs to be highlighted: poles. Yes, poles.

In the good old days (not that long ago), if someone needed to attach communications cables to someone else's poles, the process was usually quick and informal, and the communications company could start attaching its cables fairly quickly. There weren't many attachers, and the pole owners knew what was on their poles already, so a handshake (and maybe a piece of paper) was exchanged, and communications cables went up.

That still happens in some places – but not nearly as often as it used to.

> Pole owners may not allow new attachers at all, or they may impose onerous, expensive requirements.

In some projects we have seen, would-be attachers just assumed that attaching their cables would be easy and inexpensive. They relied on aerial costs in the construction estimates for their business modeling and funding commitments. When it came time to do the project, they ran into problems.

Here are some examples:

- One municipality built its aerial costs on poles owned by a cooperative. For several reasons, the cooperative wasn't allowing anyone to attach new cables to its poles. So the municipality planned on about 90 percent aerial construction and found that at most 10 percent would be possible. The project was never started.
- Another provider wanted to run fiber in an area that had a very high rock table. Therefore, it saw aerial construction as necessary. The local electric utility, which owned the majority of the poles, developed a very stringent process and attachment guidelines. The process included having to model every pole in pole modeling software. The costs to attach became very high – including having to replace a significant percentage of the poles.
- A municipality, in its financing and business models, counted on using poles that belonged to several other owners. In the detailed design stage, it found out there just wasn't room on many of the poles. The municipality's options were to replace poles or go underground. It had not factored any

of those costs into its plans. When it reran the numbers, it didn't think the project was feasible.

- A municipality found it had more pole owners to deal with, crossings were more expensive and approvals took longer than anticipated. The project succeeded but was more time-consuming and costly than expected.

From the pole owners' perspective, the process isn't as simple as it used to be. They have aging infrastructure. More companies are requesting to attach cables to their poles. In many cases, they are forced to develop a consistent, thorough process for deciding who can attach cables. All those things cost money and require additional personnel.

Typically, pole owners have contracts with existing attachers. This causes problems in large projects when existing attachers must move cables to allow for a new attacher. Sometimes, coordinating crews of six different attachers can add months to a schedule. In one case, a community decided to pass a one-touch law that assigned one contractor to do all the attaching and moving. The municipal electric utility (which owned the poles) then revealed that some of its contracts stipulated that only the attacher's union crews would move their attachments. Which takes precedence, a city council vote or a contract with the municipal utility? The courts are sorting that out.

Easements are another consideration. Pole owners have easements for placing poles for their own use. However, their easements do not cover cables or attachments of other owners. Therefore, the attachers or providers are responsible for negotiating easements – not the pole owners. Even a municipal or cooperative electric company that wants to deliver broadband services may find it can't legally use its own poles for this purpose without negotiating new easements.

Based on experience in many projects across the United States, NewCom recommends taking the following actions before beginning a fiber project:

With the growth of telecommunications networks, some utility poles are becoming overcrowded.

- Analyze the route as part of the feasibility study, and make sure there is real documentation that can be used later. This documentation should specify which parts of the route will likely be overhead and which will likely be underground. For aerial segments, identify the poles and their owners. Having this information in a format that can be used later can save time and money if the project moves forward. In our experience, GIS is one of the most usable formats for storing information during early phases. Because GIS makes changing and adding data easy, the original map can be used throughout the project.
- In the route analysis, identify the relevant pole owners and crossings. Gather the following critical details:
  - Is the pole owner willing to add attachers?
  - Is there room on the poles to attach new cables?
  - Are there requests from other potential attachers that could take the space you need?
  - What is the pole owner's attachment process? What do the pole applications look like, how long do they take to review and how stringent is the analysis?
  - What fees does the pole owner charge?
  - What is the timeline for attachment?

  - How many poles might need to be replaced?
- Make sure the costs associated with attaching cables are defined and part of your financial forecasts. Some questions to consider include
  - Will you be responsible for doing the pole analysis. If so, how much will that cost?
  - What are the pole owner's attachment guidelines? Will they add significant costs?
  - Does the owner require pole modeling? If so, does it require using specific software?
  - Can the poles be accessed for survey, analysis and construction?
  - Who pays if a pole needs to be replaced (either because of an existing problem or because your fiber overloads it)?
  - Is the project big enough to warrant a discussion of one-touch attachment? In some projects, the time it takes to coordinate all the current attachers moving their attachments on each pole can be a concern. If a one-touch rule would be beneficial, there could be issues such as existing contracts with attachers, union rules about who can do that work and so forth.
- Make sure you have the proper easements. Hiring an easement expert to give you some idea of what will be necessary can be an important step in making sure this is properly accounted for in your feasibility study.

Doing all these tasks in advance of or as part of your feasibility study is very important. The answers to these questions can significantly affect the project's feasibility. Pole issues can be so important to the project costs that failing to perform this analysis can render your project financially unfeasible. It is much better to know these impacts during the feasibility study than when everything else is done and you want to start construction.

Hoping that pole owners will still operate as they did several years ago is quicker, easier and less costly up front. But that approach can add significant costs later and cause financial problems – eating up cash that wasn't budgeted for or even making the project unachievable. ❖

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Feasibility Studies for Municipal Broadband

What communities should do during the planning phase of a broadband project – and what they can save for later

By Lori Sherwood / *Vantage Point Solutions*

When it comes to developing and expanding municipal broadband networks, there is no one-size-fits-all model. Proper planning is crucial to the success of any network deployment. However, not all broadband planning is equal; some planning processes may even be counterproductive.

Many communities borrow planning outlines from requests for proposals (RFPs) that other communities have issued and that address needs specific to the original community. This results in their spending time and resources on tasks that do not match their values and priorities.

Worse, this one-size-fits-all approach to planning can lead a feasibility process into a cycle of never-ending discussions, research requests and multiple partnership solicitations. Not every plan will (or should!) result in a full municipal network deployment, but a poor feasibility study will inevitably halt even a good, viable potential project in its tracks. Understanding feasibility study best practices will help a municipality of any size complete a proper feasibility study.

As your community considers undertaking a feasibility study, the fundamental question to keep in mind is this: What problem or problems are you are trying to solve? Are you trying to bring broadband to parts of your community that are unserved or underserved? Do you have a digital equity and utilization problem? Are consumers in your community dissatisfied with their current internet provider? Are you trying to solve all these problems? Before committing public funds or seeking private investment to support a municipal network, municipal leaders must understand the problem or problems a network might solve.

ELEMENTS OF A FEASIBILITY STUDY

A feasibility process should focus on the following seven elements. Note that not all these activities may be necessary for every planning study – this process can be streamlined depending on the needs of the community, existing community assets and any prior planning work that has been completed.

1. **Reaching Out to Stakeholders**
   Identifying all the key stakeholders in a community and ensuring that they are included in the process from the very beginning is critically important. Outreach can be accomplished through individual or group meetings and should include representatives from K–12 schools, universities, the library system, public safety agencies, the health care and business communities, active community groups, elected officials and others. This outreach is critical to uncover potential assets and financial resources and to gauge the current and future needs in the community.

2. **Understanding the Existing Infrastructure**
   A community may or may not have assets that could be used to deploy a broadband

network. Municipalities that own electric utilities are often at an advantage for developing a broadband network because they can leverage and utilize existing public infrastructure to offset deployment costs. Municipalities without in-house utilities often struggle to leverage private infrastructure either because it isn't available to be leased or does not exist at all.

It may be tempting, in the early stages of a planning study, to try to map all existing assets. However, this is often an exercise in frustration, as incumbents do not generally volunteer maps of their infrastructure or promise to lease the infrastructure. Creating a comprehensive map can be very costly, and the money is wasted if the existing assets are not available to be leveraged.

The planning phase should take a high-level snapshot of existing assets. However, boots on the ground are needed to accurately identify all existing infrastructure, and this is more cost effective and better done during the engineering phase.

3. **Conducting Market Research**
If a community has one or more existing providers, another important question is whether it can realistically support a new provider. In other words, if the community is considering a residential network, are enough residents interested in switching providers that a municipal network could obtain sufficient subscription numbers ("take rates") to meet the realities of operational demand? The answer to this question can be determined only with market demand research. If the answer is no, a fiber-to-the-home network is not viable. The data gathered through this research is critical for understanding the residential marketplace, concluding whether a municipal broadband system is feasible and demonstrating the validity of the feasibility study.

4. **Engaging With Potential Providers**
Identifying and engaging any and all potential provider-partners is an important step in determining municipal network feasibility. This engagement often occurs through informal discussions. In this effort, communities should not hesitate to look beyond the traditional incumbent providers to local telephone companies, cooperative utilities, ISPs and others. This will help identify any potential providers early in the process and gauge the likelihood that a private sector partner may be willing to contribute financial resources. To assist in this step, some communities have issued requests for information (RFIs) to solicit proposals from interested

providers. This process, though, can be costly in terms of time and resources and may lead to delays in completing the feasibility process. See the sidebar for more information about RFI best practices.

5. Determining a Model and Network Design

A community should apply all the data gathered in this process to actively explore different models and potential network designs. For example, if a market demand survey finds that an FTTP network is not viable, then a different network model and design will be necessary. Fundamental questions must be answered about network ownership, management and operation. All these questions must be explored in the feasibility process before cost analysis, business planning and financing evaluation can take place.

6. Conducting a Cost Analysis and Business Plan

A thorough cost analysis will provide critical information regarding network capital expenditure estimates, financial forecasts, pro formas and more. However, a municipality should develop a comprehensive business plan only after it selects a model. Developing multiple business plans during the planning phase is far too costly, and if a community is going to work with a private partner, any business plan should be conducted with the partner to ensure accuracy.

Communities, with good intentions, often commission business plans in the early stages of their feasibility studies – and the plans, lacking the details available later in the process, inevitably end up sitting on a shelf. Although a community should not undertake a network deployment without a comprehensive business plan, it can create a high-level cost analysis without many later-stage details in place.

7. Evaluating Financing and Funding Availability

Money! Money! Money! Finding a partner willing to completely fund a new network is very unusual. It is also uncommon for a community to obtain federal or other grant funds (unless the community is an internet service provider, plans to become one or partners with one) to finance a network build. Thus, a community should know how much, if any, funding (bonds, general funds and so forth) it can contribute to a network build. This will help determine a model as well – particularly if the answer is "little to nothing." Though sometimes uncomfortable, the funding question must be tackled head-on.

Keep in mind that broadband planning is a collaborative, dynamic process with multiple phases. Communities should not enter into the planning phase with a predetermined conclusion but rather with an openness to creative partnerships, solutions and models. Community leaders should maintain realistic expectations and avoid the temptation to spend money on Band-Aid solutions. Network solutions – and the feasibility studies that guide them – should be tailored to the unique needs, priorities and values of each community. Conducting a feasibility process that asks the right questions of the right parties will direct a community down the right path – and provide the right solution. ❖

TO RFI, OR NOT TO RFI? PROS AND CONS

Recently, many communities have issued RFIs seeking proposals from providers that may be interested in establishing public-private partnerships (PPPs). Though the RFI process can assist in drawing out interested parties, it can also create substantial delays that can stall or derail a project.

For example, RFIs that are overly broad and open-ended make it difficult for vendors to know how to accurately respond. On the other hand, RFIs that are too narrow or demand too much may be difficult for vendors to satisfy. As a result, vendors are likely to submit proposals that are completely different from one another, making them difficult to compare and evaluate. There have been many instances in which, based on information learned through a lengthy evaluation and interview process, a community has had to cancel an original RFI and start over by reissuing a new RFI with a revised scope.

In addition, putting together a proper bid for a PPP takes a considerable amount of time and effort on the part of a vendor. Vendors understand that an RFI process does not necessarily lead to an RFP or a contract. If an RFI is perceived solely as an information-gathering exercise, a vendor may not want to invest in developing a serious proposal. In this case, an otherwise interested provider may be deterred from submitting a proposal.

One thing to keep in mind is that PPPs are very difficult to establish, particularly for smaller communities. In many cases, a PPP will not be a viable option for a community, particularly if there are multiple existing incumbents or if the financial projections do not enable the provider to profit and generate a return on the investment. Before investing the time and money in an RFI process, consider holding informal meetings with potentially interested local and national providers. Gather as much information as you can before starting the RFI process. And remember – the key word is "partner." A community that pursues a PPP needs to enter the RFI process willing to be a partner.

Lori Sherwood is director of broadband development for Vantage Point Solutions, a broadband and telecommunications engineering and consulting company based in Mitchell, South Dakota. Contact Lori at Lori.Sherwood@vantagepnt.com.

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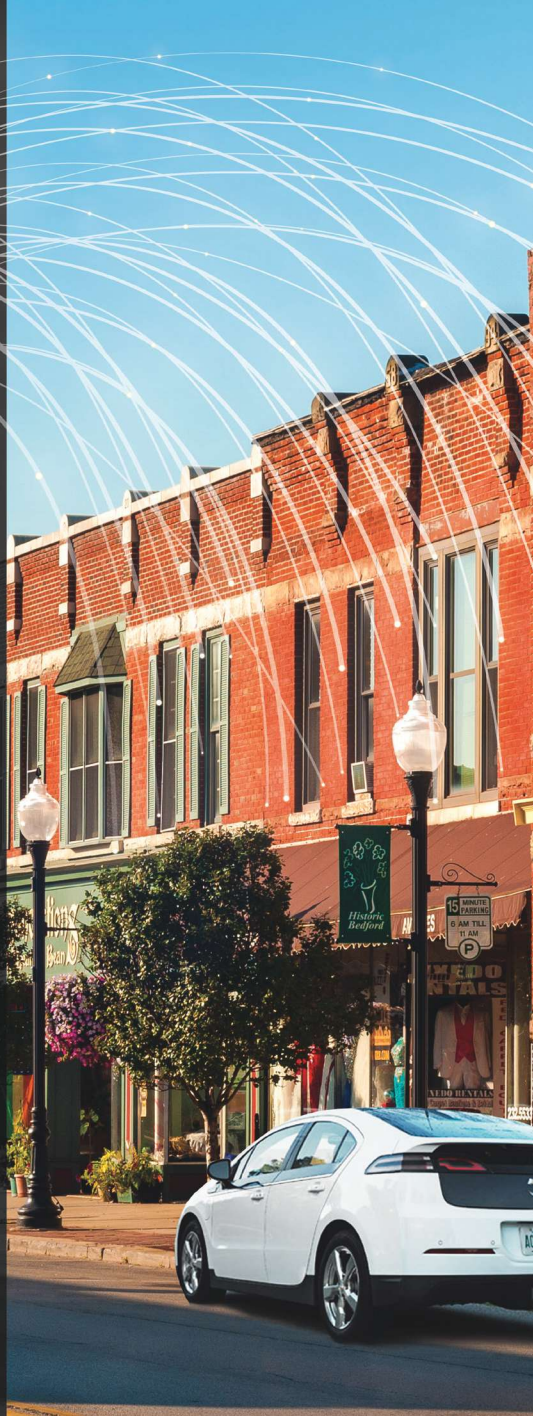

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Pavlov Media

www.pavlovmedia.com/

Founded more than 20 years ago, Pavlov Media is the largest private provider of broadband services in the off-campus student housing space. The Champaign, Illinois-based company provides a variety of IP services, including broadband, leasing office support and cable television. Currently, Pavlov Media serves nearly 200 communities in 43 states and Canada, and by the end of this year, the company will support 145,000 beds.

The company is the only MDU provider that offers a national network backbone with 15 data centers and fiber optic services. Additionally, Pavlov Media is directly peered with more than 170 content providers, which gives its communities direct access to the most popular content and improved performance.

Pavlov Media has put several properties in direct connection to its fiber optic networks in across the country, including Champaign, Illinois; Statesboro, Georgia; Starkville, Mississippi; and Lubbock, Huntsville and Waco, Texas. The direct connection provides gigabit internet capability and removes bandwidth circuit issues that are often experienced through third-party providers.

The company continues to expand its national backbone, including recently launching new locations in Los Angeles and Texas, and it plans to add fiber optic services in several additional communities.

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We help clients by providing a solution that is scalable and carrier neutral. You can rest easy knowing that you are not just relying on Synergy but following best practice network guidelines that are readily available and documented.

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In business for four decades, Thermo Bond Buildings has provided buildings for thousands of companies, including eight of the 10 largest market cap companies in the United States. We manufacture turnkey FTTH and ILA buildings and are quickly becoming the nation's leader in modular data centers. We offer lightweight, metal and concrete solutions in virtually any size to support your equipment. Our lightweight buildings feature composite fiberglass aggregate siding or a variety of architectural finishes. For applications that require a hardened facility, Thermo Bond's precast concrete buildings are naturally resistant to bullets, vandals and fire. We offer either standard or fully integrated buildings built to your specifications. Our experienced technicians and licensed electricians can lower your overall site costs by engineering, procuring and installing your specialized equipment. We also factory test all equipment to ensure quality and reliability. Thermo Bond provides quality workmanship, friendly customer service, flexible integration capabilities and dependable, on-time delivery.

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XFINITY Communities™

XFINITY Communities provides your property and residents with a better network, better entertainment and better service. With fiber-based custom network solutions, a one-of-a-kind interactive TV experience with XFINITY X1, and our new dedicated property support, we provide an end-to-end service that simply translates to better living. Our Advanced Communities Network (ACN) – a fiber network solution that provides your properties with gigabit speeds – can help attract new residents while giving existing residents what they want. Plus, at Comcast, we're driven to create the best entertainment and online experiences for your residents – from X1 to the fastest in-home Wi-Fi, and more. And just as you strive to give your residents a superior customer experience, we are dedicated to doing the same with new property-focused community account representatives (CARs), round-the-clock live support and a network monitored 24/7 for consistent, reliable service. With XFINITY Communities, it just keeps getting better. ❖

The Connect America Fund Reverse Auction

The FCC's Connect America Phase II reverse auction gives competitive providers a shot at getting USF support to build broadband networks in unserved rural areas where incumbent providers have chosen not to build. The process is complicated – at best.

By Douglas Jarrett / *Keller and Heckman LLP*

On August 4, 2017, the FCC released its public notice and technical guidance outlining the structure and procedures for the Connect America Fund Phase II (CAF II) reverse auction ("the auction" or "Auction 903"). Up to $198 million per year for 10 years of ongoing support ("the budget") for fixed broadband networks will be available in the auction.

Auction 903 has generated extensive interest among diverse groups because it is open to entities such as rural electric cooperatives, wireless internet service providers and municipalities, not only to incumbent local exchange carriers (ILECs).

The areas included in Auction 903 are principally those in the 2015 statewide offers declined by the price-cap ILECs and areas included in qualified, non-winning, category 1 bids under the FCC's rural broadband experiments, subject to the FCC's final determination of eligible census blocks, as discussed on page 63. The funds declined by Verizon for New York state are being distributed in conjunction with an auction being administered by New York. Subject to several important distinctions, the auction procedures will track those followed in the 2012 mobile broadband auction and those for the next mobile broadband auction, referred to as MF-II.

The outcome of Auction 903 will set an important precedent. In four years, the funding accepted by ILECs under the 2015 statewide offers – more than $1.5 billion per year – expires. If the auction meets expectations in terms of competitive bidding and deployment of broadband networks, a reverse auction may be used to disburse that $1.5 billion in annual funding.

Finalizing the auction principles took years, as consensus among commissioners proved difficult to achieve. The FCC projects that the auction will be conducted in 2018, as the online bidding system is now under construction.

Aspects of the proposed bidding procedures may be modified based on comments filed in response to questions posed in the public notice, but the core components will be the previously adopted weights for broadband transmission speeds and latency; a single, multiple-round reverse auction; and the budget.

In the auction, bidders will compete against all other bidders looking to secure funding ("cross-area competition") and against other bidders placing bids for the same areas ("intra-area competition").

This article outlines a complicated, multistep process but does not address every aspect or permutation of the auction's principles and procedures. It is an introduction to the bidding procedures as currently envisioned and to key

concepts. The public notice and the technical guide total approximately 60 pages, and the FCC will release at least one more public notice or decision prior to the auction. The FCC has conducted one webinar already, will likely conduct others and may conduct a mock auction. In addition, prospective bidders must familiarize themselves with the buildout requirements and the rules governing the rates they can charge for broadband and voice services made possible by support payments obtained as winning bidders.

CENSUS BLOCKS AND CENSUS BLOCK GROUPS

Census blocks and census block groups are the geographical units upon which Auction 903 will be built. The FCC selected census block groups as the minimum bidding area. Census blocks in which no service provider offers 10/1 Mbps fixed broadband service will be eligible for funding. The FCC will release the final list of census blocks at least three months prior to the auction, based on data from the latest Form 477 reports. Bids might not be placed for all areas, and some areas for which bids are placed likely will not receive funding.

RESERVE PRICES

The reserve price, or miminum bid, for each area will equal the average cost to provide broadband and voice services to the unserved locations in each block of the census block group. There are two sets of census blocks: high-cost areas, for which the average cost exceeds $52.50 (the amount end users are expected to pay) but is less than $198.60 per location, per month, and extremely high-cost areas, for which the average cost exceeds $198.60. The reserve price for extremely high-cost locations is capped at $146.10 per location per month ($198.60 minus $52.50). A separate program, the Remote Areas Fund, will support service to extremely high-cost areas for which there are no winning bids under Auction 903.

QUALIFICATIONS AND SHORT-FORM APPLICATION

All applicants looking to bid in Auction 903 must file a short-form application with the FCC in advance of the auction. This form elicits information on the bidder's identity, includes the customary certifications required for all FCC applicants, and asks whether the entity is affiliated with other entities bidding in the auction or is part of a joint-bidding consortium. An applicant must also demonstrate its experience in operating broadband or other networks, including electric distribution networks, and demonstrate its financial resources.

Each prospective bidder must also disclose the kind of network it plans to deploy in terms of the transmission speed tiers and latency measures set out in Table 1. To demonstrate that it will use the funds to serve all high-cost and extremely high-cost locations, each bidder must disclose a reasonably detailed network design and a business plan. The FCC staff will review these network and business plans and can request additional information if it identifies gaps. The staff's final assessment will determine whether the applicant qualifies to participate in the auction.

CAF AUCTION 903: SUMMARY

- This auction will award $1.98 billion over 10 years to connect underserved areas in which price-cap carriers declined to build broadband, as well as some areas originally listed in the Rural Broadband Experiment.
- The auction is open to all types of entities, public and private, that have experience operating networks and can meet other requirements. Bidding consortia are allowed.
- The minimum bidding area is a census block group, but bidders can propose to serve multiple and extended areas.
- The auction is a reverse auction, in which the winning bidder is the one that requires the lowest amount of support funds. Bidders start high and bid lower in each round until the aggregate support requested fits within the overall budget.
- Bidders cannot propose to receive more than the average connection cost for each census block (less in extremely high-cost locations).
- Bidders must demonstrate basic technical and financial competence.
- Bids are weighted to favor networks with high bandwidth, high data caps and low latency.
- Applicants have some flexibility to change the areas they bid for in each round.
- If bidding areas overlap, the FCC has some flexibility to reduce the sizes of bidding areas to eliminate overlaps.
- The second-price rule dictates that the winning bidder actually receives the support payment bid by the runner-up. This saves bidders from having to guess what others are going to bid. In addition, bidders receive information to let them know how close the budget is to clearing.
- If two bidders bid equal amounts in the clearing round to serve the same area, bidding continues for that area on an intra-area basis until a winner emerges.
- The successful bidder for each area must complete a long-form application and obtain eligible telecommunications carrier status.

Competitive providers can now win CAF support to build broadband in high-cost rural areas where price-cap incumbents declined to build.

Each applicant's short-form application must disclose the state or states in the which it plans to bid. There is no restriction on the number of states and no maximum number of areas in which an applicant can bid, although the FCC asked whether a maximum should be established. An applicant is not required to disclose the areas in which it plans to bid. This short-form application information will not be available to the public.

BIDDING BASICS

A bidder can bid for a single area or multiple areas. It can submit a separate bid for each area, one or more bids for multiple areas (referred to as package bids), or a combination of single-area and package bids. A bidder's single-area and package bids cannot include the same area. Package bids must be limited to areas in a single state. As discussed below, the FCC adopted rules for package bids to prevent all-or-nothing bidding and because of the likelihood that multiple package bids could cover the same areas (overlapping bids).

The auction is described as a multiround descending clock auction. Bidders must understand the bidding procedures and the FCC's criteria for selecting winning bids to determine their bottom-line bid amounts. The auction is structured to incentivize bidders to bid in each round. A bidder can place bids for areas for which it did not bid in earlier rounds prior to the clearing round, subject to a maximum switching percentage.

As in other auctions, the FCC will allow multiparty bidding groups and consortia, but applicants must disclose all members of a group in the short-form applications. Affiliates under common control will be subject to the same disclosure requirements. To minimize collusion, only one party to a joint bidding arrangement or one affiliate can bid in a state.

TRANSMISSION SPEED TIERS AND LATENCY WEIGHTS

In February 2017, the FCC determined the weights that would be added to Auction 903 bids, assigning the highest weights to bidders proposing networks having the lowest broadband transmission speeds and high latency technologies. Networks based on the highest transmission speed tier and the low latency category, typically fiber-based networks, will be given zero weights. (Having a lower weight is an advantage.) Table 1 shows the performance tiers and latency categories.

KEY CONCEPTS AND BIDDING PROCESS

The weights, the budget and the likelihood of package bids with overlapping areas add complexity to this descending clock auction. The FCC uses declining percentage bidding to normalize bids among entities whose proposed networks have different weights. In each round, the percentage of the available reserve price per area will decline at a defined decrement, tentatively set at 10 percent, which the FCC can also adjust between rounds.

Entities can bid at the lowest percentage of each decrement – the so-called base clock percentage – or any intermediate point between the base clock percentage and the previous round's base clock percentage. For example, if the base clock percentage is 80 percent and the previous round's base clock percentage is 90 percent, a bidder can bid anywhere from 80 percent to 89.99 percent. A bidder's percentage bid is referred to as its price point.

After each round, the bidding system calculates the dollar value of each area bid. This is referred to as the implied support amount. The weights and the bidder's price point are the variables in

TABLE 1: WEIGHTS ASSIGNED TO PROPOSED BROADBAND NETWORKS

PERFORMANCE TIER	SPEED	USAGE ALLOWANCE	WEIGHT
Minimum	10/1 Mbps	150 gigabytes	65
Baseline	25/3 Mbps	150 gigabytes or U.S. median, whichever is higher	45
Above Baseline	100/20 Mbps	2 terabytes	15
Gigabit	1 Gbps/500 Mbps	2 terabytes	0

LATENCY	THRESHOLDS	WEIGHT
Low	≤ 100 ms	0
High	≤ 750 ms and mean opinion score of 4	25

calculating the implied support amount for each bid. The FCC's explanation, slightly paraphrased:

> *For a given area and a given tier and latency combination, the implied annual support amount in a bid varies with the price point and is calculated using the following formula:*

$$\text{implied support} = \min\left\{R, \left(\frac{PP - (T + L)}{100}\right)R\right\}$$

where

- *R denotes the area's reserve price*
- *T denotes the tier weight*
- *L denotes the latency weight.*

For example, if two bidders propose networks with different tier and latency combinations and bid the same price point for an area, such as the base clock percentage, the implied support for the entity bidding the highest tier and low latency combination (lowest weight) will have a higher implied support amount.

At the end of each round, the bidding system sums up the highest implied support amounts for each area (or the implied support amount for the only bid in an area) to determine whether the total clears the budget – that is, whether the aggregate of implied support amounts for all bids is at or below the budget of $198.0 million x 10. If not, bidding continues to the next round and so on until the budget clears. The round in which the budget clears is referred to as the clearing round.

The opening clock percentage for each area is another key concept. For each area, it is equal to highest opening clock percentage of any bidder for an area: the area reserve price (100 percent) plus the tier and latency weights. Recall that the weights for a minimum-tier, high-latency network equal 90 (the maximum weight combination), and the network design with the gigabit tier and low latency (the lowest weight combination) equals zero.

Thus, in an area in which one bidder proposes a network design with the maximum weight combination, the opening clock percentage is set at 190 percent. If all bidders in an area propose networks with the lowest weight combination, the opening clock percentage for that area is 100 percent. Thus, the implied support amount for the bid that has the highest opening clock percentage in an area declines more quickly in successive rounds than the implied support amount for bids that propose lower-weight networks.

Bidding continues for multiple rounds, with bids declining in each round until the aggregate across all areas fits within the overall budget cap.

ACTIVITY AND SWITCHING PERCENTAGE

Auction 903 is structured for bidders to bid in each round. This is achieved by setting an activity metric. A bidder's activity equals the implied support amounts for all areas for which it bids during a round. A bidder's activity declines in each round. To provide some flexibility, a bidder can bid in areas in which it did not bid in prior rounds, up to the switching percentage, which is tentatively set at 10 percent of the bidder's activity. However, a bidder cannot bid in a round if it did not bid at all in the previous round.

PACKAGE BIDS

Recognizing that most bidders will prefer to provide service to large geographical areas, such as a county, the FCC adopted a set of rules for package bids, or bids for more than one area in a state. The areas in a package bid do not have to be contiguous. A bidder can bid any combination of single-area and package bids in a state, but it can place only one bid per area. A bidder can reduce the number of areas in a package bid from one round to the next, but it cannot increase the number of areas in the package.

Because of the likelihood that package bids may include some, but not all, areas included in single-area bids or in other package bids, the FCC adopted a mechanism to prohibit "all or nothing" bids that could limit competitive bidding or inadvertently exclude areas from the auction. Thus, all package bids must include a minimum scale condition: a percentage of the sum of all implied support amounts for the areas in the package. When placing a package bid, a bidder agrees to provide service (at the specified performance tier and latency) to all areas in the package *or* to a subset of areas determined by the minimum scale percentage. The FCC is considering setting a minimum scale percentage at 80 percent, requesting comment on what this percentage should be.

The subset of areas awarded to a package-area bidder may not correspond to the bidder's priority of preferred census block groups. Table 2, adapted from the FCC's technical guidance document, illustrates this point.

Areas in package bids are assigned per the principles outlined below for single-area bids, subject to the qualification that the uncontested areas in the package bid must meet the minimum scale percentage. Unassigned areas in a (partial) winning package bid are carried forward to the next round for single-area bidding. Potential bidders can gain a fuller understanding of how areas in package bids are assigned by reviewing the examples in the FCC's technical guidance document.

THE CLEARING ROUND

As noted above, the clearing round is the bidding round in which the budget clears. In earlier rounds, bidders engage in cross-area competition against all other bidders for a portion of the budget. During these rounds, each bidder receives feedback from the bidding system for each area in which it is bidding and, between rounds, the extent to which current bids exceed the budget. (This feedback is described more fully below.) The rules governing

TABLE 2: EXAMPLE OF MINIMUM SCALE CONDITION RULE

A bidder develops a package bid for areas 1, 2, 3, and 4, the FCC sets the minimum scale condition at 80 percent, and the bidder places a bid in a round for which the base clock percentage is 75 percent.

AREA	RESERVE PRICE	TIER WEIGHT	LATENCY WEIGHT	IMPLIED SUPPORT AT THE 75% PRICE POINT
1	$120	15	0	$72
2	$140	15	0	$84
3	$160	15	0	$96
4	$200	15	0	$120

The sum of implied support amounts for the whole package is $72 + $84 + $96 + $120 = $372. For a subset of areas to be assigned, the total implied support amounts must be at least 80 percent of $372, or $297.60. The bidder can be assigned areas 2, 3 and 4, because the sum of the implied support amounts is $84 + $96 + $120 = $300, or more than 80 percent of $372, but not areas 1, 2 and 3, because the sum of the implied support amounts is $72 + $84 + $96 = $252, less than 80 percent of $372.

the assignment of bids and the amount of support awarded varies depending on whether a bid is assigned during or after the clearing round.

In the clearing round, the bidding system

- Determines which bids can be assigned
- Calculates the clearing price point, the highest price point in the round at which the aggregate cost for assigned areas and the dollar value of bids under the second-price rule is less than or equal to the budget (the clearing price point determination)
- Calculates the support payments based on the second-price rule.

The second-price rule is used to encourage truthful bidding, per economic theory. Under the second-price rule, the support amount equals the clearing price point or the bid of the second-highest bidder. Thus, the actual payment will be higher than the implied support amount of a winning bid.

Bids are first assigned to bidders that bid at the round's base clock percentage if there are no other bids for the area or if all other bids are at higher price points. Then, bids are assigned in areas in which one or more bids are above the base clock percentage but below the clearing price point. The lowest bid below the clearing price point is assigned. The support payments are calculated under the second-price rule – the winning bidder that bid at the base clock percentage receives a support payment equal to the clearing price point. If two bidders are below the clearing price point, the support payment equals the higher bidder's price point.

In areas in which two or more entities bid at the base clock percentage, bidding continues to the next round. These are referred to as carried forward bids. Bidders that bid above the clearing price point in the clearing round cannot continue to bid.

BIDDING AFTER THE CLEARING ROUND

After the clearing round, all bidding is intra-area. If only one bidder bid at the base clock percentage for the round, its bid is assigned; the support payment is equal to the previous round's base clock percentage. The lowest bid below the clearing price point is also assigned. If contested (two or more bidders at the base clock percentage), bidding goes to the next round. If no bidding occurs in a round in which the previous round was contested, the bidding system will randomly select the winner among the bidders from the previous round. No switching is allowed after the clearing round. Areas not included in bids assigned during the clearing round will not be funded during Auction 903, except areas in the carried-forward bids.

For package bids during and after the clearing round, the same rules apply; in addition, the minimum scale percentage must be satisfied.

INFORMATION PROVIDED TO BIDDERS

The bidding system provides information to bidders during each round; the information provided in rounds prior to the clearing round is different from the information provided during and after the clearing round. Prior to the clearing round, bidders are apprised of their activity and the number of areas bid. After the clearing round, the data provided includes the annual support the bidder has received, data on implied support for its carried-forward bids and the areas still being bid.

Prior to the clearing round, each bidder is provided between rounds with the aggregate cost (sum of all implied support amounts per bid area) for *all* bids in the round. This gives the bidder an idea of how close the budget is to clearing. For each area bid by the entity, the number of bids at the base clock percentage (0, 1 or greater than one) is provided. After the clearing round and each subsequent round, the feedback includes the bidder's areas assigned and the support amounts, areas assigned to other bidders and the number of bids at the base clock percentage for the areas bid in the previous round.

POST AUCTION LONG-FORM APPLICATION PROCESS AND SUPPORT PAYMENTS

A winning bidder must also submit a letter of credit (LOC) from a qualified financial institution for each state in which it is a winning bidder. The LOC must be maintained until the

winning bidder constructs its network to provide service to all locations before or as it satisfies the six-year buildout requirement, as certified by USAC. Again, prospective bidders should fully understand these requirements *prior to* the auction.

The other significant requirement is that a winning bidder must submit proof of its eligible telecommunications carrier (ETC) designation, as required under Section 214 (e) (2) of the Communications Act, from the relevant state commission(s) within 180 days after the FCC's public notice announcing the winning bidders or from the FCC if a state does not grant ETC designations.

CLOSING THOUGHTS

Reverse auctions have captured the imaginations of policymakers and pundits. These bidding procedures and related rules set a high bar for participation that prospective bidders should evaluate fully. The best perspective may be that complexity is in the eye of the beholder. Based on the involvement of various interest groups in developing the rules for Auction 903, electric cooperatives, major satellite operators, ILECs, rural cable operators and wireless internet providers want to participate in this auction even though only $198 million out of the $4.5 billion high-cost program's annual budget is being offered. If this interest translates into meaningful auction participation and broadband networks are built in unserved rural areas, the time and resources will have been well spent. ❖

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Clean Up Your Act

Fiber networks are more reliable when the installation is kept clean.

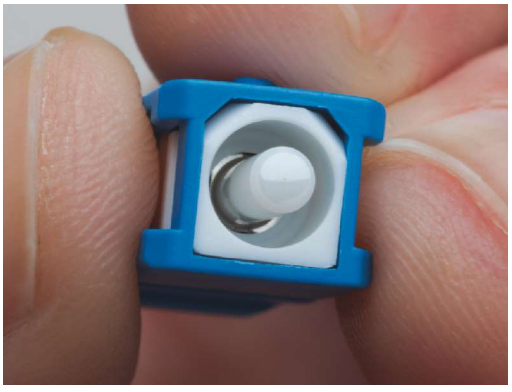
By Mike Jones / *MicroCare Corp.*

Modern societies have an apparently limitless desire for greater connectivity. From Facebook to video on demand to mobile cloud computing, the demand for digital data appears to be infinite and insatiable. Broadband access has become a crucial link in every aspect of people's lives, affecting jobs, medical care, security and even the congestion on the highways.

Because of the utility, ubiquity and affordability of broadband data, end users are demanding. They expect uninterrupted data services. Reliable, trouble-free fiber optic networks are the key to the interconnected future. Maintaining all that fiber can be problematic, but cleaning fiber is the single most important task a tech in the field can accomplish to ensure that a fiber network achieves its design goals.

According to numerous industry sources, properly cleaning fiber connectors can eliminate 80 percent or more of all network problems. Cleaning is critical to the long-term reliability of any network and at the heart of the profitability of a successful fiber deployment.

Field technicians must be taught the proper procedures to clean fiber. They must be provided the right tools. Managers must include the cost of cleaning in their budgets and quotes. And end users should demand proof of cleaning from installers, including, both sides of every end face, every time a fiber is installed, tested or reconfigured.



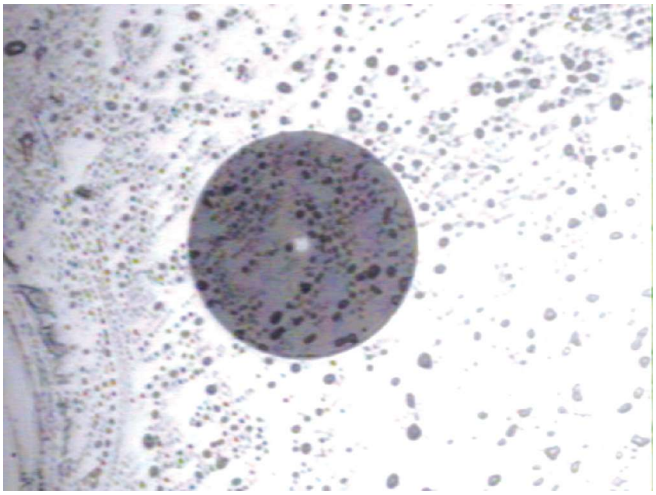
The fiber end face is where the rubber meets the road. Only perfectly clean end faces can enable fiber networks to achieve their maximum potential.

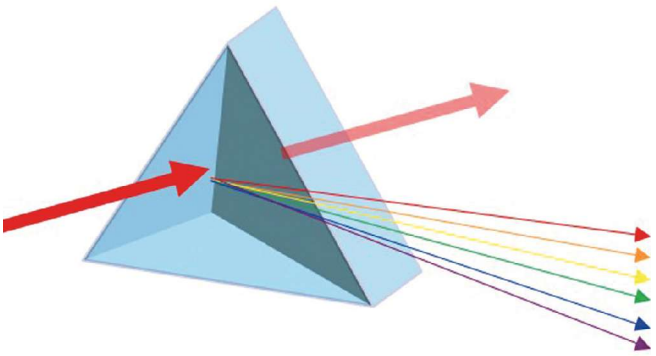
Properly cleaning fiber connectors can eliminate 80 percent or more of all network problems.

CONTAMINATION AFFECTS SIGNALS

Contamination is defined as anything on an end face that should not be there and is removable. It includes fingerprint oils, lint from clothing, moisture, exhaust fumes, outgassed plasticizers from protective dust caps, plastic particles from connector wear and simple dust. Each type of contamination causes different problems, but all types must be removed.

Consider fingerprint oils. This thin liquid contains numerous compounds, salts and fluids that can create air gaps between end faces. The





Translucent liquid contamination is particularly troubling for fiber networks because the fluid changes the refractive index of the fiber, which can spray different optical frequencies unpredictably.

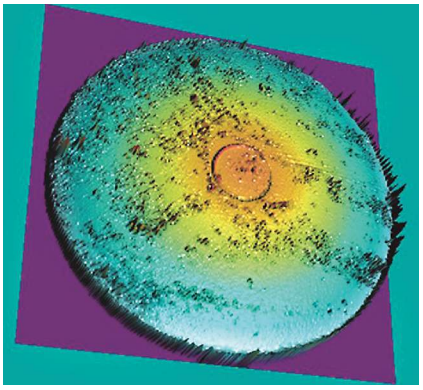
air gaps cause insertion loss (the signal weakens) and back-reflection (the signal is diverted back to its source).

Light is made up of different wavelengths. If a fiber end face is coated with oil, the contamination changes the index of refraction engineered into the fiber. This will change the path of the signal through the fiber. The changed path is known as chromatic aberration. If the contamination is very severe, the refraction angle can change enough for the signal to be completely lost. This is particularly acute in wavelength-division-multiplexed fiber systems, which use different colors of light to load more channels into the fiber. The higher the frequency of the light, the greater its sensitivity to changes of the refractive angle. This means that fast modern networks are more vulnerable to contamination.

DON'T LET THE DUST SETTLE

Dust can have a huge impact on network reliability. The environment is loaded with airborne dust that can play havoc with fiber end faces: plant pollen, exhaust particulate and skin particles are just a few sources. Like oil, these microscopic particles create air gaps between end faces. This can result in back-reflection, signal attenuation, instability in the laser system or even a complete system shutdown.

Dust also can scratch the surface of the fiber if particles are trapped between two terminus end faces. At a microscopic level, the two end faces are jammed together with a great deal of pressure. A rigid chunk of dust between the two end faces can pit or scar the end faces beyond repair.



Most field techs carry optical inspection scopes to examine end faces, but interferometers offer a richer, more detailed look at the contamination in all three dimensions.
Photo courtesy Promet Optics

Once dust has found its way onto a fiber end face, it can become locked in place by static. Static can be generated on an end face in several different ways, but the most common is simply wiping an end face with a dry wipe while cleaning. This creates friction, and the friction creates static. Other activities that can produce a static charge include

- Using foam swabs to clean an end face
- Cleaning with only compressed air
- Inserting a connector into or removing it from an adapter during mating
- Removing the protective end cap from a connector
- Connecting the fiber to test equipment multiple times.

To eliminate static during cleaning, iNEMI, IPC and other organizations strongly recommend "wet-dry" cleaning with the use of a static-dissipative fluid.

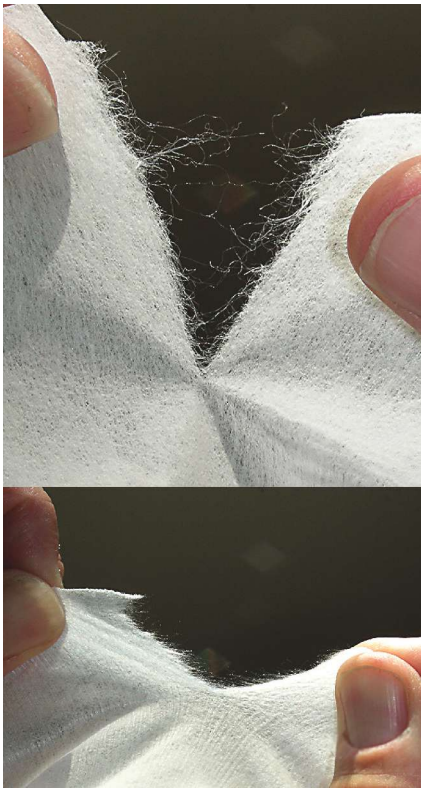
The components of a fiber connector are made from nonconductive materials such as plastic, ceramics, glass and epoxies. This means there is no path for the electrostatic charge to dissipate, so a charge remains on a connector end face indefinitely, sometimes even for months. Even if the central contact zone initially was clean, an electrostatic charge can cause dust to migrate from the outer regions of the ferrule toward the ferrule apex in the contact zone. The dust particles will be locked tightly to the ferrule surface as if the end face were a magnet.

Introducing a static-dissipating cleaning fluid creates a conductive path that makes it easy to physically wipe away dust and other debris. The most effective cleaning process to solve the static problem is using a nonflammable, high-purity, optical-grade cleaning fluid. Isopropyl alcohol (IPA) purchased from the local pharmacy is not a suitable fluid.

Technicians should be trained to clean fiber effectively and provided with the equipment that works best for the job at hand. They should clean every end face, every time.

CHOOSE THE RIGHT FLUID

Although IPA may be your cleaner of choice, it is not the way to go. Traditionally used to clean fiber, IPA contains hygroscopic molecules that absorb moisture from the air. This is especially apparent with the old-style pump bottles that often are used in the field. These bottles rarely are cleaned, adding another source of cross-contamination.



Many field techs are provided cheap paper wipes to clean their end faces, but these can cause static and leave particulate on the end faces. A cheap paper wipe (top) is easily ripped, and many fibers are released, but a stronger, cleaner fabric wipe is much stronger, resists shredding and is less likely to leave fibers on the end faces.

Water trapped in the alcohol slows the drying process. This means more time is needed to evaporate the liquid from the end face. Some techs and engineers may use canned air to speed the cleaning and drying of the fiber, but all this does is increase the static charge and push the debris around the area being cleaned.

When choosing a cleaning fluid, ensure that it is fast-drying and nonflammable, has a low surface tension and dissipates static. Fast drying time is especially important for cleaning fiber, as it keeps moisture from being attracted to the fluid and therefore stops contamination. Using a specially designed fiber cleaning fluid and a lint-free wipe will achieve optimum results.

Alcohol is no longer suitable for cleaning modern fiber optic networks. A much better choice that will lower network maintenance costs is a nonflammable, water-free, fast-drying fluid packaged in a sealed, nonrefillable container. Here, a lint-free fabric wipe is dampened from a convenient pump bottle dispenser.

Another key point to look out for is the packaging of the cleaning fluid. Make sure it is hermetically sealed to prevent cross-contamination. Refillable pump bottles are simply not up to the task and will contaminate the fiber even more.

Also make sure always to clean both ends of a connector pair just before mating. Don't forget to clean new jumpers and patch cords; even protective end caps do not guarantee cleanliness.

If a stick is used to apply cleaning fluid, use one stick per end face to avoid cross-contamination and rotate sticks in only one direction. "Clicker" cleaning tools are extremely convenient and quick. They are a good option for light contamination; however, out in the field, where high contamination is likely, the best option is cleaning fluid and wipes.

EDUCATION IS KEY

Education is key to prevent network failure caused by contamination. Technicians need to be trained to clean fiber effectively and provided with the equipment that works best for the job at hand. Make no assumptions about the cleanliness of end faces even if the fiber and its connectors are new. Expecting a patch cord from the factory to be pristine is unrealistic. Clean and inspect every end face, every time.

Find a cleaning method that is quick and effective, and it will future-proof your fiber installations. Seek the help of an experienced vendor that specializes in fiber cleaning and can advise you which method will work best for you.

Modern, proper cleaning procedures save time and money because they make a network more reliable. Expensive warranty claims and repair visits will be significantly reduced. Don't cut corners. Do the job right the first time, and clean! ❖

Mike Jones is vice president of MicroCare Corporation, which develops critical cleaning products and processes for companies that demand perfectly clean parts. Contact him at MikeJ@MicroCare.com and visit www.microcare.com to learn more.

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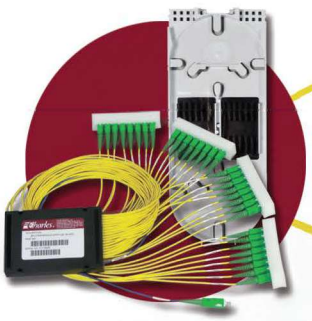

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FCC Should Focus On Broadband Experience

In its annual assessment of the state of advanced telecommunications capability, the FCC should forget about speed and focus on the capacity to provide an excellent broadband experience.

By Heather Burnett Gold / *Fiber Broadband Association*

Since 1996, the Federal Communications Commission has been required by Section 706 of the Telecommunications Act to release an annual report that assesses the state of advanced telecommunications capability in the United States and to adopt measures to further deployments. The FCC's approach has remained largely the same over the past two decades: It measures the market based on broadband speeds. After all, providers have always sold broadband based on speed.

Times, however, have changed. The Fiber Broadband Association recently proposed a different approach that could fundamentally change the way the FCC assesses broadband health in the United States. We recognize that consumers and broadband providers have moved beyond speed and that broadband experience is now the measure for success. Given that everyone understands that the best broadband experience comes from all-fiber networks, the path forward is clear: The FCC should focus on fiber.

Fiber gives U.S. consumers the broadband experiences they want – the whole package, not just impressive speeds. Sure, fiber provides the fastest symmetrical speed, but more important, it enables the most reliable, high-quality, low-latency service possible. It's also built to last. Unlike copper and coaxial cable, which require periodic replacements and repairs, fiber is future-proof. Consumers want the broadband experience fiber can provide, and they're willing to pay for it. People are willing to pay, on average, 8 percent more to rent and 2.8 percent more to buy an apartment equipped with fiber.

Consumers aren't the only ones with their eyes on fiber. Wireless providers also understand how important fiber is; that's why they use it to link their cell sites. As Kyle Malady, Verizon's senior vice president and chief network officer, recently said, "Fiber is basically the nervous system of the networks of the future." It's no wonder that providers across the country – from AT&T, Comcast and Cincinnati Bell to i3 Broadband, Chariton Valley Telephone and Shentel – are increasing their spending on fiber networks and touting fiber's capability to attract and retain customers.

Providers are also preparing for the fiber future. In a recent survey of 172 rural broadband providers, NTCA – The Rural Broadband Association found that 82 percent had developed long-term fiber deployment strategies, a notable increase from 74 percent in 2015. Sixty-six percent of respondents planned to be able to provide fiber networks to half or more of their customers by the end of 2019.

The market has evolved to the point that all-fiber connectivity is everyone's new broadband benchmark, and it is time the FCC got on board. In comments to the FCC, the Fiber Broadband Association urges the FCC to adopt an "all-fiber" metric – examining whether customers have access to all-fiber networks – to assess the United States' advanced telecommunications.

For the FCC to accurately assess access to broadband technology, speed cannot be the primary metric. The FCC should measure by the technology that can actually provide high-performance, future-proof broadband service: fiber. Robust fiber networks are essential to adequately meet community and enterprise needs, and they have what it takes to move the United States' digital potential to the next level. For that to happen, Americans must first have access to fiber.

The Fiber Broadband Association's comments to the FCC also urge the FCC to take steps to encourage and enable faster deployment of all-fiber networks. Tackling barriers to entry and excessive regulation will accelerate deployment to all consumers throughout the United States and fast-track a healthier, better, sufficient – read, all-fiber – state of broadband.

As the FCC considers the comments it received and prepares this year's Section 706 report, all of us at the Fiber Broadband Association will continue to advocate for the benefits of fiber – and fiber will continue to provide top-notch access to broadband. ❖

Heather Burnett Gold is president and CEO of the Fiber Broadband Association, a nonprofit organization whose mission is to accelerate deployment of all-fiber access networks. You can contact her at hbgold@fiberbroadband.org.

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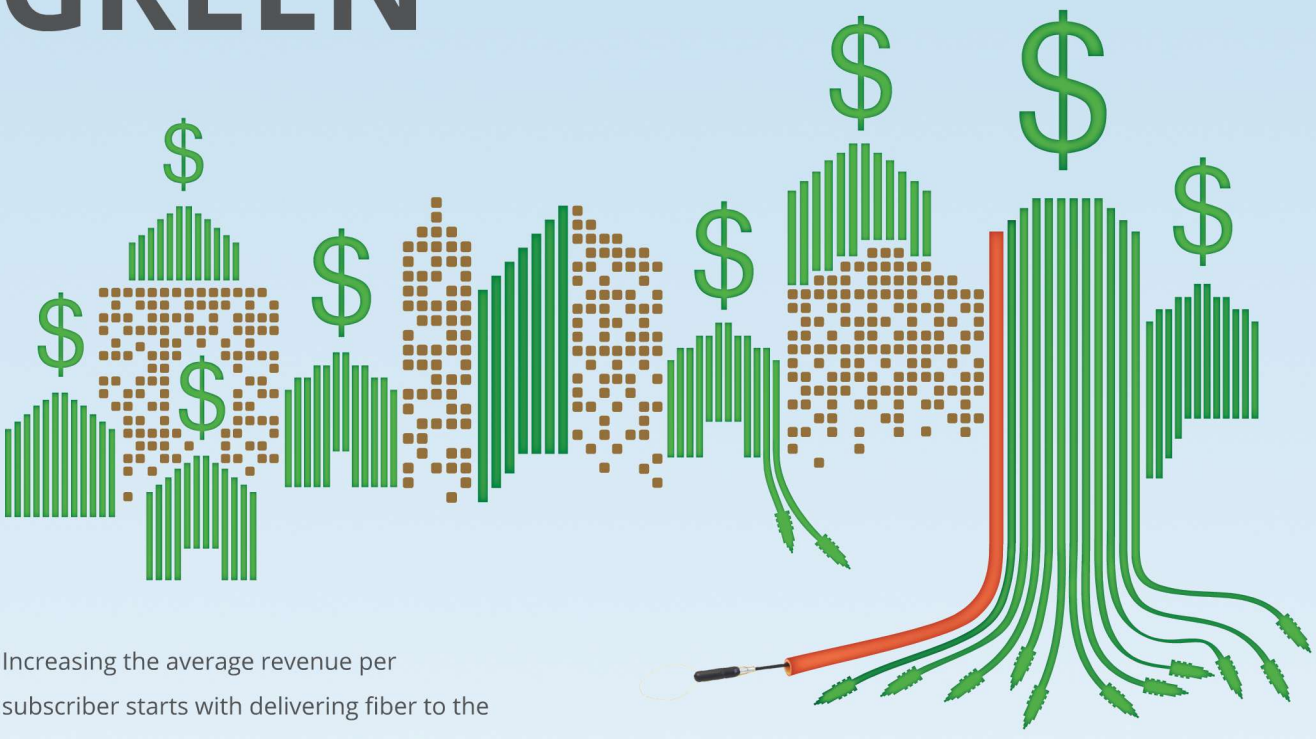

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