





At BBC Summit 2021, we're excited to meet again in person with a focus on rekindling our connections and taking ACTION in a post-pandemic economy. It's about both experienced and new voices driving change, innovation, and evolution in the broadband business to create a more connected future.

Register now and get ready to DO MORE.

NEW FOCUS AREAS & FEATURES

Industry Power Players • Up-and-Coming Voices • Legislative Action Entertainment Industry • Roundtable Problem-Solving Sessions Office Hours for Speakers & Industry Leaders

Special Discounted Rate: **\$350** Use VIP Code: **Houston2021** (Save \$600 off regular Summit price of \$950) Offer expires May 31, 2021

FIBER: TRANSFORMING THE POST-PANDEMIC ECONOMY

Secure your position now so that promotion of your participation begins immediately.

See who's already decided to do so:

PLATINUM SPONSOR:



ENHANCED GOLD SPONSORS:





GOLD SPONSORS:





SILVER SPONSORS:





FEATURED SPONSOR:



















































EDITOR'S NOTE

BroadbandCommunities BUILDING A FIBER-CONNECTED WORLD MAGAZINE

CEC

Barbara DeGarmo / barbara@bbcmag.com

PUBLISHER

Nancy McCain / nancym@bbcmag.com

EDITOR-IN-CHIEF

Sean Buckley / sean@bbcmag.com

CONTRIBUTING EDITOR

Masha Zager / masha@bbcmag.com

EDITOR-AT-LARGE

Steven S. Ross / steve@bbcmag.com

COPY CHIEF

Eli Penberthy / eli@bbcmag.com

ADVERTISING SALES ACCOUNT EXECUTIVE

Irene Prescott / irene@bbcmag.com

EVENTS COORDINATOR

Dennise Argil / dennise@bbcmag.com

MULTIFAMILY NEWS CORRESPONDENT Valerie M. Sargent / valerie@bbcmag.com

ART DIRECTOR

Karry Thomas

CONTRIBUTORS

Rollie Cole, Sagamore Institute for Policy Research David Daugherty, Clarus Broadband Heather Burnett Gold, HBG Strategies Joanne Hovis, CTC Technology & Energy Trevor Jones, OTELCO Michael A. Kashmer, Digital Broadband Programming Consultant W. James MacNaughton, Esq. Christopher Mitchell, Institute for Local Self-Reliance Bryan Rader, UpStream Network Craig Settles, Gigabit Nation

BROADBAND PROPERTIES LLC

CEO

Barbara DeGarmo

VICE PRESIDENT, BUSINESS & OPERATIONS

Nancy McCain

BUSINESS & EDITORIAL OFFICE

BROADBAND PROPERTIES LLC 1909 Avenue G • Rosenberg, TX 77471 281.342.9655 • Fax 281.342.1158

www.broadbandcommunities.com

Broadband Communities (ISSN 0745-8711) (USPS 679-050) (Publication Mail Agreement #1271091) is published 7 times a year at a rate of \$24 per year by Broadband Properties LLC, 1909 Avenue G, Rosenberg, TX 77471. Periodical postage paid at Rosenberg, TX, and additional mailing offices.

POSTMASTER: Please send address changes to **Broadband Communities**, PO Box 303, Congers, NY 10920-9852.

CANADA POST: Publications Mail Agreement #40612608. Canada Returns to be sent to Bleuchip International, PO Box 25542, London, ON N6C 6B2. Copyright © 2021 Broadband Properties LLC. All rights reserved.





Local Broadband Keeps Community Dollars Flowing

Broadband gives communities an opportunity to stay relevant.

hen I think about how broadband can drive community economic development and job creation, I recall my job interview with Sean Griffey, former CEO of Fierce Markets. When I asked why most staff in the telecom group worked remotely, his response was simple: "I want to attract the best people."

Griffey was ahead of his time in understanding that work does not have to be tied to one location. Flash forward to 2020, when the COVID-19 pandemic drove a sharp increase in the number of remote workers who now depend on bandwidth-hungry videoconferencing applications, such as Zoom.

A recent Statista survey revealed that only 17 percent of respondents worked remotely five days a week before the pandemic, but that figure has since jumped to 44 percent.

In this issue of **Broadband Communities** – my first as editor-inchief – we look at communities using broadband to keep themselves relevant in an increasingly online world.

For example, after it could not strike a deal with its two incumbent providers, Bristol, New Hampshire, launched an initiative to deliver symmetrical fiber internet to residents and connect businesses, municipal buildings and educational facilities in the town and nearby university.

Other towns, such as the tourist destination New Shoreham, Rhode Island, committed to build an \$8 million fiber-to-the-premises network to replace slow DSL and satellite with gigabit internet and phone service to every home and business on the island.

The networks in these small towns and others like them across the country have the potential to improve local business productivity, enable telecommuting, drive job creation, and entice younger people to stay. They also can draw new residents, encourage tourism, and strengthen real estate markets.

FOCUS ON LOCAL BROADBAND

For all the possibilities broadband brings to smaller communities, the key challenge is that Tier-1 service providers don't often address communities' unique needs.

The Broadband Equity Partnership found in its national survey of community leaders that although large ISPs received a large portion of federal funding from programs such as the Connect America Fund and now the Rural Digital Opportunity Fund, respondents favored local, smaller ISPs as potential partners.

Dr. Christopher Ali, associate professor in the department of media studies at the University of Virginia, summed it up best during the recent Senate Commerce Committee broadband hearing: "Local broadband is the best broadband." Indeed. By keeping broadband local, communities can reinvest savings to keep community dollars flowing in their local economies. .

Jean Bucklee sean@bbcmag.com

Reliable Network Connections

Through Superior Fiber Optic Solutions



Realizing the need for speed and network reliability, Hexatronic provides complete end-to-end passive system solutions for FTTH, as well as micro cabling systems for smart city, wide area, and long-haul networks utilizing best-in-class blown fiber technology.

The Hexatronic advantage includes:

- Lowest CAPEX and OPEX to provide the highest ROI
- · Fastest speed of network deployment and subscriber connection
- · Maximum scalability & flexibility 5G ready
- Complete training on system design and installation
- Extensive 20-year system warranty

Connect with us: +1 859 554 8877 and at Booth #404 at the Broadband Communities Summit, Sept 27-30, 2021, in Houston





TABLE OF CONTENTS

COVER SECTION: ECONOMIC DEVELOPMENT

National Efforts to Close the Digital Divide Require Local Empowerment /

By Ariel Benjamin, Erman Eruz, Danny Fuchs and David Gilford, HR&A Advisors

- **Broadband Essential to Post-Pandemic Economies** / 26 By Craig Settles, CJ Speaks
- A Fiber Network Spurs a New Northern New Hampshire **Tech Corridor** / By Sean Buckley, Broadband Communities
- **Rural Communities Launch Publicly Owned** 36 **Fiber Networks** / By Michael A. Solitro, Sertex Broadband Solutions
- 4() A Michigan FTTH Network Rebuild Sets Stage for **Greater Bandwidth, Smart-City Applications** /

By Sean Buckley, Broadband Communities

FEATURES

FTTH DEPLOYMENT

Gigabit Fiber Comes to Los Altos Hills / By Masha Zager, **Broadband Communities**

CONFERENCE COVERAGE

INCOMPAS 2021 Policy 48 **Summit Highlights** /

By Sean Buckley, **Broadband Communities**

HOT PRODUCTS

56 **BROADBAND COMMUNITIES'** 20th Annual List of Leading **Broadband Technologies** and Services

TECHNOLOGY

- **Building Competitive** Advantage with Automation / By Sean Robertson, ADTRAN
- 66 The Key to Boosting Network Resilience? It's in the Data / By Gordon Smith, Sagent
- G.hn Is Vital to Gigabit 68 **Broadband Services Rollouts** / Bv Livia Rosu, HomeGrid Forum

INDUSTRY ANALYSIS

- **LEO Satellites: A Path to** 72 Nowhere? / By Deborah Kish, Fiber Broadband Association
- 76 **Pandemic Spurs Broadband Bump** / By Bruce Forey, BroadMax Group
- 78 **Three Big Telco** Predictions for 2021 / By Pravin S. Bhandarkar, RtBrick
- **Can You Trust Your Business** 80 **Case for Broadband Expansion?** / By Raj Singh, VCTI



Visit **www.bbcmag.com** for up-to-the-minute news of broadband trends, technologies and deployments

twitter.com/bbcmag

ABOUT THE COVER

New York artist Irving Grunbaum and his neighbors are finding new economic benefits



IN THIS ISSUE

PROVIDER PERSPECTIVE

Multifamily Broadband 10 Gets a Shot in the Arm /

By Bryan J. Rader, Single Digits

Broadband remains the glue that holds the multifamily broadband industry together.

CONNECTIVITY **MATTERS**

The New Face of 12 **Economic Development** /

By Trevor Jones, OTELCO

The pandemic has redefined economic development for many rural communities.

MULTIFAMILY BROADBAND TECHNOLOGY

How the Pandemic 14 **Created Urgency for Smart-Tech Adoption** /

> By Kevin Donnelly, NMHC and Valerie M. Sargent. **Broadband Communities**

Seamless connectivity is more important as intelligenthome needs rise.

PROPERTY OF THE MONTH

Closing the Digital 16 **Divide for Low-Income** and Special-Needs **Residents: Main Street**

Connect / By Sean Buckley, **Broadband Communities**

The Maryland apartment complex offers symmetrical 50 Mbps internet.

DEPARTMENTS

- **EDITOR'S NOTE**
- 6 **NEW BEGINNINGS**
- **BANDWIDTH HAWK**
- 82 MARKETPLACE ADS
- ADVERTISER INDEX / 84 **CALENDAR**

with broadband.





Exceed residents' expectations with faster WiFi

Set your property apart and attract the residents you really want. Get secure, reliable, best-in-class WiFi speeds. Deliver endless streaming entertainment options and feel confident with 24/7, industry-leading support standing by.

To increase the value of your property, visit **SpectrumCommunitySolutions.com**

A New Transition

Broadband Communities may be passing the editor torch but will continue to provide insight and perspective on the ever-changing broadband industry segment.

By Masha Zager / Broadband Communities

fter 12 years as editor of BROADBAND COMMUNITIES, I have stepped down and turned over the reins of the magazine to my younger, more energetic and very talented editorial colleagues - Sean Buckley, formerly executive editor and now editor-in-chief, and Eli Penberthy, the copy chief. Founding editor Steve Ross (aka the Bandwidth Hawk) remains in his current role as editor-at-large; his deep experience and acute insights will continue to inspire and inform the editorial team.

When I wrote my first article for Broadband Communities (then Broadband Properties) as a freelancer in 2005, fiber to the home was largely unknown. Companies deploying it - mostly on a very small scale were excited about it. Other people, if they had heard of it at all, dismissed it as unconventional, unproven or, at best, unneeded.

This magazine was the only publication in the United States that championed fiber as the future of broadband. And that wasn't an esoteric technical opinion. We weren't interested



Masha Zager and Sean Buckley

in technology for its own sake – or, at any rate, not interested enough to devote a whole magazine to it. Rather, we thought fiber would change the world. And we were right.

Yes, other good broadband options exist today. But it's important to remember that they were developed only in response to the challenge that fiber to the home posed. And increasingly, these other technologies are viewed as steps in the inevitable transition to fiber.

I feel lucky to have spent these years reporting on and advocating for this transition. Playing even a minor role in such a major transformation was a great privilege.

There's still a long way to go, of course. Too many people in the United States and around the world lack adequate broadband – and the bar for what constitutes adequate broadband keeps being raised. But new technologies, new business models and new financing options will make fiber

feasible for more communities in years to come

In other words, there's still plenty for my former colleagues and our authors to write about, and I look forward to reading what they have to say. ❖

Masha Zager is a contributing editor for **BROADBAND COMMUNITIES**. She previously served as the editor-in-chief of the magazine for 12 years. Contact her at masha@bbcmag.com.

A HEARTFELT THANKS

What a pleasure it has been to have Masha Zager steering the editorial ship at **Broadband Communities**. Her depth of knowledge of the industry and her ability to explain it are truly remarkable. She has been generous and kind with her advice, and she leaves the magazine in good hands. So cheers, Masha, and thank you. And welcome, Sean and Eli, as you pick up her reins. Masha trained us well for this latest transition.

- Barbara DeGarmo, CEO, Broadband Communities



Get Ready for USDA ReConnect Round Three

As the USDA prepares for a third round of about \$600 million in ReConnect rural broadband grants, here's a detailed look at the results of the first two rounds.

By Steven S. Ross / Broadband Communities

his year will see a third round of rural broadband grants through the USDA ReConnect Loan and Grant Program. At the time this article was written, a new permanent director for the USDA's Rural Utilities Service (RUS) was yet to be appointed, and the program's rules were yet to be finalized. However, we know that roughly \$600 million will be on the table this year, fiber deployments account for almost all the previous 165 awards, and the basic eligibility rules did not change:

- Areas where at least 90 percent of premises cannot get at least 10/1 Mbps (10 Mbps download speed, 1 Mbps upload speed) are eligible.
- An applicant must agree to build a network capable of at least 25/3 Mbps, and the scoring system favors faster speeds.
- Grants require that deployers put up 25
 percent of the funds needed to deploy, but
 that money can come from state or local
 grants if local officials allow it. ReConnect

Generate local support for broadband now. A third of \$1 trillion was appropriated in the latest COVID-19 stimulus. But broadband is competing against other needs.

- grants are competitive, loan/grant combinations are a bit less so, and requests for loans are evaluated as they come in.
- ReConnect does not allow double-dipping with USDA money. Applicants already receiving FCC grants from the Universal Services Fund – CAF or the Rural Digital Opportunity Fund (RDOF) – cannot get help through ReConnect.
- Almost any kind of deployer is eligible.
 Local exchange carriers (LECs) dominate.
 Telephone cooperatives were 16 of the 77
 project winners in 2019 and 20 of the 88 last
 year. Electric co-ops won five awards in 2019
 and nine in 2020. Public carriers mainly
 municipal broadband companies dropped
 from seven in 2019 to just three in 2020,
 perhaps due to COVID-19 pressures. Three
 tribal carriers won ReConnect awards one
 in 2019 and two in 2020.

For the USDA, strong local support helps, so now is the time to start generating it. This year, there is an extra reason: A staggering third of \$1 trillion for state and local infrastructure of all kinds (including broadband) was authorized and appropriated in the latest COVID-19 relief package. But broadband advocates and deployers will be competing against other infrastructure and subsidy needs: roads, transit, schools, health and more.

Some new funding is meant for specialized purposes, such as telehealth. Broadband

deployers will work mainly through local officials, not federal agencies. There will be more on that in upcoming issues of Broadband Communities.

ReConnect itself is not a small program. In 2020, it awarded \$675 million in grants and loans, up from the first round's \$663 million in 2019. There were 113,000 premises passed with that money in 2020, compared with 161,000 in 2019. Thus, what the USDA spent to pass a home, business or community asset, such as a school or police station, rose from about \$4,100 to almost \$6,000.

That would be expected as the easier, more justifiable projects tend to be approved in earlier rounds whenever federal or state money is on the table. Indeed, the average project density fell to nine premises per square mile in 2020, from 10.4 in 2019. The largest single project included more than 9,800 premises in 2020, less than half the largest project in 2019 (22,600). I am unclear about premises per route mile, as COVID-19 has kept me from deep dives in U.S. Geological Survey mapping data.

NOTABLE ODDITIES

I did notice some oddities. A half-dozen projects originally approved in 2019 and listed in **Broadband Communities** tables for the first 54 projects (in the March-April 2020 issue: www.bbcmag. com/community-broadband/fiberdominates-first-batch-of-reconnectawards) are no longer listed for 2019 by the USDA. Three did carry over into the second round. Project areas originally listed in the first 54 often narrowed as deployments progressed.

All this suggests that the RUS director at the time, Chad Rupe, and his staff did a good job monitoring deployment progress and holding grantees' feet to the fire. The RUS did not stray from its vision either. Almost all projects started out promising fiber networks and, so far, have ended up that way. Of 165, fewer than a half-dozen are fixed wireless or hybrid fiber coax or fiber with a mix of other technologies.

As money has become more available through normal banking and investment channels at low interest rates, prospective deployers knocking on the doors of the RUS have become far more interested in outright grants. Sixty-three competitive grants were awarded through ReConnect in 2020, up from 44 in the first round. Grant/ loan combos fell from 31 in 2019 to

21 last year. There were ultimately five outright loans in 2019, and just four in 2020. The interest rate is 2 percent. Indeed, four of the 31 combo winners in 2019 turned down the loan part and borrowed elsewhere. Even more did so in 2020. 🕸

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

LEARN MORE



Need more detail? Download our complete tables - one for ReConnect 2019 and one for 2020, including 11 winners with extra ReConnect funds from the Coronavirus Aid, Relief, and Economic Security (CARES) Act. Each awardee is listed by type of award, amount, location, premises served – and more.

Find them here:

www.bbcmag.com/pub/doc/Mar21 Hawk-Table1.xlsx and www.bbcmag.com/pub/doc/Mar21 Hawk-Table2.xlsx

The Leading Broadband Event for Multi-Housing, Commercial Properties, and Communities

Broadband Communities
Magazine Congratulates

Xfinity communities



For becoming an Enhanced Gold Sponsor at the 2021 Broadband Communities Summit

For more information on Xfinity, visit www.xfinity.com/xfinitycommunities.

You are cordially invited to come see Xfinity at the upcoming



September 27 - 30, 2021 HOUSTON, TX Marriott Marquis Houston

To Exhibit or Sponsor contact: Irene G. Prescott irene@bbcmag.com | 505-867-3299

For other inquiries: 877-588-1649 | www.bbcmag.com



PROVIDER PERSPECTIVE

Multifamily Broadband Gets a Shot in the Arm

Broadband remains the glue that holds the multifamily broadband industry together.

By Bryan J. Rader / Single Digits

ave you received your broadband vaccination yet? Well, I think the multifamily broadband industry iust got it, and it didn't even have to wait in line, scour different websites to get an appointment or pull the age card. Nope - the industry got the shot, and you can see the results everywhere you look.

Look around the industry right now. Many "back to business" signs are popping up. If this pandemic taught us anything, it's that multifamily providers offer one of the products most crucial to consumers. Every day, multifamily providers connect seniors so they can talk to their doctors, kids so they can go to school, and parents so they can work remotely. It's not an overstatement to say that multifamily providers are the glue holding society together.

I'm not taking anything away from the vaccine manufacturers and pharma companies that found a medical solution in less than a year. But the broadband industry should realize how important multifamily providers have become in the contemporary digital world.

Roll up your shirt sleeve for a moment.

INDEPENDENTS STEP UP

Independent broadband companies are deploying exciting new platforms for multiple-dwelling-unit (MDU) communities everywhere: managed Wi-Fi networks, fiber to the home (FTTH) and fixed wireless. Broadband providers that serve MDUs are seeing speeds 20 times faster than the FCC "high-speed" requirements, and solutions for all types of users. This is the evolution of a business that once had the informal motto: "Connect a T-1 line near the leasing office, and open up the internet gates for all residents." Not anymore. Multifamily providers have grown into world-class providers of internet solutions.

Have you recently seen a social media post from someone who just saw a grandparent for the first time in a year? It's one of the most heartwarming kinds of videos. This is the same experience multifamily providers get when an industry company raises a new round of funding or closes a big portfolio of apartment communities with a new client.

The multifamily industry has seen cycles like this before, but they haven't always lasted awfully long. And this time, I don't think the industry will need a booster shot to address another new variant of the virus.

This time is different. Why? For one, apartment owners and real estate developers recognize that the product the

MDU service industry provides connects everything they do – from connecting their residents in amenity spaces, to aiding virtual leasing tours, to managing sensors in vacant units. Networks are the key to effectively renting, managing and servicing today's multifamily communities. And that's not going away anytime soon.

Many property owners have told me that internet service is the most important service they provide. Property managers tell me they don't want to go to work if there's some type of outage, fearing a line of residents waiting outside the clubhouse. The National Multifamily Housing Council reports that, according to studies of resident preferences, high-speed broadband is the top amenity their members provide.

INDUSTRY BOOST

Another way to gauge the boost the multifamily broadband industry is experiencing is to look at the number of companies announcing new investments or recent acquisitions. The industry has never seen this much activity before. Consider all the requests for proposals being sent out by consultants with requests for bulk managed Wi-Fi or bulk fiber internet. They all point to future success for the industry.

Years ago, the FCC conducted a competitive study on the size of the multifamily broadband industry's share of the market. At the time, the multifamily market's biggest product was pay TV, and the FCC said the industry segment had between 1.5 and 2 million users. Today, if the FCC did the same study, and counted broadband, it would find that multifamily providers certainly have more than doubled their market share in the past decade. That's right – doubled. This is share that used to go to the big cable and telco folks. Not anymore.

This momentum feels similar to the reopening spirit businesses are experiencing across the United States today. Entrepreneurs now relish the indoor seating, greater capacity, and fewer restrictions around their places of business. This is great to see.

The multifamily industry got there a little earlier than the rest of the economy. Its "broadband vaccination" already gave the industry the shot in the arm the segment needed. I think the independent providers are in a healthy spot moving forward. Don't you agree?

OK, you can roll your sleeve back down. �

Bryan Rader is the president of UpStream Network, a Single Digits company. He can be reached at brader@singledigits.com.

IN MEMORIAM

BOB VOGELSANG

BroadbandCommunities

Broadband Communities notes with great sadness the passing of our Board Chairman, Bob Vogelsang.

His leadership, guidance and vision have been instrumental in the success of our industry for decades.

A pioneer in the private cable industry, Bob's firsts include: the first programming distributor for the private and wireless cable industry and founder of the first hotel pay-per-view company.

He also founded Global Exposition
Holdings, an international trade show
company that developed conferences
around the world covering the pay-TV
and interactive services industries. And he
purchased and headed Private Cable and
Wireless Cable, the technology magazine
and trade show that today are Broadband
Communities, the leading source of
information on digital and broadband
technologies for connected communities.

Bob will be remembered for his love of his hometown, Rosenberg, Texas, where he and his wife, Marcia, who survives him, were known as tireless promoters of the community's historic downtown area. He held a B.S. in mechanical engineering from the University of Texas and an MBA from the University of Dallas.

Robert 'Bob' Louis Vogelsang September 18, 1943 - February 17, 2021

The New Face of Economic Development

The pandemic has redefined economic development for many rural communities.

By Trevor Jones / OTELCO

raditionally, the goal of economic development has been to bring large employers to a community. These employers provide jobs and bear more of the tax burden so that more families come to town. Done well, this leads to a healthy cycle of growth for a community. The tools of this mode of economic development have been industrial parks, highways and public utilities such as water and electricity.

That may be changing. I live in Maine, a very rural state with an aging, shrinking population. Apart from its well-known tourism industry, the Maine economy is driven largely by small businesses and cottage industries, and the state has known for years that better broadband is an essential tool for these industries to succeed.

Maine's leaders also know that work will soon become less location-specific for many people. At the ribbon cutting for a community network in Rockport, Maine, almost seven years ago, Sen. Angus King said, "For the first time in history, people can work where they live instead of living where they work."

Though King's words may have been true for some then, they have become significantly more so now thanks to the disruptive influence of a major global pandemic that rapidly forced remote work into the mainstream.

RISE OF REMOTE WORK

COVID-19 has driven remote work forward like nothing ever has before. According to Statista, only 17 percent of respondents worked remotely five days a week before the pandemic. After the pandemic, that number increased to 44 percent. Many of those people have now been working remotely for a year or more, and those of us who are hiring know that prospective employees now want and expect the option to work remotely.

Here in Maine, that means that people "from away" are starting to move here, lured by the state's open spaces and quality of life. Real estate prices have skyrocketed because demand exceeds supply in much of the state – at least in those areas with good broadband connectivity. Meanwhile, news outlets report an exodus from major cities. A recent article in The Atlantic noted that rents are falling rapidly in pricey coastal "superstar cities," and migration is taking people away from populous states to more rural locales.

This trend toward remote work may change the way towns and cities look at future economic development. Rather than starting by trying to attract employers, it may soon be more effective to start with residents. Consider what will happen if those remote employees who moved into rural areas are able to maintain their remote work environment after the pandemic is over. They will begin to patronize local restaurants, shops and service providers. This will create jobs and fuel local economies.

Economies such as Maine's, which enjoys a healthy tourist component, also will benefit from the increased capacity for remote work. Seasonal residents able to work remotely can spend more time in their vacation homes. Some may even make their residency permanent, although here in Maine that may require hardy souls.

ENABLING RURAL BUSINESS LOCATIONS

The migration to rural communities will also make it possible to start businesses in rural communities where it might not have been feasible before because availability of talent is now much less of an issue. When skilled professional staff can work from anywhere, it's no longer necessary to place primary offices where there are large numbers of available workers. In addition, skilled professionals who will form the basis for these future organizations are already distributing themselves to rural communities where they will start their own businesses or join local operations in the future.

If it's true that the economic development of the future starts with people rather than businesses, then the tools that drive economic development will change. Instead of industrial parks and transportation, the focus will be on broadband, schools and quality of life.

Personally, I'm excited at the prospect of what might happen when leaders at the local level focus more on making communities great places to live than on bringing in the next big employer.

Trevor Jones is vice president of marketing, sales and customer service for OTELCO, which owns independent telephone companies in seven states and partners with several community networks in Massachusetts. Contact him at trevor.jones@otelco.com.

Expert predictions for 2021 and beyond

The future of connectivity is for multifamily developments

Daniel O'Connell, Vice President of Connected Communities at CenturyLink

"The good news is that developers have caught on to the importance of technology. I think where we're heading is toward unifying all of the connected applications across multifamily properties."



We've got you covered

Next-gen connectivity for residents



Engage with us, and plan for your future.
Visit **centurylink.com/connectedcommunities**



How the Pandemic Created Urgency for Smart-Tech Adoption

The importance of seamless connectivity is amplified as broadband and intelligenthome needs rise.

By Kevin Donnelly / NMHC and Valerie M. Sargent / Broadband Communities

The pre-pandemic world had apartment operators testing the smart-home waters, thinking about what solutions might work best for their companies and communities. They found themselves examining the potential return on investment (ROI) and benefits of smart tech, both for their residents' overall satisfaction and for operational efficiencies regarding preventive maintenance and asset protection.

This steady, thoughtful deliberation was highjacked and suddenly thrust full-speed ahead when the pandemic hit. Suddenly, multifamily owners found themselves searching for tech-related solutions that residents and prospects were demanding. "Cool" features that were just an idea for the future quickly became must-haves.

Certainly, some smart-home technologies were adopted pre-pandemic. Features such as touchless controls for doors, touchless elevators, access control, smart thermostats and smart lighting mostly were adopted in Class A and B properties and in certain geographic areas more than others. But these things quickly became more critical for communities of all ages and sizes when COVID-19 came to town. Owners went from

Many in the multifamily industry often take a wait-and-see attitude with new technology, wondering which tech has staying power and will be the best to implement.

evaluating the ROI of deploying nice-to-have smart tech across their portfolios to quickly deploying tech critical to successfully and safely operating their buildings during the pandemic.

PANDEMIC'S EFFECT ON SMART-TECH ADOPTION

Access control took off like a rocket as the pandemic put fuel in the smart-tech rocket ship. In-person touring had to change quickly, and communities found that they had to introduce virtual tours or lose prospects. Properties needed increased video capability and premises monitoring to provide heightened security and control access to newly restricted amenity spaces in the wake of government orders.

There was also an urgent and continuing desire to meet resident and prospect expectations by making cleanliness central to property operations. "Clean is the new green" became a common phrase for multifamily operators, with many people expecting more and even some drawing a red line if there were not fresh air systems or ultraviolet air purifiers in place.

Most important, all the existing and new smart tech deployed relied on and was controlled by buildings' telecom infrastructures. This demand was matched by a surge in resident use of networks as stay-at-home orders turned multifamily communities into round-the-clock offices, schools and entertainment hubs. This massive shift worked for communities that had a dependable connectivity backbone in place and enough capacity, ultimately enabling the deployment of intelligent building amenities. Property owners and their provider partners have deployed various ways of doing this, all with the understanding that a seamless, always-on network is critical, whether built from the ground up or rehabbed and upgraded along the way.

Smart tech goes beyond residents' apartments and in many ways is more exciting and a bigger value add for multifamily

operators. Intelligent building platforms and products have the potential to offer energy-saving technologies and monitoring systems that can help with preventive and predictive maintenance needs when looking at smart lights, leak detections, smart thermostats and such. Cool tech really has the potential to be a game changer for multifamily in allowing owners to gain significant operational and insurance cost savings.

INDUSTRY CHALLENGES REMAIN

A successful smart-tech strategy at the property level relies on high-quality, always-on connectivity. However, the reality is that some broadband connectivity challenges could prevent optimal performance or the benefits of some of this tech.

Different segments of the market are ahead of the curve because they have had the ability to invest more resources in connectivity than others. Smaller, more rural, affordable or senior properties often have fewer revenue opportunities for broadband providers, and owners must carry the infrastructure costs on their own. This makes it less likely for some communities to deploy all the bells and whistles of smart-home technologies or to future-proof with processes such as conduit installs. It is easy to proactively include these technologies in a new-build project, building out extra space for cabling to prepare for what comes next. For older communities or those with more limited budgets, however, it can be a big capital expenditure.

Other potential challenges are the regular maintenance, software updates, security and privacy protections that smart technology requires because it is connected to people's phones or a building's other systems. Smart-tech management platforms have emerged, but some owners remain hesitant; some say they would forgo some smart technologies to avoid the headache of maintaining them. Even when an owner is willing to take the leap into a full embrace of smart tech, there is always a huge concern over life span and whether the investment made today will be in a technology or product that is irrelevant in just a few short years.

In multifamily, an investment made today needs to have a considerable runway to be worth the effort. Many in the multifamily industry often take a wait-and-see attitude with new technology, wondering which tech has staying power and will be the best to implement. A developmental pipeline can be so long that what may be cool and different today could become obsolete tomorrow. This is where many owners were in their thought processes before the pandemic.

A prime example is voice-enabled devices. At the outset of owners' dipping their toes in the waters of cool, smart-home tech, devices such as Amazon's Alexa and Google Home were easy and cheap enough to deploy, but as brand loyalty among residents rose, the owner-installed devices often went unused. Certainly, voice-enabled tech has a lot of room to grow, and consumer demand for these devices makes them an important piece of the smart-home puzzle for multifamily, just not the easy, quick fix that many thought it would be at the outset. In the end, it serves as a lesson for both multifamily owners/

There are several future trends to keep an eye on, including artificial intelligence technologies that could fuel property operations and more ubiquitous facial recognition technologies that could control property access.

operators and smart-tech suppliers on what ultimately makes an investment worth it.

BROADBAND AND CONNECTIVITY ARE CENTRAL

As owners have leaned into smart-home capabilities, ongoing seamless connectivity has become even more important. Coupled with how essential broadband has become to daily life during the COVID-19 pandemic, the broadband industry is set to increase its heavy prioritization of high-quality, reliable networks across multifamily communities. Despite the focus and urgency in that space, overall connectivity is incredibly important. The availability and affordability of traditional telecom products, such as wired phone service and video offerings, and the strength and reliability of cellular service at the property level remain important aspects of apartment operators' ability to attract and retain residents.

There are several future trends to keep an eye on. Prime examples are emerging artificial intelligence technologies that could fuel property operations and more ubiquitous facial recognition technologies that could control property access. There are benefits and questions to these and other technologies centered around network security and privacy. The industry will need to take these issues seriously as an emerging patchwork of consumer privacy protections spread across the country. However, strong consumer demand for these technologies will draw residents in and enhance resident retention, forcing multifamily firms and suppliers to find solutions that fit.

If those in the multifamily industry learned anything during the past year, it's that the industry can be nimble and pivot easily, adjusting and adapting along the way and embracing new ideas and technologies while reinvesting in existing tech, such as broadband networks. �

Kevin Donnelly is vice president of government affairs for the National Multifamily Housing Council and can be reached at kdonnelly@nmhc.org. Valerie M. Sargent is a multifamily speaker, trainer and executive consultant and is the multifamily news correspondent for Broadband Communities. Contact her at valerie@bbcmag.com. For more information, visit www.nmhc.org, www.bbcmag.com or www.valeriemsargent.com.

Closing the Digital Divide for Low-Income and Special-Needs **Residents: Main Street Connect**

Main Street Connect is a new apartment complex in Montgomery County, Maryland, that offers symmetrical 50 Mbps internet services and digital training for low-income and special-needs residents via a partnership with the county government's Department of Technology Services. **Broadband Communities** thanks Joseph Webster, the department's chief broadband officer in the Office of Broadband Programs; Marjorie Williams, the department's broadband, cable and franchise division manager; and Pierre Trudeau, CTO of Positron, for helping compile this profile.

By Sean Buckley / Broadband Communities

hen Jillian and Scott Copeland began looking for long-term housing where their son, Nicolas, who has developmental disabilities, could thrive, they found very few options. Hoping to help other families facing a similar challenge, the Copelands founded Main Street Connect in 2017. Their mission: to create affordable, inclusive housing that offers residents of all abilities dynamic opportunities and community engagement.

The Rockville, Maryland, apartment complex opened in August 2020. Today, 25 percent of the building's 70 units are allocated for adults with disabilities, and the remaining 75 percent offer affordable housing options for all.

The Montgomery County Department of Technology Services provides symmetrical speeds of 50 Mbps and internet bandwidth to support Wi-Fi service in all public areas in the building via its internet service network, MoCoNet. The service includes Wi-Fi coverage, online security, parental and access controls, and 24/7 customer service.

By providing MoCoNet's service at low or no cost to Main Street Connect community members, the county aims to promote digital equity. Digital equity means everyone has equal access to the technology necessary to participate in all aspects of society. For low-income households especially, access to the internet can be a burden when added to the costs of rent, child care, food and other necessary expenses.

Qualifying residents of Main Street Connect apartments may choose between MoCoNet, Comcast or Verizon for internet service. MoCoNet is free for eligible residents; Comcast and Verizon charge for their services.

"When we contacted the developers about providing robust internet access for residents in their units, they were very interested," says Joseph Webster, chief broadband officer in the Office of Broadband Programs at the Montgomery County Department of Technology Services.



Main Street Connect is a 70-unit apartment building in Rockville, Maryland, that houses special-needs and low-income residents. The Montgomery County department of technology services provides 50 Mbps internet via MoCoNet as part of its commitment to digital equity.

COUNTY NETWORK TIE-IN

The idea of establishing MoCoNet to extend affordable broadband to Main Street Connect is rooted in Montgomery County's FiberNet network.

FiberNet enables the county to provide voice, data, video and Wi-Fi services to county departments, offices and agencies. The network also serves the county's 911 center and connects 220 K–12 public schools, the schools' data center, FiberNet's data center and several other commercial data centers. It also serves agencies not directly tied to county government, including planning, sewer control and others.

The 600-route-mile fiber network enables Montgomery County to modernize communications services, including expanding broadband capacity necessary to support increased usage of wireless devices within workplaces and public spaces and the transition to IP-based public safety communication services.

Having built a Cisco-based

MPLS network that serves the greater Montgomery County suburban community and metro over the past 20 years, the county is in the process of upgrading to what it calls its "thirdgeneration network."

About a year ago, Montgomery County appointed Gail Roper as chief information officer. She shares a passion for bringing internet services to more people and educating them about how to leverage internet and digital services.

"Gail, our Department of Technology Services, and my team in the Office of Broadband Programs all have an interest in digital equity," says Webster. "The county has been doing a number of things, including providing free Wi-Fi in our 22 libraries, county buildings and senior centers."

PROPERTY OF THE MONTH HIGHLIGHTS ~ Main Street Connect ~

- 70-unit property for low-income and special-needs residents
- 50 Mbps symmetrical services for all units
- Digital literacy training
- Choice of three providers: MoCoNet, Verizon Fios and Comcast
- Wi-Fi motion detection
- Online security
- Parental and access controls
- 24/7 customer service

PROPERTY OF THE MONTH



The common areas of the apartment building have Wi-Fi courtesy of MoCoNet.



The floorplan of Main Street Connect apartments

EXTENDING BROADBAND TO LIVING SPACES

Providing free Wi-Fi in public spaces is just one element of Montgomery County's desire to help people access the internet. With the advent of COVID-19, the Department of Technology Services started looking for projects to extend internet services into people's living spaces.

Today, FiberNet has fiber connected to several affordable housing developments through Montgomery County's Housing Opportunity Commission (HOC).

"Historically, we have only provided Wi-Fi in common areas or meeting rooms at HOC properties. While it is better than nothing, it is not ideal," Webster says. "The goal was to find a proof-of-concept project where we could extend internet directly into people's living spaces."

But carrying out this mission is easier said than done. FiberNet had to wade through myriad laws that in many cases prohibit municipal broadband.

"More than half of states have restrictions or outright prohibitions on community broadband or municipal broadband," Webster says. "Fortunately, we don't have that issue in Maryland, so there are no state regulations or restrictions on a city's or locality's ability to provide internet directly."

ENHANCING BROADBAND OPTIONS

In Montgomery County, residents and businesses can access broadband services from Verizon Fios and Comcast. RCN also offers services in some pockets of the county. Comcast and Verizon previously installed facilities to provide internet services and video to Main Street Connect apartments. The walls were up and the building's wiring was already in place by the time Montgomery County got involved in the project in early 2020, so the Department of Technology Services could not install its own wiring, which it does in county buildings.

"The situation left us a little bit challenged because typically we would use Cat 6 wiring and provide Active Ethernet service," Webster says. "Fortunately, I came across Positron at **Broadband Communities**' economic development conference in October 2019."

Leveraging the coax network and the equipment from these vendors, Montgomery County developed MoCoNet, which offers 50 symmetrical to all residents who want it.

"The criteria to get the service is very easy: it could be a special-needs apartment and/or an affordable unit," Webster says. "There are about 10 apartments at Main Street that are market rate, which means they would not qualify, but the rest do. We're providing only internet access."

Residents can choose to use MoCoNet and Verizon, but they can't use Comcast and MoCoNet because the two providers can't use the coax simultaneously.

Positron provides the broadband access equipment necessary for residents to connect to Montgomery County's free internet.

The vendor's G.hn access multiplexer (GAM) family can deliver near-symmetrical gigabit internet access to subscribers in multiple-dwelling-unit (MDU) buildings over existing telephone or coaxial infrastructure.

"Positron's GAM is perfectly suited for this situation," Webster says. "The fiber was installed by Verizon, and the coax was paid for and controlled by the developer, so Positron's equipment allowed us to leverage the existing coax."

The two other key partners were Plume and Cisco. Plume provides its Wi-Fi software, HomePass, which is delivered through the Plume Cloud, the Plume app and SuperPods.

"Plume was an important partner, and Cisco provided free routing and switching equipment as part of this digital equity project," Webster says. "We had three important technology partners."

Though MoCoNet is not using Plume for IoT and building management applications, such as monitoring leaks and heating, it has tapped into Plume Motion, a Wi-Fi sensing application. Plume Motion detects disturbances in Wi-Fi signals between its pods or between a pod and a motion-capable device. These disturbances in the signal are translated into Plume Motion events, which residents can use to detect activity in their homes.

"Residents can download the app on their phones, and if there's a human walking around in their apartments, it sends a phone notification," Webster says. "For some residents, family members who are not in the building with them could say 'My family member is up and walking around, and I know they are OK."

Main Street Connect is the first complex where MoCoNet is piloting its symmetrical service, but it won't be the last.

"Main Street was our first foray into providing service inside people's living spaces," Webster says. "We refer to it as a proof of concept, where we are trialing vendors like Positron to maintain and operate it." He adds the agency is looking for other MDU opportunities in Montgomery County.

"The goal is now to extend it to other affordable living units in the county," Webster says. "MDUs make the most sense because they bring the biggest bang for the buck."

FOCUS ON DIGITAL INCLUSION

Providing broadband access is just one benefit MoCoNet provides. MoCoNet also will offer training on how to access the internet and use devices through a partnership with Main Street.

Marjorie Williams, the broadband, cable and franchise division manager

The Montgomery County Department of Technology Services provides free internet service to eligible residents via its network, MoCoNet. Residents can get video and data from Comcast and Verizon Fios for a fee.

in the Department of Technology Services, says that although COVID-19 puts a damper on implementing a training program for residents, it's a necessary service.

"We are hoping to partner with Main Street to provide training on how to use devices and find some partners to provide devices such as laptop computers and tablets," Williams says. "Many residents are using just smartphones, but we want to help them get out into the community."

Many of Main Street's residents are around 22 years old, so the agency would also provide training on how to look for jobs online and write résumés.

"Main Street Connect wants to work with us to provide that training," Williams says. "We just feel like in an environment like this, it would be hard to train them remotely. They really need hands-on support."

The agency plans to offer similar digital literacy education at the next apartment complex it plans to serve, which is a senior living facility.

"We will be providing digital literacy education, but it will be a different angle," Williams says. "We'll help residents learn how to get food delivered, order prescriptions, and conduct videoconferencing with their doctors. We'll be tailoring our program based on each community that we're considering."

VITAL STATISTICS

Property Description: Main Street Connect offers a unique model of affordable, inclusive community living and engagement for residents and non-resident members so people of all abilities can live their best lives. **Demographics:** Low-income and special-needs residents

Greenfield or retrofit? Greenfield

Number of units: 70

Style (High-rise/mid-rise/garden):
Mid-rise

Time to deploy: 90 days

Date services started being delivered: September 2020

Special property requirements:

Providing symmetrical data rates of 50 Mbps-plus (upload and download) to support Wi-Fi service in all eligible living units in the building. The ability to increase the user bandwidth profile on demand.

LESSONS LEARNED

What was the biggest challenge? Although the developers always planned to offer commercial/paid internet services to residents of Main Street Connect apartments, by the time Montgomery County was aware of the development, the walls and ceilings were already up, and the painting had already begun, so it was too late to run Ethernet cable for traditional commercial access points. This left wireless mesh as the only realistic option for high-quality, in-apartment Wi-Fi in all units. Although the county had also been providing free or low-cost internet service to residents in libraries and other public spaces for some time, significant challenges existed with this project from a timing, technology and support perspective.

What was the biggest success?

The ability to use the existing coax

cabling to offer a fiber-like user experience to residents. The Plume HomePass Wi-Fi service suite also provides a valuable set of features and capabilities that go well beyond traditional Wi-Fi routers and accesspoint equipment.

What feedback does the leasing/ sales office get from residents/ guests? What has the experience taught them about marketing, installing or supporting these services? Residents love having high-speed internet. Main Street Connect likes it because it's a selling point to attract residents. The part of the building that houses disabled residents is already fully occupied. The parents of young-adult, specialneeds residents are grateful and can't wait for training on how to use the internet and devices to start because they want their kids to be independent. The other part of the

complex, for low-income residents, is not fully occupied, but the property manager says free 50 Mbps internet access is a big selling point.

SERVICES

Services: The network offers symmetrical 50 Mbps internet access to all apartment units.

Provider choice: Eligible residents have the option to purchase MoCoNet, Comcast Xfinity or Verizon Fios services. MoCoNet provides internet access, but residents can get video and data from Comcast and Verizon Fios.

Do additional service providers operate separate broadband networks on the same property? Yes, Comcast Xfinity and Verizon Fios are also available to all units in the building.

On the network described, can residents choose among multiple service providers? Yes, residents can choose their network service provider.

Is the point of contact for resident technical support the property manager, the service provider or a third party? The community technology team in the Montgomery County government's Office of Broadband Programs helps residents with initial installation and set-up of the service and downloading/ activation of the Plume app. Once the service is up and running, all resident technical support is handled by Plume and its 24/7 support center. Residents who subscribe to MoCoNet service are given a refrigerator magnet with Plume's 24/7 toll-free customer-support number at initial installation and service set-up.

BUSINESS

Which parts of the network are owned by the service provider, and which parts are owned by the property owner? Internal wiring to the units is owned by the developer; the rest is owned by the service provider.

Is there a marketing agreement with the property owner? No.

TECHNOLOGY

Broadband architecture: The building has fiber and coax. MoCoNet uses the existing coax wiring.

Technology/medium used to deliver signals to each unit: The network leverages Ethernet over the existing coax wiring. MoCoNet provides Wi-Fi in the living units and in common areas.

Vendors/products

- Positron (G.hn broadband access equipment)
- Plume (Wi-Fi software, access points)
- Cisco (routers and switches) �

Sean Buckley is the editor-in-chief of Broadband Communities. He can be reached at sean@bbcmag.com.





WITH FIBER, VVE CAN.

When communities are connected, they thrive. With a commitment to offer broadband, businesses are able to expand as residents work from home and lives are changed. Over the past few years, we have helped many of your municipality peers successfully build their broadband capabilities and create the most positive impact on their communities. To transform yours, and to learn more about our other partner successes, visit us at calix.com/munis.



National Efforts to Close the Digital Divide Require Local Empowerment

Findings from a survey of more than 120 state and local leaders confirm a need for investment in broadband infrastructure nationwide and a new approach to funding deployment.

By Ariel Benjamin, Erman Eruz, Danny Fuchs and David Gilford / HR&A Advisors

niversal broadband is the 21st century equivalent of electrification, foundational to equity and economic prosperity in urban and rural communities alike. As the Biden-Harris administration and Congress consider the most ambitious infrastructure funding bills since the New Deal, states and localities have a once-in-a-generation opportunity to close the digital divide.

The Broadband Equity Partnership conducted a national survey of state and local leaders, asking them about their priorities for a national broadband stimulus. More than 120 respondents provided insights into their investment and policy preferences, current and desired partners, confidence in deployment mechanisms, and community connection challenges. Respondents hail from 18 states across the country, including localities that vote across the political spectrum. They represent small towns, big cities, state and local economic development and IT agencies, utility companies, nonprofit organizations and educational institutions - many at different stages of implementing broadband plans.

The respondents are diverse but aligned in their investment needs. As the federal government prepares to allocate hundreds of billions of dollars for historic investments in infrastructure as part of post-COVID-19 recovery efforts, the survey confirms a need

for investments in broadband infrastructure nationwide and a new approach to funding for broadband deployment: 88 percent of respondents ranked fiber deployment among their communities' highest priorities for investment. Beyond physical infrastructure, subscription subsidies, digital literacy and inclusion programs are the highest-priority investments. Communities understand that closing the digital divide requires not only closing the infrastructure gap but also the affordability and adoption gaps.

CHANGING FINANCING APPROACHES

To close the digital divide, the federal approach to distributing funds needs to change. Respondents have the highest confidence in the abilities of local internet service providers (ISPs) and local economic development agencies to use federal funds to close the digital divide.

National ISPs historically have been the primary benefactors of federal funding for broadband. Time and again, however, these companies fail to deliver infrastructure where it is needed. Survey respondents expressed greater confidence in more local, smaller ISPs as potential partners to develop tailored infrastructure solutions through federal funding: less than 25 percent of respondents had confidence in national ISPs' abilities to use any future federal funds to close the digital



Identified **fiber deployment** as a high priority investment in their communities

2X

Trust expressed for local, smaller ISPs using federal funds to close the digital divide, compared to incumbents

divide, and a majority were confident in local or community-based ISPs' abilities to do so.

As one respondent pointed out, "The best local organizations to do this work are often not successful at obtaining federal funds, which go to the larger national companies. However, given their lack of [local] knowledge, [the larger ISPs] are often unsuccessful at expanding access."

Indeed, communities see broadband as a crosscutting economic development issue rather than siloed as information technology or infrastructure. Overwhelmingly, respondents see local economic development agencies as capable implementation partners: 70 percent of respondents are confident in these entities' abilities to use federal funds effectively in closing the digital divide.

Local governments' other ideal partners depend on the unique challenges they face. For some, cooperation with state agencies on broadband plans is essential for overall support and matching communities with the right federal or state programs and private sector or institutional partners. For others, the most effective partners are state public utility commissions (PUCs). Some local governments already do or wish to operate as municipal ISPs themselves.

States and local governments want to determine their broadband futures, which will require changes in federal funding distribution and program standards. Respondents call for funding dispersal at the state and local levels, with the flexibility to deploy that funding to directly support their own priorities.

Communities are asking for more accountability on how ISPs spend public funding. If the existing service provision definitions are retained, ISPs can fulfill requirements with buildouts that do not address community needs. Communities so far have had little say in the way national ISPs spend federal funds to build out infrastructure. This results in buildouts in places where ISPs want to build while retaining private ownership.

At the same time, more than half of state-level agency respondents indicated that they have "investment-ready" broadband plans but lack funding. The COVID-19 relief-focused \$1.9 trillion American Rescue Plan dedicates \$350 billion in assistance to state, local and tribal governments and territories, and \$10 billion for a new Coronavirus Capital Projects Fund. These funds can be spent flexibly, and investments in expanding broadband infrastructure or service are eligible uses.

Several respondents successfully used funding from 2020's CARES Act to fund broadband initiatives, despite challenging implementation timelines. Future infrastructure legislation in support of the Biden-Harris Build Back Better Recovery Plan is poised to deliver historic, longer-term investments in infrastructure and should continue in the direction set by the earlier measures.

EMPOWERING LOCAL COMMUNITIES

Empowering local communities to close the digital divide requires meaningful policy changes that complement new approaches to federal funding distribution.

Broadband is already an essential utility and should be classified as such. Fifty percent of survey respondents identified either utility classification or municipal ISP authority as a high priority for policy change for their communities.

Many respondents seek broadband utility classification and the removal of policies impeding the public sector's ability to provide infrastructure and service, including becoming municipal ISPs. These policy changes would increase leverage for local governments when partnering with third-party ISPs, set regulations around subscription prices and service requirements (such as

CONOMIC DEVELOPMENT

net neutrality), increase access to utility rights of way and provide more options for direct household subsidies.

Respondents noted opportunities for greater impact from existing federal broadband programs, including the FCC's E-Rate Program, which reduces connectivity costs for schools and libraries. Extending eligibility to anchor institutions would enable greater connectivity within their surrounding neighborhoods.

Rural local governments face additional challenges that require significant policy changes. Through the Rural Digital Opportunity Fund (RDOF), the FCC is using a reverse auction mechanism to direct up to \$20.4 billion over 10 years to finance broadband networks in unserved rural areas. Communities note that RDOF recipients often are not adequately evaluated on their financial and technical capabilities and do not have

satisfactory buildout plans. Some echoed the words of a respondent who said, "The RDOF should be completely revamped or eliminated. Optimally, the funds should go to the state/counties for specific targeting."

Rural localities are also held back by broadband service definitions and their misalignment with the connectivity realities of those communities. In federal maps that determine eligibility for grants such as the RDOF, many communities that experience infrastructure and service gaps are mapped as having satisfactory service, rendering their digital divides invisible.

Localities cannot afford to wait. Although the national stimulus survey provides lessons for federal government programs, we hope that communities are energized by the urgency of the moment. As with the CARES Act funding, communities

that initiate early partnerships and plan for shovel-ready projects will be better positioned to spend federal funds once available. A century ago, electrifying the country was a long-term process requiring coordinated federal and local action; achieving universal broadband access wiil be similar. For local officials and national policymakers alike, decisions made now will shape more than just the nation's infrastructure for decades to come.

Ariel Benjamin, Danny Fuchs and David Gilford are co-founders of the Broadband Equity Partnership, a consultancy and program management team powered by HR&A Advisors and CTC Technology & Energy. Erman Eruz is a senior analyst with HR&A Advisors. The Broadband Equity Partnership survey was originally published by the Benton Institute for Broadband and Society.

WideOpen Delivers Open Access Networks



- Financial models and pro formas
- Take rate analyses and cash flow projections
- Funding strategies and financing development
- Network architecture and specs for fiber and wireless

We build your Gigabit network

- Construction management
- Vendor selection for fiber and wireless equipment
- Contractor selection and procurement management
- Service provider selection and negotiation

We operate your Gigabit network

- 24/7/365 network operations center
- Service provider management
- Marketing and public awareness
- Equipment and fiber asset management



Call us at 540.552.2150



WESCO® ANIXER & TVC



Bridging the Digital Divide

The Leaders in Delivering FTTx and Wireless Solutions for Rural Broadband Deployments



Launched



As Complete Supply Chain Provider

26



As Supply Chain



As Consultant Partner & Supply Chain Provider

13

Over 100,000 miles of Rural Fiber Networks Deployed

Broadband Essential to Post-Pandemic Economies

The results of a new survey of economic development experts indicate the changing role and value of broadband and digital technology as development tools.

By Craig Settles / CJ Speaks

ast March, when schools and offices closed seemingly overnight to slow the spread of COVID-19, the seriousness and extent of the digital divide was fully exposed. People who lacked adequate broadband access were at a stark disadvantage. Mercifully, federal and state agencies jumped into action and have been opening the spigots for billions of dollars in financial aid to prioritize broadband access for communities that need it most.

Meanwhile, broadband groaned under the strain of massive shifting computer data as more people learned and worked at home. Fiber was still the gold standard for broadband infrastructure then, but the only things moving faster than toilet paper off store shelves were wireless routers.

It's fair to say that over the past year, economic development experts saw changes in the roles, responsibilities, and value of broadband and digital technology as development tools.

KEY SURVEY RESULTS

Results of the Broadband, Local Economies & the Age of COVID survey show economic development experts believe there has been progress in the impacts of community broadband, broadband coverage and increased applications of digital technologies. I have been collaborating on this annual broadband survey with the International Economic Development Council (IEDC) since 2006. This year, ETI Software sponsored the survey, and the software

company SizeUp provided sources of economic developers to survey.

Here are some key findings.

- Many markets reflect monopoly and duopoly influence, but some respondents (9 percent) feel there's at least some ISP competition for businesses in their jurisdictions.
- Respondents now have a markedly increased interest in telehealth as a local economic tool than they had 18 months ago.
- Most survey participants (52 percent) believe broadband can influence low-income workers, and 62 percent believe it can influence unemployed workers to become entrepreneurs before and after the pandemic ends.
- The majority of respondents (52 to 75
 percent) believe federal and state broadband
 policies and funding rules work to the
 detriment of local communities.
- Ultimately, economic developers expect broadband and digital technologies will be helpful to local economies when the pandemic is over.

Unfortunately, the views of midsize to large cities aren't well accounted for in the survey because the membership of the IEDC heavily represents rural communities. That said, a significant number of counties (40 percent) and regions (22 percent) are represented, and these contribute to 25 percent of respondents representing urban, suburban and rural communities together in their jurisdictions.



Sixty-nine percent of survey participants called for "increased local control of broadband networks and policy." Most also expect broadband and digital technologies will be helpful to local economies when the pandemic is over.

DIVERSE BROADBAND PLANS

The survey found that for jurisdictions that have or are planning public networks this year, 8 percent hope to build a wired network, 5 percent are building a wireless network and 8 percent are building a hybrid wireless/wired network. This collective 21 percent is an increase from 15 percent in 2019 that had or planned to build a public network. Another 9 percent of jurisdictions plan to build public networks of one type or another, though they aren't sure how soon.

This year's respondents provided more details on "limited-reach" public networks, meaning networks confined to specific parts of a city or town. Sixty-three percent of respondents indicated they are building these networks in anchor institutions such as schools, libraries or government buildings.

However, 47 percent and 48 percent of respondents, respectively, want

limited-reach networks in commercial districts and downtown areas. Limited-reach networks also are targeted to residential areas for 40 percent of jurisdictions. I expect that further digging would reveal that these are areas with low-income homes where incumbents won't build.

In terms of business models, public-private partnerships lead the pack, accounting for the first choice of 43 percent of jurisdictions. A quarter of respondents say they want the municipal government or public utility to own and operate their networks, and 27 percent want a public entity to own the infrastructure and a private company to sell and manage the broadband services.

Forty-nine percent of jurisdictions have WISPs. The prominence of WISPs on the broadband landscape is due in part to nearly three decades of rural growth, starting in Wyoming in 1992.

Currently, there are more than 2,500 WISPs, of which about 10 percent are in urban cities.

Fourteen percent of survey respondents say they have co-ops offering broadband, and 7 percent say co-ops plan to build broadband networks soon. Electric co-ops started these networks in 2013, and almost 100 co-ops are building networks now. Telephone co-ops have a 15-year head start on electric co-ops.

TELEHEALTH'S ECONOMIC IMPACT INCREASES

Forty-one percent of survey respondents think attracting more health care professionals to communities impacts local economies; 26 percent believed so in 2019. Thirty-nine percent think reducing ER visits through telehealth is a significant economic benefit, and 24 percent thought the same in 2019. Having more mental health care

ECONOMIC DEVELOPMENT

Telehealth kiosks can reduce ER overcrowding, provide emergency and general care, and save health care facilities money.

services stay local is a strong benefit for 32 percent of respondents; just 24 percent said so in 2019.

"There's a reason broadband is a super-determinant of public health," says economist Dr. Bento Lobo, an expert in digital technology and public health's economic impact.
"By having Chattanooga's 10 gigabit public network in his home office, Dr. Jim Busch and the other radiologists together at Diagnostic Radiology Consultants save \$18.2 million a year in time – their typical radiologist saves 1,000 hours a year."

Telehealth kiosks can reduce costs in the ER equation. Low-income African Americans, other people of color and immigrants often use the ER as primary care. Kiosks can reduce ER overcrowding, provide emergency and general care and save health care facilities money. The units enable two-way communication with health care professionals who can remotely observe patients, or medical assistants equipped with various digital diagnostic tools can go to kiosks.

Kiosks can compensate for the loss of hospitals in urban and rural communities because vendors can configure kiosk capabilities to meet specialties needed in certain areas and connect them via broadband into a single network. Clinics and kiosks can team up to deliver big-city quality services to sparsely populated areas, plus attract businesses and individuals to an area and keep profits local.

Local government can place modified mobile kiosks at food banks and other places where needy people gather. "Counties possibly could set up kiosks in homeless shelters to provide 'safety net' free emergency and general health services without patients needing to visit urgent care clinics," says Eric Haden, president at Drexly Telehealth Solutions.

BROADBAND POLICY SHOULD BE LOCAL

Twenty-one states passed varying degrees of prohibitions against public utility—owned broadband networks. But COVID-19 changed the political dynamics. Some state legislators value constituents' needs (and fear their wrath) as political tides shift. Sixty-nine percent of survey participants called for "increased local control of broadband networks and policy."

This is happening in some parts of the country. The Arkansas governor signed a bill this year significantly reducing barriers to municipal broadband. It allows government entities "to acquire, construct, furnish, or equip facilities for the provision of voice services, data services, broadband services, video services, or wireless telecommunications services" as long as they "partner, contract, or otherwise affiliate with an entity that is experienced in the operation of the facilities."

Currently, public utility districts (PUDs) in Washington state are able to offer unrestricted broadband on a wholesale basis only through a dark fiber or open-access network, meaning cities can't sell broadband directly to consumers or organizations. House Bill 1336 was introduced to remove these restrictions and allow PUDs to sell outside their existing territories and construct broadband infrastructure for federally recognized tribes.

Survey respondents were asked if there should be a drive to "return local right-of-way (ROW) rules." For several years, incumbents have been trying to centralize control of ROW rules in statehouses rather than in cities and counties, thereby ensuring incumbents' greater control and lower ROW fees.

Seventy-three percent of survey respondents say it's worth fighting for the return of local control over ROW. Local governments want fair market prices for ROW fees from incumbents, control over what kind of broadband is deployed, knowledge of constituents' rates, and franchise agreements terms.

EQUITY SHOULD BE PRIORITIZED

Digital redlining is the practice of under investing in digital connectivity resources for low-income neighborhoods. Though heavily associated with urban communities, rural areas are not immune. Survey respondents are strongly against the practice and believe there should be rules prohibiting it. Help is coming as dozens of organizations have asked the FCC to directly confront digital redlining.

Should federal broadband grants for broadband urban areas increase? Currently, billions of dollars in federal grants are given predominately to rural areas. In contrast, in urban areas, there is a weak subsidy program and a comparatively small number of federal grants. Fifty-two percent of respondents favor grant parity between urban and rural.

I suspect that the reason there is less support for this policy change is the fear that any advancement for urban broadband funding will lead to an automatic reduction of rural broadband grants. But this is not a zero-sum game – everybody needs broadband! Communities do themselves a disservice falling into an "us versus them" incumbent trap. ��

Craig Settles is president of CJ Speaks. His workshops, consulting services and books have helped public, private and nonprofit organizations worldwide use technology to cut costs, improve business operations and increase revenue. Settles can be reached at craig@cjspeaks.com.



AT&T fiber

It's all anyone wants in an apartment.

AT&T FIBER** **DELIVERS MORE BANDWIDTH**than cable.

Based on combined upload and download capacity of Internet 1000 vs. Xfinity, Spectrum & Cox 1 GIG service with uploads of 35Mbps.

Up to 20x

FASTER UPLOAD SPEEDS

than cable.

Comparison of Internet 1000 wired upload connection speed to Xfinity, Spectrum & Cox 1 GIG service with uploads of 35Mbps. For more information, go to www.att.com/speed101.

085838



A Fiber Network Spurs a **New Northern New Hampshire Tech Corridor**

Planning, perseverance and strategic alliances pay off for the rural community of Bristol, NH, as it overcomes obstacles to bring better broadband and better jobs to residents.

By Sean Buckley / Broadband Communities

ristol, New Hampshire, is either underserved or unserved with broadband according to the FCC definition, but it is eager to provide affordable, high-speed broadband to its residents and businesses. The rural town has some internet options, but they're largely low-speed services from the area incumbent telco and cable operator that can't support demanding applications.

To make progress toward reaching its broadband goals, Bristol developed the Bristol Broadband Now initiative, an effort by the town's Economic Development Committee to build a multipurpose fiber network. The network will provide symmetrical fiber-to-thepremises (FTTP) network internet to residents throughout Bristol and connect businesses, municipal buildings and educational facilities in Bristol and nearby Plymouth.

Three desires drove Bristol to consider building its own FTTP and middle-mile fiber network: to improve cellular service, provide adequate residential broadband to meet the demands of the COVID-19 pandemic, and attract new businesses.

"The Economic Development Committee had been looking at how to improve cell coverage in the town," says Nicholas Coates, Bristol's town administrator. "It's a tough



problem to attract new business and people who want to settle here if we don't have good cell coverage."

But the town's efforts to engage wireless operators to enhance wireless coverage were unsuccessful. These providers told Bristol that



they would not be able to make a strong business case because the town's location is far from the state's major highway system.

ENHANCING BUSINESSES, JOB CREATION

When the large wireless operators could not prove there would be a strong ROI for enhancing wireless coverage, the town took it upon itself to find a solution. Bristol quickly realized a big part of the cost to connect wireless towers and microcells is the fiber backhaul facility.

Bristol hopes its proposed fiber network will spur further development of a tech corridor along route I-93 in northern New Hampshire. Although the tech corridor already exists in the southern part of the state, northern towns such as Bristol have been looking for ways to create the workforce and educational programs that draw technology companies and enable them to thrive. The towns hope to achieve this by creating a pathway between education and business while expanding the availability of broadband.

In Bristol, for example, Freudenberg-NOK Sealing Technologies, which makes seals and pistons for the automotive industry, has a manufacturing plant in the town that employs 500 people. "As the gas engine switches over to more of an electrical engine, gas parts won't be needed anymore," Coates says. "So, we asked how we can help create a workforce that will be ready for that and how we can help this business retool."

BRIDGING RURAL NORTHERN NEW HAMPSHIRE

Bristol is just one New Hampshire town trying to offer more-robust broadband. The Grafton County Broadband Committee was convened to bring large-scale broadband access to the New Hampshire North Country. The committee's first initiative is to develop a middle-mile network for 30 other rural New Hampshire communities.

"Similar to Bristol, we're looking at how to provide an ROI that would make sense for a company to come in or whether we can conduct a private-public partnership to tie into that backbone and deliver last-mile connectivity into a rural community," says Nicholas Coates, who serves as chair of the committee made up of five Grafton County town officials.

Coates and his colleagues in Grafton County also convened broadband committees with New Hampshire's Coos County and Carroll County. The Carroll County Broadband Committee is working with the Center on Rural Innovation, a Vermont-based nonprofit, and the North Country Council, a regional economic development agency, to complete a comprehensive survey of the county's internet offerings.

"We're taking a similar approach to the one we took in Grafton County and connecting it to what Coos and Carroll counties are doing," Coates says. "We'll have a fiber system for the entire northern rural part of the state that can compete and attract new business from Montreal, Boston, Quebec and New York."

CONOMIC DEVELOPMENT

He says "good solid internet will be needed" to help local students as they transition into the workforce. Fifty percent of kids who graduate from Bristol's Newfound Regional High School don't pursue college degrees, so preparing them to compete in the workforce by helping them acquire hightech skills is central to Bristol's plan.

"You could look at these statistics and say it's a real problem, or you could say it's an opportunity for highschool students to be tracked to jobs at Freudenberg if they learn the skills they need to work there after they graduate," Coates says. "Now, we could solve two problems: losing workers who are retiring and kids not having high-paying jobs and contributing to the economy."

The key to connecting highschool programs such as robotics to Freudenberg-NOK is a fiber network.

"We realized to make this connection, we needed to provide highspeed internet," Coates says. "To get that high-speed internet, we realized we probably would have to build a fiber network."

Freudenberg-NOK isn't the only company that will benefit from the fiber network. A local fluid dynamic company that developed an air purifier to battle COVID-19 plans to move servers from the Netherlands to Bristol.

The medical coding provider Medical Management and Reimbursement Specialists (MRS) pledged to add additional software development staff once the network is fully operational. "MRS plans to triple its workforce because it will be able to have people work remotely," Coates says.

COMMUNITY-LED EFFORT

Like its discussions with area wireless operators, Bristol's efforts to reach out to area incumbent wireline providers also failed to bear fruit. Neither Atlantic Broadband nor Consolidated Communications could see a viable way to work with the town.

Atlantic Broadband, which became Bristol's cable incumbent when it purchased area assets from Metrocast, did not want to enable another competitor.

"We talked to Atlantic Broadband, but their vision did not align with

what we were trying to do," Coates says. "They told us we would end up becoming a competitor to them in a territory where they already provide service, so they were not really interested in working with us."

Consolidated Communications had similar thoughts about Bristol's network ambitions. "Consolidated said it already has fiber and doesn't need to build it out anymore," Coates says. "The telco suggested we could rent space on its lines, which we said would not work."

When it became clear the incumbents were not interested in helping Bristol build a network, the town took matters into its own hands. It began by pursuing Northern Border Regional Commission (NBRC) grant funds. NBRC is a federalstate partnership for economic and community development in northern Maine, New Hampshire, Vermont and New York. Every year, NBRC provides funding for critical economic and community development projects throughout the Northeast. These investments, which leverage privatesector investments, drive job creation.

Bristol residents agreed during the town meeting to provide a level of funding if the town could win a NBRC grant, which it did. Between the town appropriation and the grant, Bristol ended up with \$260,000 for its new network.

By building its own network, Bristol could have a level of control. Instead of working with a provider that might cherry-pick the most profitable areas, Bristol's fiber-to-the-home (FTTH) network could cover the entire town.

"We are able to build the network the way we want it and aren't beholden to Atlantic Broadband or Consolidated Communications, who said 'you can have a network, but only where we already have it," Coates says.

MULTIFACETED NETWORK

The NBRC grant and town appropriation was a start, but Bristol knew it was not be enough to get a network built the way it wanted. The town wanted the network to serve not only residents, but also businesses and the local university.

"One of the things we realized is that we really wanted to make that connection to Plymouth State University (PSU) and that \$260,000 would not get us there and to the other things we want to do," Coates says.

But Bristol found a new opportunity to fund Bristol Broadband Now when the New Hampshire government launched the Connecting New Hampshire - Emergency Broadband Expansion Program funded by the Coronavirus Aid, Relief and Economic Security (CARES) Act. This program authorized the allocation and expenditure of \$50 million from the CARES Act to address the increased need for internet connectivity resulting from the COVID-19 pandemic.

The first project is a 24-mile fiber route that passes nearly 400 Bristol residences and connects to the NetworkNH system at PSU. The second project will provide the additional fiber backbone and fiber distribution required to connect all Bristol municipal, educational and commercial buildings and is funded by the NBRC grant and town appropriation.

Coates says the focus of the Emergency Broadband Expansion Program was in line with Bristol's plans.

"A lot of the stuff we were thinking about was what the program was touching on, such as telemedicine, remote schooling and telework," Coates says. "As we were planning this project, we were talking about it from an economic development standpoint we were going to connect businesses, schools and municipal buildings, but we did not have enough money to do fiber to the home."

To get the support of Bristol voters, Coates felt the town needed to also have the funds to build an FTTH network.

"I had been pushing our economic development chair, saying that if we're going to get buy-in from the voters on the vision of doing a full build for the entire community, we're going to have to do fiber to the home," Coates says. "The focus of the Emergency Broadband Expansion Program grant was related to three areas: deliver fiber to the home to about 450 residences, make the connection to Plymouth State University, and branch out into other areas that we identified as high priorities."

After years of planning and strategizing with project stakeholders, the town issued a request for proposals in August 2020 for the design, engineering and construction of the network, which was completed in December 2020 to meet CARES Act funding regulations.

Following a formal procurement process, Bristol selected eX² Technology to build out a hybrid FTTH network architecture using Active Ethernet and GPON. "Bristol chose eX² because it was not affiliated with any provider, which allows us to make the best decisions for the town," Coates said.

Jay Jorgensen, COO of eX² Technology, says the nature of the CARES Act funding posed an interesting challenge for completing the Bristol fiber project.

"The unique part about it was that it had a quick burn," he says. "The CARES Act money needed to be spent by the end of the year, so we had a 90-day cycle to build 24 miles of fiber in New Hampshire, where winter obviously becomes an issue."

ELECTRIC CO-OP PACT

After securing funding, Bristol also had to clear another hurdle in its network plan: gaining access to existing utility poles.

"We started to look at what we should do and banged our head against the wall for three years," Coates says. "Our insurance company would not provide us insurance because the rates are too high, and the area utilities, Eversource and Consolidated Communications, would not change their insurance policies on pole attachments, because we would be a competitor."

When it could not find a solution to the pole attachment and insurance issues, Bristol went back to Consolidated and Atlantic Broadband and proposed a public-private partnership in which the town would build the network in exchange for

Bristol was the only municipality in New Hampshire to receive Coronavirus Aid, Relief and Economic Security (CARES) Act grant money for telecom infrastructure.

the utilities insuring, managing and operating it. "We got a tepid response of no, not really," Coates says.

Bristol eventually found a kindred spirit in New Hampshire Electric Co-op (NHEC). Unlike traditional investor-owned utilities, NHEC is a member-owned electric cooperative.

Headquartered in Plymouth, NHEC connects its members through 5,600 miles of energized lines, crossing 115 communities throughout rural New Hampshire.

"As we were going through our

process, I thought it would make sense to partner with NHEC because it's in its mission to provide rural electricity," Coates says. Broadband was initially not part of NHEC's plans, but the co-op was being told by some of the towns it serves with electricity that it needed to get into the broadband game.

Coates reminded NHEC that it had a lot of fiber on poles that had been overbuilt and could be turned into a revenue stream. He says he told the co-op, "Since it's in your mission to provide electricity in rural areas,

ELECTRIC CO-OPS MAKE RDOF GAINS

It's clear that electric cooperatives are making broadband a priority. According to the National Rural Electric Cooperative Association, nearly 100 electric co-ops have started offering high-speed internet access to rural homes, businesses and schools.

As electric cooperatives work to bring broadband to the rural United States, some have formed partnerships with telecom operators and towns. In Georgia, for instance, the city of Colquitt has partnered with Windstream, and the New Hampshire Electric Cooperative has partnered with Bristol, New Hampshire.

Electric cooperatives had a big showing in the FCC's Rural Digital Opportunity Fund (RDOF) reverse auction, securing \$1.6 billion to serve more than 900,000 locations in 31 states. In total, 180 electric co-ops competed as part of five consortiums that garnered a total of about \$1.5 billion. Five individual electric co-ops won a total of \$59.4 million.

For example, Conexon, a rural fiber network design and construction management provider, and members of its Rural Electric Cooperative Consortium were awarded more than \$1.1 billion through the RDOF Phase I auction to provide gigabit-capable broadband. Consortium members will use these funds to launch and operate fiber-to-the-home networks in more than 600,000 rural areas across 22 states.

Cooperatives have continued to step up to provide rural area broadband service. More than 100 co-ops are engaged in broadband projects. CAF II, the last FCC reverse broadband auction, was the first time electric co-ops were eligible for FCC rural broadband funding. Thirty-two electric co-ops won 35 bids in that 2018 auction.

ECONOMIC DEVELOPMENT

why would you not do the same with broadband?"

When Bristol looked at the FCC's Rural Digital Opportunity Fund (RDOF) site to see what it could fund with an Emergency Broadband Expansion Program grant, it found there was a large area of town that met the definition of underserved or unserved.

Coates learned that NHEC was pursuing funding on its own for other areas, but as the owner of most of the poles in Bristol, the co-op promised cooperation.

"We told them the pole attachment process and getting insurance had been hard," Coates says. "NHEC assured they would work with us and figured out how to make it happen if we got the money."

STREAMLINED MAKE-READY PROCESS

As a new player in the market, Bristol is not immune to the pole attachment

make-ready process, which can cause lengthy delays. But the town's agreement with NHEC streamlined the make-ready process to attach fiber to the utility's poles.

eX² Technology's Jorgensen says because Bristol had already done the legwork to get the pole attachments in place, the process to build what will be mainly an aerial network was accelerated.

"Oftentimes the permitting and approval process for pole attachments could take several months or more," Jorgensen says. "For the town to have relationships in place and for the electric co-op to work with us like that was unique and key to getting the project done on time."

Though it had NHEC on board as a pole attachment partner, the short time frame to get the network built meant Bristol could not wait for the lengthy make-ready pole attachment process. When Bristol got ready to build its network with eX² Technology, it told

NHEC it would have to do things out of the ordinary.

"NHEC told us it was good with our proposal because that's what it was going to be doing with its own projects, and eX² Technology was instrumental in having that conversation," Coates says. "The design and the construction process were very streamlined."

Now that the network is built, the next phase will be to reach pole attachment agreements with Eversource and Consolidated, which own the remaining poles in Bristol.

"While we're working on the second part of the pole attachment agreement process, we're interviewing ISPs," Coates says.

WHOLE-TOWN COVERAGE

With an eye set on having an openaccess network, Bristol is taking a close look at how different ISPs would work with the town. Bristol expects to have an ISP in the coming months.

One key question Bristol is asking ISP candidates is whether they buy into the vision in which the town retains some level of control and ownership and the ability to build out service to more areas.

"We don't want to build out just half of the town and say we're good because the other side would say 'what the heck?" Coates says. "Now, we tell these companies that we want them to build out the rest of the town over a one- to five-year period, so we obtain our goals around full FTTH opportunities."

Today, Bristol is evaluating four ISP candidates, all of which have different models. Once it completes the process, it will rank them and ask if they can meet its specific goals.

"The conversation will be that we'll partner with the ISP and write the grants and address 80 percent of the cost if it is able to put in 20 percent of the match money that's required for these grants," Coates says. "Instead of the ISP having to spend 100 percent of the costs to get customers, it only has to spend 20 percent."

BONDING WITH THE R&D COMMUNITY

In addition to connecting residents and businesses, Bristol also saw an opportunity to be a conduit for



the local research and development (R&D) community.

Bristol's relationship with PSU is rooted in the creation of the Infrastructure to Broaden Economic Advancement and Mindshare (I-BEAM-NH).

At the time I-BEAM was devised, New Hampshire proposed building a fiber ring network to connect major community anchor institutions in the state and link together several communities in the western, southwestern, and northern parts of the state that have limited or no means of terrestrial broadband access. The overall infrastructure of I-BEAM was expected to help 50,000 subscribers in New Hampshire upgrade or gain access to affordable broadband services.

"The goal was to build a network backbone to serve anchor institutions," Coates says. "NetworkNH got the money to connect all the universities and the community colleges, but they never got to the next step of connecting all the municipal and county buildings."

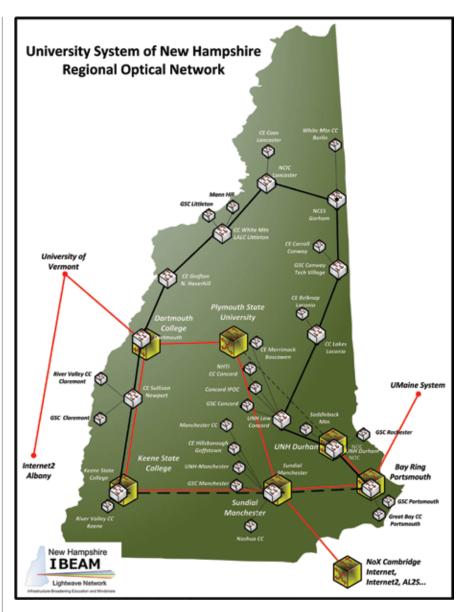
Given the initial mission of I-BEAM, Bristol surmised that there was a big opportunity for it to help connect R&D facilities at other New Hampshire colleges.

"Bristol's development chair said there is this really high-speed network tied into research and development for connecting our schools and businesses," Coates says. "So we asked why would we not want to figure out how to tie into that network to bring high-speed internet to researchers at the University of New Hampshire and Dartmouth. We could also bring MIT research to Bristol and its schools and businesses."

Bristol found that the nearest connection point was in Plymouth off River Road, which is one of the main backroads between Plymouth and Bristol. It also is an area that Bristol identified as a potential economic development target.

The town's Emergency Broadband Expansion Program grant application was focused on its conversations with NHEC, which owns the poles on River Road along the route to the PSU building.

"We have a friendly company that owns the poles and bought into what



Bristol's network connection to Plymouth State University will enable it to reach other New Hampshire and Massachusetts universities including Dartmouth College, the University of New Hampshire and MIT.

we're trying to do," Coates says. "It will get us to the front door of the university system, which is our second goal."

To make the connection into PSU, Bristol will develop an indefeasible right of use (IRU) fiber lease from PSU down to where the university's fiber terminates along River Road.

From there, Bristol will build fiber from the termination point in the municipal network to the water and sewer department, highway department, library, police department and fire department. It also will follow the path of areas it cited as economic development areas with the NBRC borders.

"We got the second grant and had to get the build going quickly," Coates says. "NHEC said it will build what it can build." .

Sean Buckley is the editor-in-chief of **BROADBAND COMMUNITIES**. He can be reached at sean@bbcmag.com.

Rural Communities Launch Publicly Owned Fiber Networks

Rural communities are deploying fiber as a way to future-proof and meet the longterm communications needs of homes, businesses, community anchor institutions and government agencies.

By Michael A. Solitro / Sertex Broadband Solutions

igh-speed internet is now the heart of the economy. According to the Bureau of Economic Analysis, the digital economy is growing nearly three times as fast as the overall economy, at about 10 percent per year.

Today, a 100/50 Mbps connection adequately allows videoconferencing, surfing, streaming and gaming with multiple devices. Projections anticipate 2 gigabit upload and download speed requirements by 2030. Yet most of the nonmetropolitan United States still limps along without a wired connection capable of meeting the FCC's minimum 25 Mbps suggested speed. Without adequate broadband services, rural areas can't participate in one of the fastest growing sectors of the economy.

Cable companies claim to offer rates up to a gigabit per second, but hundreds of users can share these connections. When many users connect at the same time, the true rate per home can be as low as 4 Mbps. Cable was designed for asymmetric data speeds with higher downstream and lower upstream rates. With 45 million people working from home in the pandemic, this often-oversubscribed data transmission system has proven to be weak and inadequate.

Enter fiber broadband. Fiber is a futureproof technology that can easily meet the communications needs of homes, businesses, community anchor institutions and government agencies for decades. The capacity of a single strand of fiber optic cable is thousands of

times the capacity of any other wired medium. Without amplification, signals carry for miles with minimal signal loss, and fiber will not corrode on exposure to weather and other environmental conditions. This means lower maintenance costs and a useful lifetime of decades – a huge economic advantage.

But only a third of U.S. homes have access to the speed and reliability of fiber optic networks. Even in the densely populated Northeast, where several states are nearly 100 percent connected, many in small towns still struggle with DSL and underperforming, expensive cable connections. Cable may soon get even more costly in areas where true high-speed broadband is available. This year, Comcast is planning to begin charging its home internet customers in the Northeast and other areas for data usage over 1.2TB per month. And Comcast's competitors can't be far behind.

Recognizing broadband as an essential utility like roads and electricity, and tired of waiting for telecommunications giants to deliver promised high-speed internet services, a growing number of rural towns in the Northeast are taking back control by building publicly owned, last-mile fiber broadband networks in their communities.

With gigabit fiber networks, these remote communities can compete digitally with big cities and affluent suburbs. By building affordable, publicly owned, fiber-to-the-premises (FTTP) networks, municipalities can take



Construction has started on Block Island's \$8 million FTTP network that will provide reliable gigabit fiber broadband to every home and business on the island and help boost the local economy.

control of their telecommunications infrastructure and open the doors for growth.

PUBLIC-PRIVATE COLLABORATIONS GIVE COMMUNITIES CONTROL

The challenge in bringing reliable broadband to rural areas is buildout costs. When small populations are spread across large geographic areas, hundreds of miles of network infrastructure must be built, often through remote and rugged terrain. Infrastructure installation is expensive, and telecommunications giants are unwilling to invest in sparsely populated areas with limited opportunity for profit.

To ensure affordability, a publicprivate partnership between a local government and private providers can leverage a municipality's ability to finance capital projects at low longterm interest rates. For taxpayers, access to public bonding means the cost for a publicly owned fiber network can be extremely affordable. By owning the networks, communities manage expensive – and often uncontrolled – ISP relationships and create infrastructure that pays for itself. In addition, using networks to deliver advanced services can even generate revenue.

In a public-private scenario, towns have a low-risk way to chart their

broadband future. Municipalities finance the fiber infrastructure and manage rights of way – things governments are familiar with doing. A community's financial investment is limited to network buildout and excludes the service side.

The private entity builds the infrastructure, maintains the fiber and equipment, and runs the business and operational end of the network. It handles sales and marketing, customer service, technology updates and customer demands – functions private entities do well. For their investment, private network operators and ISP partners benefit by quickly accessing new markets without building infrastructure at their own expense.

Just as a municipality would fund any infrastructure investment, local governments can access capital markets and use grants or low-cost public financing methods, including municipal or revenue bonds, to fund network development. No private entity has access to funding with similar rates and terms.

In New Shoreham, Rhode Island, located 12 miles offshore on isolated Block Island, residents and businesses have been struggling for years with underperforming satellite and DSL service. A tourist community with just 1,000 year-round residents and a seasonal population of up to 20,000,

New Shoreham recently committed to building an \$8 million FTTP network that will provide gigabit high-speed internet along with phone service to every home and business on the island.

The town is creating this network in partnership with Sertex Broadband Solutions, a provider of fiber optic infrastructure deployment services to unserved and underserved areas. The municipality will own all passive and active electronic elements of the island network, including conduit, underground and aerial fiber cabling and drops to about 1,700 properties. Sertex will engineer, furnish and install all conduit, cabling, drops and the necessary electronics to deliver the service. Once the network is operating, Sertex and the network's ISP will handle operations, maintenance and customer service.

The backbone network and drops are the largest capital cost for the project. The town has committed to installing all the drops while crews are on-site during the construction process. This commitment is financially efficient and will help promote market penetration. Once a network is operational, the typical cost to run an aerial service drop to a suburban home is approximately \$700 with an added \$370 for electronics, which totals \$1,070 for an installation just 250 feet from the right of way. (Drops in remote

ECONOMIC DEVELOPMENT



Over the past four years, as many as 23 small towns in the Berkshires of western Massachusetts have chosen to construct more than 1,600 miles of FTTP networks, connecting some 17,000 rural customers to gigabit-speed internet service.

areas and underground installations come at a much higher price.)

By running drops to every premises during network construction, New Shoreham is picking up the installation costs for individual customers, an investment that should incentivize any hesitant property owners to join the network. The town is financing the islandwide buildout using 2 percent municipal bonds with 40-year terms. The town will recover many of the network's costs for construction, maintenance and operations through subscriber fees, which, combined, are less than the price residents are currently paying for poor internet and phone service.

By financing only fiber cabling and conduit, the town can secure loans with 40-year terms. If it tried to finance cabling and electronics, terms would be far shorter because of the limited life span of the equipment.

The public-private model gives local governments choice and influence over broadband decision-making. More reliable, more responsive, more affordable networks replace existing, achingly slow, monopoly-controlled services.

EMPOWERING RURAL ECONOMIES

Reliable, high-speed internet access delivered by municipally owned fiber networks improves the productivity of existing businesses, allows telecommuting, creates new jobs and attracts new businesses to remote communities. It incentivizes younger people to stay in a community, draws new residents, encourages tourism, and strengthens real estate markets.

High-speed communications networks can also promote social good and human services by simplifying access to health care, enhancing public safety services, improving schools, enhancing the offerings of libraries, and allowing remote enrollment in higher education and participation in the arts. Because these networks are locally owned and operated, the millions of dollars in savings they generate can be reinvested in the local economy.

Over the past four years, as many as 23 small towns in the Berkshire region of western Massachusetts have chosen to construct more than 1,600 miles of FTTP networks that to date have connected some 17,000 rural customers to gigabit-speed internet service. These communities and many others throughout the country are experiencing:

- · Improved real estate values:
- When people look for communities to move into, the presence and speed of internet connectivity is an important factor. Research by the Fiber Broadband Association found that having a fiber broadband connection increases property values by 3.1 percent, and that private properties with 1 Gbps connections sell for an average of 7 percent more than those with 25 Mbps or lower.
- Residential growth: FTTP availability attracts people looking to move from urban areas and keeps existing residents in town, increasing a community's tax base. Often newcomers are young families that use local schools and support local businesses and institutions. The presence of a gigabit fiber network can be the reason people choose one community over another.
- Business growth: High-speed internet access allows local businesses to expand, invest and seek new opportunities by connecting them regionally, nationally and globally. Some connected towns are even recruiting corporations to relocate or add facilities in their communities.
- **Job creation:** As existing businesses grow and new businesses are created thanks to FTTP access, new jobs are created. Many fields are now knowledge-based rather

than location-based, and employees can choose to live anywhere that has a reliable high-speed connection for videoconferencing and accessing information.

- health care benefits: FTTP networks provide greater access to health care without traveling long distances. Telemedicine can improve health outcomes for people inclined to delay medical visits if they must travel to see a doctor. Communities with healthier populations enjoy stronger local economies because the economic burden of health care costs is reduced. And communities with younger populations naturally have lower health care demands.
- New income sources: There are a few ways FTTP networks can generate revenue. For example, in a tourist location such as Block Island, the town could set up a commercial Wi-Fi network that all visitors can access for free. Local

High-speed communications networks promote social good by simplifying access to health care, enhancing public safety services, improving schools, enhancing the offerings of libraries, and allowing remote enrollment in higher education and participation in the arts.

businesses can advertise on the network, and the town can collect some or all the advertising revenues. Private, subscription-based Wi-Fi networks in hotels, marinas and other closed communities could also be a source of new income.

FTTP networks can literally transform both the character and the economic status of stagnant rural

communities. With public-private models, the cost of entry is no longer a barrier, and doing nothing is no longer an option. ��

Michael A. Solitro is the founder and CEO of Sertex Broadband Solutions, an expert in fiber optic infrastructure deployment in unserved and underserved areas in the Northeast.



A Michigan FTTH Network Rebuild Sets Stage for Greater Bandwidth, **Smart-City Applications**

Wyandotte, Michigan's municipal utility provider is rebuilding its hybrid fiber coax network with fiber to the home to retain and attract new residents and businesses with 10 Gbps broadband, IP video and smart IoT services.

By Sean Buckley / Broadband Communities

Pyandotte, Michigan, located 11 miles south of Detroit along the Detroit River, is notable for being the only community in the metro Detroit area to offer a full spectrum of community-owned municipal utility services. Since the turn of the century, Wyandotte Municipal Services (WMS) has provided electric power through a municipal power plant and distribution system, operated a municipally owned water filtration plant and distribution system, and provided cable-based internet services. But the city of 25,000 is not resting on its broadband laurels.

When WMS started considering ways to future-proof its network, it looked at three options: conducting node splits in the cable network, driving fiber deeper, and pursuing a remote physical solution. The community ultimately concluded that a fiber-to-the-home (FTTH) network was the best option because it would prevent network congestion and provide a platform to support future smart-city and smart-home applications.

Before WMS settled on a fiber path, it conducted an analysis that defined and quantified the costs and benefits of upgrading the existing hybrid fiber coaxial (HFC) network versus building an FTTH network. An early evaluation of the architecture, technologies, business

resources and future service goals revealed that the FTTH build was the best option.

CommScope is helping the agency rebuild its coax network with fiber to deliver service to the city's residents. The city plans to complete the new system and begin serving its citizens within the next two years.

CommScope serves as the overall integrator for the Wyandotte project, playing the roles of adviser, consultant, engineer and construction manager. It is conducting a deep analysis and considering issues such as headend relocation, fiber overlay requirements, an FCC repack, IP delivery requirements and budget and municipal funding. Meanwhile, Graybar and Power & Tel are in charge of order fulfillment. The two companies are members of CommScope's PartnerPRO Network and provide material for the FTTH build.

By providing both the fiber technology and expertise, CommScope will enable nearly 13,000 homes and more than 700 commercial buildings to access a new network with up to 10 Gbps of internet, IP video and smart-home services.

The project requires full conversion to FTTH, management of multiple contractors, network component integration, and relocation and expansion of Wyandotte's headend.



Wyandotte, Michigan, determined that upgrading to a fiber-to-the-home network would prevent network congestion and provide a platform to support future smart-city and smart-home applications.

CommScope Professional Services will provide both inside and outside plant construction management and headend relocation. Ongoing consulting services include HFC and FTTH architecture analysis, network evolution and FTTH design services. The vendor also will provide off-air antennas and satellite signal surveys. In addition to offering its complete FTTH portfolio, CommScope will provide new fiber innovation to get more bandwidth out of the existing network infrastructure.

Other cities and towns served by large utilities see crippling outages from time to time. In contrast, Wyandotte is quick to tout the reliability of its utility platforms.

"There's a lot of pride in Wyandotte with its municipal utility," says Paul LaManes, the general manager of Wyandotte, who is overseeing the city's conversion to FTTH. "We have bragging rights given our limited electric outages compared with investor-owned utility neighbors less than a mile or two away."

He adds, "The ability to have your own cable internet and other utility services is extremely unique here."

A NEW BROADBAND JOURNEY

The fiber network Wyandotte is planning is a complete rebuild of its existing system. Though the plans to rebuild Wyandotte Cable with fiber is new, it is not the first network transition WMS has been through during its more than 30-year history.

Wyandotte's broadband journey can be traced back to the early 1980s, when Wyandotte Cable – part of WMS – installed cable infrastructure throughout the city and began offering basic cable television services. Since 1983, Wyandotte Cable has expanded what was once a basic cable television system into a full broadband telecom system that provides voice and data.

"Wyandotte Cable evolved like any of the other players in this business to provide broadband and VoIP phone services, so we offer the triple bundle like any of our competitors," LaManes says.

Like other communities that have built their own networks, Wyandotte has been able to leverage the coax and fiber network for the electricity network.

"The coax network has a wide range of uses," LaManes says. "We got a lot of utility out of the system for outage management, advanced meter infrastructure, and supervisory control and data acquisition."

Over time, the provider has been expanding the depth of its fiber network. Between 2014 and 2020, Wyandotte Cable built out additional fiber cables and converted digital and high-definition signal formats. It now offers a wide selection of cable television services, from digital and high-definition programming to advanced, internet-connected, whole-home video services powered by TiVo technology with access to everything on all mobile devices.

Today, Wyandotte Cable serves about 5,100 cable television subscribers, 6,000 high-speed internet subscribers and 900 digital phone subscribers with annual revenues of approximately \$10 million.

The fiber network will provide various benefits that impact the way Wyandotte Cable serves customers. For one, it will immediately give it another advantage over its main competitor, AT&T, which provides a triple-play bundle.

"The thrust of our project with CommScope is that we'll be able to provide speeds and reliability that none of our competitors in Wyandotte can currently offer," LaManes says. "It allows us to increase revenue with a higher-margin product than we have with our video services."

FOCUS ON IP-BASED VIDEO

Wyandotte Cable rebuilt or made major upgrades to its network about every 20 years, which is what led it to work with CommScope. Wyandotte issued 15-year revenue bonds to complete the FTTH build. It is also moving its headend from the current location to a new building.

Today, the provider offers voice, video and data over DOCSIS and quadrature amplitude modulation (QAM)-based facilities. As a result of the upgrade to FTTH, it will be able to offer the advantage of a lower-cost network.

"It also allows us to have decreased maintenance costs because of the lack of active equipment," LaManes says. "It's a long-term investment."

CONOMIC DEVELOPM



As Wyandotte transitions its last-mile network to fiber, it is also migrating from QAM to an IP-based video system.

Another part of its network transition is migrating from QAM to an IP-based video system.

Tom McLaughlin, senior vice president of service providers for CommScope, says that the IP video transition is not a jarring process. CommScope's professional services division can evaluate the best approach to IP video evolution and integrate multivendor video solutions.

"What has to happen is you build a network, which is pretty straightforward - you design a network, and you construct it," McLaughlin says. "As far as the back office on the video side, you have to make a change in the video headend to allow the video to be delivered via IP as opposed to QAM."

Wyandotte Cable's move to IPbased video is becoming commonplace.

"The majority of video providers in the industry are transitioning to this or have transitioned to this, so the equipment and technology is straightforward," McLaughlin says. "However, there's a little change that has to happen in the headend to allow for video via IP as opposed to QAMbased video."

MAINTAINING NETWORK REDUNDANCY, RELIABILITY

"The timing for the coax-to-fiber transition was perfect," LeManes says.

"We had the need to move our headend." Currently, the cable headend is in an old office in downtown Wyandotte. The old offices in the downtown Wyandotte building were converted into luxury condominiums.

The new WMS headend location is right next to its electric operations building. It will eventually create a campus for its electric and cable divisions.

LaManes says one key issue with the current headend is that it lacks the same level of reliability as the electric and water facilities.

"The voice, video and data business have no redundancy like the electric department or the water department," he says. "If I can't buy power over the grid, I can run the power plant, and if I can't filter water, I can always buy it from Detroit. However, if something were to happen to our headend, we would be out of the business immediately."

Several components of the project were bid out, and CommScope is helping WMS develop the bids because they must be offered publicly. The utility is small and needed assistance in evaluating other contractors for building the network. CommScope helped Wyandotte "not only put together the bid packs but also evaluate the bids and come up with ideas that

are advantageous to us financially," says LeManes. "We needed that partnership; we could not do it on our own."

Now in the process of awarding the bids, the city started construction on the building in February. "It is going to be a process of a year or two to complete," LaManes says. "Once we complete it, we'll be positioned to compete at the highest levels against any competitor and be positioned for the next 20 to 30 years."

ATTRACTING BUSINESSES, **HOMEOWNERS**

Giving residential customers higher speeds over FTTH is a key priority, and the new fiber network will also be a key attraction for new and existing businesses located in the city.

Henry Ford Hospital has a large facility in Wyandotte. The city's strategic plan includes building out a medical campus near the thoroughfare in downtown Wyandotte that runs parallel to the Detroit River.

Several parties will use the WMS fiber network to attract development and redevelopment in the city.

"A lot of larger buildings are being built on what would be brownfield land that housed doctors' offices that are part of the hospital," LaManes says. "This project is critical and part of the economic development plan for the city."

Along the same lines, the fiber network will benefit the surge in telecommuting that has taken place during the COVID-19 pandemic and will play a role in attracting new residents. Already, Wyandotte Cable is targeting a few condominium developments for the new FTTH project.

"Several retail, multilevel condominium developments are sprouting up in Wyandotte," LaManes says. "CommScope is helping us determine how we're going to allow this project to be taken into that development." �

Sean Buckley is the editor-in-chief of BROADBAND COMMUNITIES. He can be reached at sean@bbcmag.com.



ECONOMIST

A DISH FIBER PREMIER PROPERTY

Our residents have been extremely pleased with the newest upgrade to DISH Fiber. They appreciate paying less than their previous providers, and we've all been impressed with the speed and reliability of the service. New residents also love having internet immediately available when they move in.

Barry H. Economist Apartments Denver, CO



Great amenities attract great residents.

Gig-enabled Wi-Fi & live streaming TV.

Instantly available, property-wide.

Experience DISH Fiber: A managed Wi-Fi solution for multifamily communities that creates revenue opportunities for owners while keeping resident rates low. One common secure network connects both residents and staff, while serving as a backbone for smart communities.

DISH Fiber provides a premium experience that residents can't get with individual providers, including instant access to private networks upon move-in, gig-enabled speeds, property-wide connectivity and 24 channels of live streaming TV.



Gigabit Fiber Comes to Los Altos Hills

Residents of an underserved town use a micro-scale community model to get gigabit broadband.

By Masha Zager / Broadband Communities

os Altos Hills, in the heart of California's Silicon Valley, is the fourth richest town in the United States. The green, rolling hills are populated by tech company executives living in palatial estates. Olympicsize swimming pools, Zen gardens and thoroughbred horses abound. It's an idyllic place to live, except for one thing: The internet service is terrible. The lack of a commercial center or multifamily housing, along with the wide expanses between houses, makes the town uneconomical for service providers. Though pockets of the town have access to cable service, many residents can't get internet service at all, and others use satellite or fixed wireless. Even the cable service has proved inadequate to meet pandemic-fueled demands for videoconferencing.

However, all that is about to change. A dozen or so residents now have access to fiber to the home, and if all goes well, the entire town – about 3,800 households – will have access to it in the near future.

Several years ago, the town government formed a volunteer subcommittee on emerging technologies; its first project, not surprisingly, was to bring better broadband to residents. The committee issued a request for information from providers, asking how they could deliver gigabit service to the community.

One respondent to the RFI was a new company, Next Level Networks, that proposed

to install and manage a community-owned fiber network. The committee, intrigued with this suggestion, decided to pursue it. Though the town government did not want to own a network, interested residents got together to form Los Altos Hills Community Fiber (LAHCF), a "mutual benefit corporation" under California law similar in organization to a homeowners association. LAHCF, which owns the network being constructed, is run by a volunteer board and funded by its members. It contracts with Next Level Networks, which in turn hires subcontractors for the outside-plant construction.

Scott Vanderlip, president of LAHCF, explains that his organization recruits, coordinates and supports broadband champions in each neighborhood of the town; these champions recruit their neighbors to join the network. "There are a lot of very interested people here who want to connect," he says. "Everyone wants to be first in the queue." In the most underserved neighborhoods, interest is extremely high. Even in better-served neighborhoods, some homeowners are willing to pay for a redundant line because executives working from home "can't afford to have outage time." Vanderlip suspects these backup connections may soon become the homeowners' primary connections.

Next Level works with community organizers, providing tools to assist in generating interest and assessing participation levels and costs. When a neighborhood reaches a critical



mass of committed subscribers, LACHF collects installation fees from them and turns over a payment to Next Level Networks so it can begin engineering and building that neighborhood. In addition to the upfront installation fee, each member pays a monthly fee once service begins. Next Level Networks is the service provider in this case, though LAHCF is building the network as an open-access network enabling other internet service providers to deliver service over LAHCF's network.

As new members join, a portion of their installation fees goes to reimburse earlier subscribers so that all members end up paying an equitable amount for installation. Because the monthly service fees are shared costs for operating the network, the monthly service fee is reduced for everyone as new members join. Next Level Networks can provide advance estimates of the installation and service fees required for any number of subscribers in a neighborhood, so that LAHCF can decide for itself when a neighborhood reaches critical mass which may occur with only a few homes. In the same vein, Next Level Networks also presents LAHCF with other sorts of tradeoffs - such as battery backup versus standby generator for each neighborhood headend – so that potential customers can make these decisions based on their own needs. As Darrell Gentry, founder and chief technology officer of Next

Level Networks, says, "Transparency is disruptive."

LAHCF is investigating several ideas for financing the upfront installation costs, which are on the order of \$5,000, over a period of several years. The earliest subscribers have been people who could afford to pay the lump sum out of pocket – one even fronted the costs for his neighborhood to get to critical mass sooner – but LACHF or individual members may also be able to borrow money from HOA financing or home-loan financing organizations. Another idea is for the town to float a bond issue.

Once a neighborhood goes live, Next Level Networks takes responsibility for

FTTH DEPLOYMENT



customer installation, billing, customer support, and internet service delivery.

TECHNOLOGY CHALLENGES

For the project to be feasible at all, LAHCF sought to use dark fiber for backhaul to the internet. This was a challenge, Vanderlip says, because the incumbent phone and cable companies do not offer the option to lease dark fiber. Eventually, LAHCF was able to lease unused capacity on a fiber cable originally installed to serve a town school and connect to a data center in Santa Clara, 25 miles away.

Another challenge was that the first neighborhoods to sign up for FTTH were not contiguous, and building fiber trunks between them at the outset was not practical. LACHF and Next Level Networks decided to create "fiber islands" and install point-to-point microwave connections, using Siklu radios mounted on housetops, to backhaul data from each "island" to the fiber backbone. "This allows

us to bring in neighborhoods much faster," Vanderlip explains. The fiber backbone will eventually be extended to these neighborhoods, and the radios will either be left in place as backup equipment or be repurposed to serve new fiber islands.

To keep FTTH equipment costs down, Next Level Networks uses an open-source Active Ethernet solution developed by the Telecom Infra Project that Facebook Intel, Nokia and others launched in 2016. White-box switches from EdgeCore Networks and others are equipped with the Open Network Install Environment (ONIE) and the SONiC open-source network operating system that stems from the open-networking mindset. The solution originally was intended to provide an agnostic, open-source, costeffective approach for rapidly scaling organizations, but the technology is catching on in new market segments and for diverse applications. For example, it's well suited to micro-scale builds

because the length of each fiber run is fairly short. (Active Ethernet, a point-to-point architecture, usually requires more fiber runs than a PON architecture.) "It's much cheaper than GPON," Gentry explains, "though it has some drawbacks" – for example, increased expense to repair backbone fiber cuts.

Gentry says Next Level Networks is exploring next-generation PON solutions to see whether they might make sense for future builds. "We're ultimately agnostic about technology," he says. "We're looking for a superior level of connectivity at the lowest cost."

One advantage of active Ethernet over GPON is that customers who need multigigabit service can easily access it. At present, 10 gigabit customerpremises equipment is relatively expensive, and Next Level Networks does not directly support it (though a couple of customers have bought their own). However, as prices fall over the next year or two, the company expects to standardize on 10G service.

DEPLOYMENT IN LOS ALTOS HILLS

As befits its micro-scale model, LAHCF started very small. A pilot project in 2019 connected four customers. After supply-chain issues and technical glitches paused the deployment, the backbone is now functional, and the network passes 24 homes. As of press time, 14 of these have subscribed to the network and are now connected; another property owner has asked to join the network, which will be the first test of the reimbursement mechanism. Construction has begun on two more network extensions, which will pass a total of 16 more homes.

Many more network extensions are in the pipeline – including one that has already made a financial commitment, several others that are close to doing so, and dozens of others that are in some stage of organizing. "We're finally showing that this can work and be successful," says David Barron, Next Level Networks' CEO. Barron notes that customers are so excited about the project and have such a sense of pride and ownership in the network that they are turning out to help the construction crews with everything from digging trenches to pulling fiber.

Barron expects to have more than 200 homes connected to fiber by the end of 2021, and he thinks the pace will accelerate in 2022. "We'll never get 100 percent of the homes in the town," he says, "but this was never intended to be a universal solution. Insisting on universal coverage can delay things; it's easier to base coverage on people's needs and desires." This approach can be politically advantageous compared with municipally owned networks, which sometimes generate pushback from taxpayers who object to paying for infrastructure they don't plan to use. Even with a minority of homeowners on the LAHCF network, prices will be reasonable - gigabit service will cost \$70 per month once the network gets to about 230 customers, and it will continue to go down from there.

FUTURE PROJECTS

Although Los Altos Hills is not a typical underserved town, Next Level

Networks believes its model will work in many other situations. The company is currently in discussions with a variety of potential clients.

Closest to home is the community college in Los Altos Hills, which would not become part of LAHCF but would simply lease fiber from Next Level Networks. However, because of the college's location in the town, building a fiber extension to reach it would help accelerate the buildout to homes in the community and bring some of the "islands" into the fiber network.

Two other projects in Silicon Valley that are currently in the design stages, are similar to LAHCF, but in communities that are less wealthy, though equally spread out. Barron is confident that micro-scale community networks aren't a solution for only the super-rich, especially once homeowner financing is available.

Other potential clients include a large apartment building in North San Jose and a new single-family-home development near Sacramento, California. Unlike the micro-scale projects, these networks will cover their entire communities – close to 200 units in the case of the apartment building, several thousand in the case of the new development – and provide internet service to residents as an amenity. They are more similar to the bulk-service model common in multifamily housing.

Although COVID-19 delayed these projects, it also made them more urgent. "There's a skyrocketing vacancy rate in Silicon Valley," Barron explains, noting that new hires are working remotely rather than moving to the Valley. "Buildings are trying to differentiate themselves."

In Los Altos Hills, Vanderlip is enthusiastic about the future of private, community-owned fiber. "It's just not going to happen unless people take it on themselves," he says. "There's nothing crazy about fiber that communities couldn't take on a project like this."

Masha Zager is a contributing editor at **Broadband Communities**.



INCOMPAS 2021 Policy Summit Highlights Regulatory and Network Buildout Issues

The event covered key issues for competitive broadband providers, including the homework gap, net neutrality, broadband mapping and the FCC's RDOF reverse auction.

By Sean Buckley / Broadband Communities

FCC's Brendan Carr: Title II Was a Monumental Mistake

s the United States nears the end of Joe Biden's first 100 days, the president faces pressure from constituents and other leaders to reinstate the net neutrality rules the FCC overturned in 2017. At the time, state legislators in California responded by introducing net neutrality legislation at the state level.

Now the big question is this: Are there ways to reconcile differences regarding net neutrality?

Brendan Carr, a Republican FCC commissioner, told attendees during the INCOMPAS summit that there should be a "path forward" for net neutrality.

"If you separate out the question of whether there is legal authority from the rules of the road, you will



Brendan Carr

identify so much common ground," Carr said.
"In the last Congress, Senators Roger Wicker and Kyrsten Sinema worked to codify basic rules of the road – no blocking, throttling and a lot of other rules to put in that bucket – and I would support that."

SMALLER CARRIER IMPACT

Though significant discussion on net neutrality centered on how the largest ISPs, such as AT&T and Comcast, would deal with Title II, smaller carriers also had a mixed response to Title II rules.

Carr said the main issue he had with the previous net neutrality rules was reclassifying ISPs under Title II, which allowed the FCC to regulate internet service providers as if they were utilities.

"If you look back at the two-year experiment with Title II, it proved that it was a monumental mistake," he said.

In 2017, 22 small cable providers signed a letter to the FCC asking for the end of net neutrality, arguing the policy imposed "onerous burdens" on their businesses. Other providers, including Common and Monkeybrains, told The Verge in 2017 that they did not have any issues with net neutrality. Still other providers, including central Arkansas provider Aristotle, agreed to the basic principles of net neutrality but saw other issues with the Title II classification.

Aristotle pointed out that FCC reporting requirements such as network performance, data caps and other network statistics could cost

it up to \$40,000 a year.

Carr did not cite any specific providers he saw that were affected by Title II regulation but emphasized that implementing it again as part of a net neutrality law would be a mistake.

"If you look at the small providers trying to build out internet infrastructure, the onslaught of Title II regulation drove them to pull back on investments and network builds," Carr said. "At a point in time in this country when internet connectivity is more important than ever before, it would be a mistake to go back to that."

LIGHT-TOUCH REGULATION

As the pandemic hit, people were forced to work and study from home, which required more broadband bandwidth. Carr cites how well networks were able to hold up during the COVID-19 pandemic as proof that U.S. regulations are successful.

"If you look at COVID-19 ... I think that was the definite stress test for our country's approach to internet regulation," he said. "If you look at countries that have more heavily regulated internet providers, their networks performed far worse than

[networks] did in the United States."

Carr added that by having a less burdensome regulatory regime, service providers are more likely to continue to expand networks.

"Our light-touch approach over the past 20 years ... has stimulated massive investment in our networks," he said. "We have a lot of investment, new infrastructure builds going out, more miles of fiber being deployed, competition is increasing, and prices are coming down."

Rep. Pallone: Universal Broadband Plan Needs to Address Access, Affordability and Skills

As chairman of the House Energy and Commerce Committee, Rep. Frank Pallone (D-NJ) has a lot on his plate these days. In addition to helping find a way to conquer the COVID-19 pandemic and provide relief to rebuild the economy, access to broadband is a key issue.

The committee's jurisdiction is far-reaching. It includes issues pertaining to health care, energy, the environment, commerce, food and drug safety, consumer protection and communications technology.

Pallone, who has held a seat on the committee since 1993, told attendees during the INCOMPAS summit that providing broadband to more people is a multifaceted issue.

His colleague House Majority Whip James E. Clyburn launched the new Rural Broadband Task Force, which will work to advance solutions ensuring that all Americans have access to high-speed internet by 2025.

"Making broadband universal is our goal," Clyburn said. "It's not just about running lines to every house but rather about a lot of different things."

MOVING FORWARD ACT

To meet Clyburn's universal broadband goals, three gaps first must be addressed: lack of access to broadband, affordability of service, and lack of training in using computing equipment to navigate the internet.

In 2020, the House Energy and Commerce Committee and the House overall laid out a foundation for a major infrastructure build called the Moving Forward Act (H.R. 2). It dedicated more than \$100 billion for broadband-related programs. Then-Senate Majority Leader Mitch McConnell did not bring it up in the Senate, however, so it never passed.

"Our committee is mainly addressing things directly related to COVID-19, [such as] crushing the virus, testing and getting out the vaccine," Pallone said, adding that he expected that if an economic stimulus package passed, it would include "investment in infrastructure and other things that will create jobs."

Indeed, the Biden administration's \$1.9 trillion COVID-19 relief bill (H.R. 1319), passed in March, has more than \$17 billion in funding that could subsidize broadband, including a homeowners assistance fund states can tap to subsidize broadband for lowincome residents during the pandemic.

Meanwhile, Clyburn recently introduced the Accessible, Affordable Internet for All Act, which authorizes more than \$94 billion to provide affordable, high-speed internet access to unserved and underserved communities.

That is in addition to the \$3.2 billion in the Emergency Broadband Benefit Program Congress approved last December, which helps households struggling to pay for internet service during the pandemic. It provides a discount of up to \$50 per month toward broadband service for eligible households and up to \$75 per month for households on tribal lands. Eligible households also can receive a one-time discount of up to \$100 to purchase a laptop, desktop computer or tablet from participating providers if the providers contribute \$10–\$50 toward the purchase price.

"I encourage all of the internet providers represented by INCOMPAS to participate because it's voluntary," Pallone said.

GETTING BROADBAND MAPPING RIGHT

Broadband mapping has been one of the vexing issues for figuring out where broadband is available in an area. Under the traditional FCC mapping method, a town is considered served by broadband even if only one home has access.

One ray of light came in 2020, when then-President Donald Trump signed S.1822, the Broadband Deployment Accuracy and Technological Availability (DATA) Act, into law. The legislation is designed to increase the accuracy of the FCC's broadband availability maps by strengthening the broadband data collection process.

CONFERENCE COVERAGE

Among other things, the DATA Act requires the FCC to collect granular service availability data from wired, fixed wireless and satellite broadband providers. It also creates a process for consumers; state, local and tribal governments; and other groups to challenge FCC maps with their own data and require the FCC to determine how to structure that process without making it overly burdensome for challengers.

Pallone said broadband mapping, passing bills to battle robocalls, and helping smaller carriers migrate away from Huawei gear are three cornerstone issues resolved in a bipartisan manner.

"We did pass the DATA Act, and at the end of the year, we had the money to do it," he said. "The issue now is to generate the right maps."

As a next step, he said, "We need to make sure the Biden administration moves quickly with the maps ... used to form funding and policy decisions."

Sen. Ed Markey: We Need to Bring Finality to the Net Neutrality Debate

As the nation recently celebrated the 25th anniversary of the Telecom Act of 1996, Massachusetts Sen. Ed Markey (D-MA), a key internet freedom advocate, will



Sen. Ed Markey

soon introduce a bill to bring back net neutrality.

The proposed new law aims to end the debate over net neutrality and secure open internet protections for Americans under Title II regulations. Net neutrality establishes rules stipulating that service providers offering broadband services should treat all internet traffic equally and not block, throttle or prioritize any content or data over others for commercial purposes.

In December 2017, then-FCC Chair Ajit Pai's Restoring Internet Freedom Order was approved in a 3:2 vote along party lines. Pai's order rolled back the net neutrality protections that Tom Wheeler, former chair, put in place.

Several states, including Washington and Oregon, previously passed legislation similar to the net neutrality rules adopted under Wheeler. California passed a bill in its state Senate to reestablish net neutrality and prohibit zero-rating programs in the state. In February, the U.S. Department of Justice dropped its 2018 lawsuit challenging California's net neutrality rules.

With a soon-to-be Democratic-led FCC in place and now a Democratic White House, Markey is keen on passing a permanent net neutrality law.

"I want Congress to bring finality to the net neutrality issue," he said.

"In order to preserve the free and open personality of the internet, we need strong and enforceable net neutrality rules and FCC authority over broadband access."

He added, "We need to reverse the wrong-headed decisions of the Trump FCC, and that's what I am going to be working to advance."

ENABLING ACTIVISM, **PROTECTING CONSUMERS**

The presence of net neutrality rules gives a voice to activist groups that want to drive awareness on issues such as gun control and racial equality.

"The reality is that net neutrality is also a civil rights issue," Markey said. "Today, individuals of all walks of life are carrying the torch of American activism on the streets and also online."

The absence of net neutrality could keep people from expressing their views.

"Without net neutrality, Americans may be slowed down or stopped when they attempt to speak their minds on social media [and] livestream or organize peaceful protests," he said. "We can't allow that to happen as our country strives to root out systemic racism and other injustices."

Net neutrality should also protect consumers from large companies' using their personal data. In recent years, companies have used online algorithms to monetize people's privacy.

"It's time to step back and begin to put in place the guardrails that protect people from the misuse of power, which the internet has put into the hands of certain private-sector individuals," Markey said, adding that power should be "in the hands of the individuals who use the internet."

DRIVING COMPETITION, EQUITY

In addition to making sure the internet

is open under net neutrality, fostering competition is also important. Markey pointed out that consolidating the telecom industry put all the power into the hands of a few players.

"While we fight to make the internet free and open, we have to ensure competition in the online ecosystem," he said. "I have long opposed harmful consolidation in the telecom industry, and I will continue to oppose mergers that raise prices, stifle competition and stifle real innovation."

Although the Telecommunications Act of 1996 aimed to drive competition, the industry can do more. For example, there has been a host of megamergers between the likes of AT&T and DirecTV and T-Mobile and Sprint. Charter acquired Time Warner Cable.

"When we passed the [Telecommunications Act of 1996], I said we would unleash a revolution of new changes that will be the product of competition," Markey said. "We have made great strides toward that goal, but that work remains unfinished because the technology industry is increasingly dominated by a powerful handful of companies."

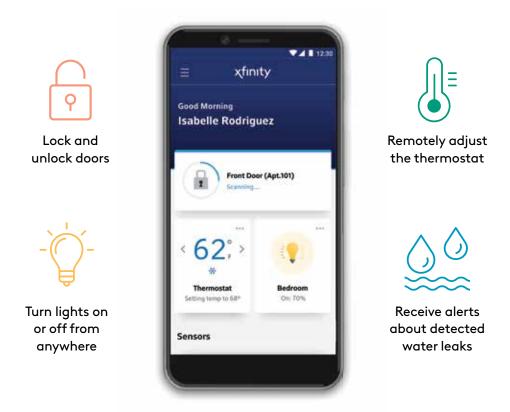
Another issue that continues to rise is discriminatory data usage. Data discrimination, often referred to as "discrimination by algorithm," is bias that occurs when predefined data types or data sources are intentionally or unintentionally treated differently than others are.

"We must address issues around discriminatory data uses and biased algorithms that are harming vulnerable populations in our country," Markey said. "That means enacting a comprehensive federal privacy law that includes data use limitations.'

Transform your property into a smart community.

The future of connected living is here.

With Managed WiFi and the Xfinity Smart Community platform, you can enjoy more comfort and control. Remotely control lighting and temperature in common areas to manage time and energy. Unlock doors in vacant units for showings. And receive notifications if a leak is detected. That's the flexibility of smart management.



Your residents will love living in a smart community. They can adjust temperature and lighting, lock and unlock doors and receive alerts if leaks are detected. Best of all, they can control their home anytime, anywhere from an easy-to-use app.

Discover the ultimate connected living experience. Visit **xfinity.com/xfinitycommunities**.



CONFERENCE COVERAGE

FCC's Starks: RDOF Stakes Are High

Geoffrey Starks, a former head of the FCC's Enforcement Bureau and a current commissioner, focuses on making sure participants in the Rural Digital Opportunity Fund



Geoffrey Starks

(RDOF) deliver on what they promise.

When the FCC established the RDOF last February, Starks voted to approve the plan but dissented in part over concerns related to the FCC's mapping mechanism. He cited two issues: distributing funds based on deeply flawed Form 477 mapping data and a confusing and counterproductive approach toward coordinating RDOF money with state funds.

Under a two-phase process, the FCC will direct up to \$20.4 billion of Universal Service Fund money over 10 years to finance broadband networks in unserved rural areas.

"I wrote in RDOF that we're able to make sure we can hold folks accountable, so I do understand why Congress has questions," Starks said. "The stakes are high. We are spending an enormous amount of ratepayer money, and communities have been waiting far too long for this broadband infrastructure."

Starks was hardly alone in citing concerns about RDOF. At the time the FCC voted, fellow commissioner and now interim FCC Chair Jessica Rosenworcel, said the agency should know exactly where broadband service is available before it spends any money.

"Right now, if a single subscriber in a census block is identified as having broadband, we conclude broadband is available throughout," said Rosenworcel. "That's not right. We rush billions of dollars out the door in what feels like a broadband publicity stunt without taking a broad view of what the nation needs."

A RIGOROUS REVIEW

During the first phase of the RDOF reverse auction, the FCC awarded

\$9.2 billion in funds to a diverse set of traditional wireline service providers, cable operators, electric cooperatives, fixed wireless providers and satellite companies. To ensure accountability for any provider that applies for RDOF funds, the FCC has instituted a rigorous review process.

"We require a lot from companies at the long-form stage for good reasons," Starks said. "This is a live controversy before us, so I don't want to prejudge those reviews at this stage, but I am going to follow this very closely."

Questions have been raised, however, about the ability of some applicants, such as LTE Broadband and SpaceX, to deliver on their promised bandwidth claims.

LTE Broadband was awarded \$1.3 billion in the RDOF auction to provide gigabit speeds to rural areas using fixed wireless technology. The provider said it would also use fiber. Meanwhile, several experts questioned how SpaceX plans to use low-Earth-orbit (LEO) satellite technology to deliver 100 Mbps services.

In early February, NTCA—The Rural Broadband Association and the Fiber Broadband Association (FBA) submitted to the FCC a technical assessment and model to help the agency review RDOF longform applications for LEO satellite broadband networks. Analysis conducted by Cartesian, based on current publicly available information, estimates that Starlink will face a capacity shortfall by 2028, and more than 56 percent of Starlink's RDOF subscribers will not be fully served. (For more on this, see "LEO Satellites: A Path to Nowhere?" p. 72.)

NTCA and the Fiber Broadband Association are not the only organizations that have raised concerns about LEO satellites and broadband wireless providers' ability to provide high-speed broadband services.

Electric cooperatives, which had a large presence in RDOF, cite similar concerns. Among them is Conexon's Rural Electric Cooperative RDOF Consortium, made up of more than

30 different applicants, which was awarded \$1.1 billion to provide highspeed broadband to 22 states across 618,000 locations.

Jim Matheson, CEO of the National Rural Electric Cooperative Association (NRECA), an industry trade organization that represents electric cooperatives bidding for RDOF funding, encouraged the FCC to take a close look at satellite and broadband wireless players.

"We ask you to direct commission staff to undertake a comprehensive review of the detailed business plans and technical showings in the longform applications submitted by winning bidders proposing gigabittier fixed wireless and hybrid fixedwireless solutions," Matheson said in a letter to the FCC. "We also believe a comparable, in-depth review is appropriate related to the winning bids of entities relying on low-Earth-orbit satellites bidding at the 100/20 Mbps tier. It is critical that the FCC ensure that these bidders possess the technical ability to meet their committed service obligations in all areas in which they secured winning bids at the funding level in which they bid."

Wireless operators are not taking this criticism lightly. The Wireless Internet Service Providers Association (WISPA) wrote a letter to the FCC, refuting what it said is "unwarranted criticism leveled at certain winners of the RDOF Phase I auction, and the RDOF process as a whole."

WISPA called out NTCA for claiming fixed-wireless access networks cannot deliver gigabit speeds.

The association stated that the unlicensed 60 GHz band and soon-tobe-available 6 GHz band devices make gigabit download wireless speeds a realistic alternative to fiber broadband.

"WISPs operate across a range of frequencies, from TV white space up through the millimeter wave bands, and while not all of these spectrum bands are capable of delivering gigabit services, that does not rule out provision of such services in many targeted areas," the WISPA letter said.

GETTING MAPS IN ORDER

Mapping continues to be an Achilles heel for developing broadband plans. Under the current FCC mapping regime, a community is deemed served even if only one home has broadband access.

Congress passed the Broadband Deployment Accuracy and Technological Availability (DATA) Act last March, which aims to reform how the FCC collects, verifies and maps broadband data and builds upon the Digital Opportunity Data Collection (DODC) report and order that the FCC adopted in August 2019.

A lack of accurate maps has been a point of frustration for consumers who often see that the FCC considers their communities served even though they can't get access.

"For far too long, states, consumers and cities have called on the FCC to

get its broadband data in order," Starks said. "We've heard from households that have had the all-too-real but disappointing experience of looking at that broadband map that says their home has broadband when they know that it is not available at their location."

He added, "I was a strong supporter of the DATA Act and widely acknowledged the flaws in our maps both for RDOF as well as for the 5G mobility fund."

For its part, the FCC adopted additional rules for the DODC to ensure the agency collects precise and accurate broadband deployment data.

The new rules specify which fixed and mobile broadband internet access service providers are required to report availability and/or coverage data and adopt requirements for reporting speed and latency for fixed technologies. In addition, they require fixed broadband internet access providers to report

whether broadband services are offered to residential and/or business customers.

Now that Congress has provided the funding to create new maps, Starks said he expects to see "quick action."

"We have bipartisan agreement around the importance of getting our maps in order," he said. "New maps must be completed, especially as we move from Phase I to Phase II of RDOF and obviously with regard to the 5G fund."

Starks and other members of the FCC also want the RDOF to reward broadband networks that can support long-term needs.

"When you look historically, we paid a lot of good money to deliver 4/1 Mbps broadband services," he said. "We need to make sure that with that 10-year commitment, we think about what the needs are going forward as well as address affordability, especially during the pandemic."

Broadband Providers Battle Inconsistent Local Permitting Obstacles

Federal laws have great influence on governing broadband and fiber buildouts, but local ordinances, and the permitting processes to get access to a city's or town's infrastructure, also pose various challenges and opportunities for providers.

The Great Broadband Buildout panelists at the INCOMPAS summit said that though federal investment is critical, so are smart local solutions that attract competition and investment.

On a local level, service providers typically run into four key issues in public rights of way (ROW): permitting, fees, access in infrastructure and specialized access to railroad crossings and bridge crossings.

"In terms of broadband deployment, there are a lot of obstacles with respect to deploying in the public rights of way," said Ronald W. Del Sesto Jr., a partner at the law firm Morgan Lewis.

PERMITTING INCONSISTENCIES

A key issue service providers face when they move to deploy fiber and wireless facilities in a town or city is that every community has different rules about how to access public ROW.

Zayo, a large metro and long-haul fiber provider to businesses and other carriers, found that the permitting situation was different before COVID-19.

"The permitting process pre-COVID-19 was either too opaque or it changed based on incoming leadership within local governments," said Brandon Reed, vice president of underlying rights and government relations for Zayo. "We have also seen it being used as a way to thwart our ability to negotiate for actual and direct costs."

Fatbeam, a fiber provider that has been expanding its presence in the Pacific Northwest, agrees.

Different permitting processes in different locations "hamper our ability to be consistent with delivery, and this can contribute to capital costs of



Tony Perkins

deployment," said Tony Perkins, COO of Fatbeam. "There is a consistent set of obstacles we all face, and any effort we can put forward as companies to assist with consistency is probably what we look forward to the most."

The same issue exists for wireless players that require access to wireline facilities to backhaul traffic. Though some wireless operators, such as Verizon, will build out their own fiber for backhaul, most providers must secure wholesale circuits from third parties in places where they don't have their own wireline facilities.

Milo Medin, vice president of wireless services at Google, noted several challenges wireless operators face.

"There is one network, which is the wired network, and there's a little



Milo Medin

bit of wireless at the end of it," he said. "There's at least one large city that has stopped processing permits to deploy

CONFERENCE COVERAGE

wireless infrastructure in the middle of the pandemic, which has led to a lot of frustration for wireless operators trying to generate new capacity by deploying new base stations.'

Medin added that wireless franchise fees can also hold up deployments.

"Many communities have wireless franchise fees that can be quite large," he said. "Some of these fees were designed for cellular operators, but fixed-wireless operators have different business models, so this can have consequences that can retard wireless infrastructure deployment."

Uniti Group, which has been expanding its wireline metro and longhaul fiber networks organically and through acquisitions, said getting to know local town and city permitting officials is important.

This comes as the provider noted strong fourth-quarter bookings for its wireless offerings as a result of network densification efforts and the broader rollout of 5G services within its markets. Uniti also sees increased demand for its non-wireless service

offerings and leasing-up anchor wireless builds.

"We approach the permitting process as all relationship-based," said Kelly McGriff, vice president and deputy general counsel at Uniti. "We try to help people with their task and to understand we are trying to provide a service to the citizens in their community."

Though Uniti acknowledges there are common challenges with permitting and accessing ROWs, such as fees and technical ordinances, these issues are not insurmountable.

"There are challenges at the local, county and state level with getting access to rights of way, which are all obstacles we all try to work around," McGriff said. "Brandon from Zayo and I have been to many late-night city council meetings where we get to know them and when you do that, it paves the way a bit."

NAVIGATING THE PANDEMIC

The pandemic has impacted how service providers collaborate with communities and attempt network builds. The interactions between providers and permitting authorities changed, in part because authorities were navigating how to work at home. Some providers found that there were delays in getting decisions made on simple issues, such as fees and permit costs.

Despite the challenges of the pandemic, Zayo, for one, saw an increase in sales of dark fiber, Ethernet and connectivity it sells to carrier and business customers during the pandemic. Reed said that when the pandemic shuttered businesses and forced businesses to have workers work remotely, the service provider made a point to collaborate with local cities and municipalities to ensure constant network connectivity.

"As people faced office closures and the reality of stay-at-home orders set in, the hard work of telecom service providers [was clear]. They needed to be on the front lines and accessing streets, sidewalks and highways to deploy what became not a need, but a demand," he said.

COVID-19 also placed a challenge on Fatbeam's network build efforts.

"As we go into each market, we try to find ways to partner with entities that we're engaging with and COVID-19 did not help this much," Perkins said. "There was some lack of resources and some decisions being made in different municipalities with fee and cost structures."

Uniti acknowledges that COVID-19 created challenges. The provider and other members of the Broadband Deployment Advisory Committee worked through these issues during the first days of the pandemic.

"Many municipalities were hitting pause on things and how they process permits and receive payments when people are working from home," McGriff said. "We have approached all [partnerships] on a case-by-case basis and have been able to overcome those challenges." *

Sean Buckley is the editor-in-chief of BROADBAND COMMUNITIES. He can be reached at sean@bbcmag.com.

EXPERT PERSPECTIVES

"We want to make sure we get unserved areas equipped with broadband and get people connected."

- Sen. Bob Latta (R), Ohio

"Today, 12 million children lack the home internet access and devices they need to fully participate in virtual learning and that's simply unacceptable."

- Sen. Ed Markey (D), Massachusetts

"Leaving households disconnected will hurt our country's ability to rebuild the economy and our workforce, diminish our ability to keep Americans and our health care systems safe by advancing telemedicine, and diminish the education horizon of our young learners everywhere."

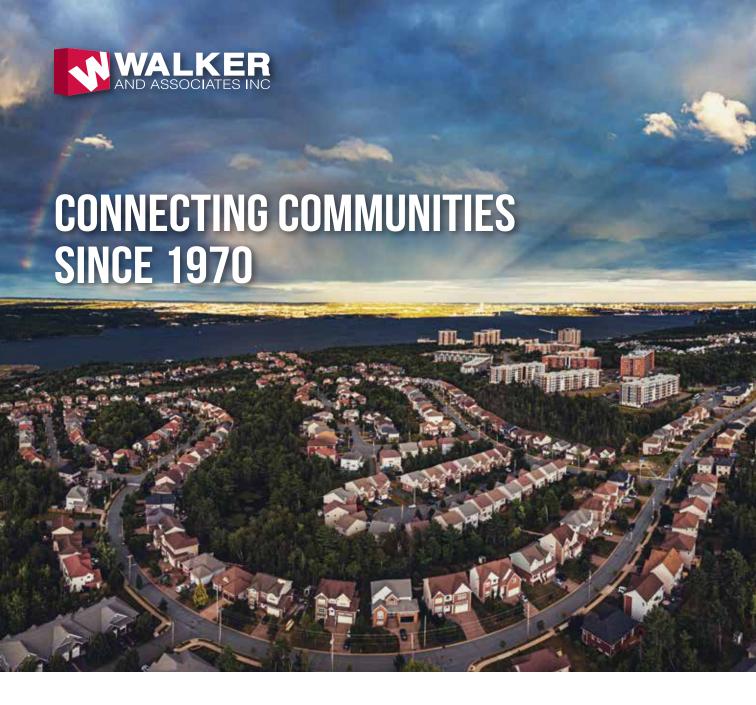
- Geoffrey Starks, FCC Commissioner

"Laws are blueprints and snapshots in time."

- Mignon Clyburn, former FCC Commissioner

"One Touch Make Ready (OTMR) was a great first step, but we need to focus on what the evolution of OTMR looks like."

- Tony Perkins, COO, Fatbeam



Rural broadband deployment projects require experience, expertise and relationships you can trust. Walker and Associates has been a trusted advisor for network operators who deploy and manage fiber networks since 1970. As you upgrade and modernize critical infrastructure and deploy new community services, count on Walker for the products, people, partnerships and processes required for success. Your community counts on you. You can count on Walker.



LEARN MORE > Scan the following QR code to download a complimentary copy of WalkerFirst Services Overview or access online: http://communication.walkerfirst.com/bbcmagazine_march2021



BROADBAND COMMUNITIES' 20th Annual List Of Leading Broadband **Technologies and Services**

The latest offerings from top broadband hardware and software suppliers, distributors and service providers

CALIX

2777 Orchard Parkway San Jose, CA 95134 W: www.calix.com Contact: Carl Meyerhoefer E: carl.meyerhoefer@calix.com



Customers: Telcos, Cable TV, Municipalities, Electric Co-ops **Products/Services:** Customer-Premises Equipment

CENTURYLINK

100 CenturyLink Dr. Monroe, LA 71203 P: 564-888-2017

W: www.centurylink.com/connectedcommunities

Contact: Katie Cooper

E: katie.cooper@centurylink.com

Customers: MDUs/PCOs

Products/Services: Internet and Video Services/Programming



CenturyLink ON is our recommended customer solution for properties and communities, giving them an edge over their competition. Wi-Fi ready your property. Residents can access Wi-Fi the moment they move in and easily sign up for home entertainment services.



CenturyLink technology (including fiber), services, features and offers are not available everywhere.

CHARLES INDUSTRIES, LLC – AN AMPHENOL COMPANY

1450 American Lane, 20th Floor Schaumburg, IL 60173

P: 847-806-6300

W: www.charlesindustries.com

Contact: Steve Skiest

E: mktserv@charlesindustries.com

Customers: Telcos, Cable TV, Municipalities Products/Services: Passives - Outside Plant, Customer-Premises Equipment







INNOVATIVE ENCLOSED SOLUTIONS"

Charles Industries' new Fiber Optic Dome Closures (FODC) are readily available, costeffective, fiber splice solutions developed to

help users complete their FTTH projects on time and on budget. The FODC family of closures comes in three sizes. FODC-A is a small closure offering a 144-splice capacity. FODC-B is medium-sized and can accommodate up to 288 splices. The third size, FODC-AS, is a drop dome closure that incorporates an internal SC adapter frame and up to 48 splices available with integrated 1x4, 1x8 or 1x16 PLC splitters for distributed split architectures.

These environmentally sealed, robust solutions use economical compression sealing technology that provides an IP68 rating to allow use for any deployment topology, including aerial, pole, wall or pedestal mounting, as well as below-grade in a handhole or vault. FODC ship fully configured with splice trays, sealing grommets and all other needed accessories to install, seal and splice fibers. For more information, visit www.charlesindustries.com/main/te_fodc.html.

CLEARFIELD, INC.

7050 Winnetka Ave. N. Minneapolis, MN 55428 P: 763-476-6866 W: www.SeeClearfield.com Contact: Mickey Smith E: sales@seeclearfield.com



CLEARFIELD

Customers: MDUs/PCOs, Telcos, Cable TV, Municipalities, Electric Co-Ops, Government

Products/Services: Active Electronics - Wireline, Passives -Outside Plant, Passives - Inside Plant, Customer-Premises Equipment, Optical Fiber and Cable

Designed to streamline and ease FTTH deployments, Clearfield's Home Deployment Kits include everything you need to connect a home to fiber - all in one box. Truck rolls are minimized and turnup is fast, reducing installation time by up to 30 minutes per home.

Home Deployment Kits complete the fiber connection from outside the home to the customer equipment inside the home. Because home styles vary greatly, different types of



fasteners are needed to attach fiber. Clearfield packages all the necessary fasteners in one convenient kit.

For consumers willing to take a do-it-yourself approach, the Home Deployment Kit enables a contactless installation, keeping residents and fiber technicians at a safe distance.

Home Deployment Kits include four choices of an outside plant test access point. In addition, every Home Deployment Kit includes a consumer-friendly CraftSmart Fiber Outlet for inside wiring, fiber patch cords and FieldShield drop fiber as needed.



HOT PRODUCTS

CORNING OPTICAL COMMUNICATIONS

4200 Corning Place Charlotte, NC 28216 W: www.corning.com/fttp Contact: Alyson Moore E: Alyson.moore@corning.com

Customers: Telcos, Municipalities, Electric Co-ops Products/Services: Passives - Outside Plant; Passives -Inside Plant; Passive Optical LAN; Planning, Design or Construction; Training; Optical Fiber and Cable

Introducing Evolv Solutions with Pushlok Technology - this is the FTTx preconnectorized breakthrough you've been waiting for. It's all you need, wherever you connect. The Pushlok connector is an entirely different hardened connector form factor with a compact, durable, craft-friendly



design. The single-fiber connector leverages an SC APCcompatible ferrule; is backward compatible with widely deployed, threaded OptiTap ports with a field-installed adapter, and can be converted for use with standard SC APC patch panels. Evolv terminals are a quarter of the size of conventional preconnectorized products and designed to go anywhere - on poles, facades or strands and in pedestals and handholes. Maximize the flexibility and minimize the

stress of your FTTx deployment. Save time, save space, save infrastructure, save inventory. Less of everything, except quality - Evolv Solutions enable up to \$500 in savings per location.



DISH FIBER

dish fiber 9601 S. Meridian Blvd. Englewood, Colorado 80112

P: 888-422-3246 W: www.dish.com/fiber

Customers: MDUs/PCOs Products/Services: Internet and Video Services/ Programming

DISH Fiber is a game-changing, managed Wi-Fi solution for multifamily communities that provides all residents with immediate access to premium, gig-enabled Wi-Fi and live streaming TV upon move in. Residents benefit from reliable and secure Wi-Fi networks accessible propertywide and 24 channels of live streaming TV, as well as the option to easily upgrade programming and entertainment equipment

at reduced prices. For owners, DISH Fiber provides the opportunity to increase net operating income by offering internet and TV through a fee revenue model that beats traditional revenue sharing every time. DISH Fiber also provides a common network for connecting propertymanaged smart devices that help increase operational efficiency and make units more attractive to residents. Delight your residents and boost your bottom line with a communitywide Wi-Fi and TV solution from one nationwide provider with DISH Fiber. One network, endless possibilities.

ESPI

630 E. Lincoln Ave. Clay Center, KS 67432 P: 785-777-2707 W: www.espicorp.com Contact: Ryan Emerson E: info@espicorp.com



Customers: Telcos, Cable TV, Municipalities, Electric Co-ops **Products/Services:** Active Electronics – Wireline, Active Electronics - Wireless, Customer-Premises Equipment, Other Managed Services

Quality Products. Simplified Installation.

During the planning process, what are the most important qualities you look for in an uninterruptible power supply (UPS) before deploying to your network?

If you pose this question to plant managers or field technicians, both ease of installation and product quality generally tends to be near the top of their list. Why? They are busy. It is imperative to finish the job quickly and move on to the next, without having to return for any follow-up repairs.

Cutting down the duration of time technicians spend on-site and reducing the number of future truck rolls is a measurable goal for any telco operation. The implementation



of quality, longer-life UPS equipment that is easy to install and improves network resiliency is one of the easiest ways to achieve that goal.

During the design and build phase, the network designers should consider the overall long-term costs once the system is deployed. When reviewing costs, it is tempting to eliminate UPS units from the network design or choose a cheap one, but this inevitably leads to increased truck rolls and time on-site – making the "cheap" solution turn into the "costs-a-fortune" solution in the long run.

In previous years, a 30-minute disruption in service may have been acceptable. But in today's world, making compromises on the equipment powering your network has the potential of affecting your customers' livelihoods. Thus, the utilization of reliable, easy-to-install back-up power equipment to the residence or business is vitally important.

For solutions to your UPS needs and input during the design stage, visit www.espicorp.com. You'll find a number of solutions and alternatives and contact information for sales and production engineers.

FINLEY ENGINEERING COMPANY, INC.

104 East 11th Street Lamar, MO 64759 P: 417-682-5531 W: www.FinleyUSA.com Contact: Molly White

E: m.white@finleyusa.com



Customers: Telcos, Municipalities, Electric Co-ops Products/Services: Other Managed Services; Planning, Design or Construction

Broadband is no longer a luxury. It's a necessary utility, as the COVID-19 pandemic made apparent. Whether you're a rural electric cooperative, a municipality, a telecommunications company or another organization exploring fiber opportunities, your goal is the same:



find the optimal way to bring high-speed broadband to your community and close the digital divide. After more than 67 years and hundreds of implementations, Finley has seen just about everything, and crafted the right solutions for even the toughest deployment challenges. We are with you from beginning to end, starting with building a business case, finding funding and identifying the right technical approach. Then we see your project through to the end, becoming a trusted extension of your team. We stand beside you, rolling up our sleeves and tackling the challenges with you, every step of the way.

HEXATRONIC

4040 Finn Way, Suite 240 Lexington, KY 40517 W: www.hexatronic.com Contact: Beni Blell, VP of Sales E: beni.blell@hexatronic.com

Customers: MDUs/PCOs, Telcos, Hospitality, Municipalities, Residential Products/Services: Optical Fiber and Cable

HEXATRONIC



Viper and Raptor Take a Bite Out of Fiber System Costs

Hexatronic offers a full line of blown-fiber microcables with demonstrated highest levels of performance and reliability. Compared with traditional fiber cables, microcabling systems provide overall lower labor costs and a reduction in materials and installation time with the fastest blowing speeds. Hexatronic's series of Viper microcables and Raptor nanocables offer the smallest size and longest blowing distances.

Viper microcables are based on a slim, loose tube design with up to 12 polyimide tubes per cable, carrying up to 432 total fibers. These robust cables are ideal for long-distance, air-blown installations in microducts with an inner diameter range of as little as 5.5 up to 16 mm. The Viper cables have excellent bend performance, are impact-resistant and perform in an extremely wide temperature range (-45 degrees Celsius to +70 degrees Celsius). Compared with other cables installed in larger ducts, the Viper series also lowers costs of handling and transportation.

The slim nanocables in Hexatronic's new Raptor series can be installed in microducts with an inner diameter of 3.5 to 12 mm and fiber counts to 24. Nanocables minimize the initial investment and at the same time provide a future-proof network that is easy to expand, upgrade and maintain. Their main applications are fiber-access networks, such as FTTH and FTTA. With an integrated strength member that adds increased stability and robustness, this cable is ideal for blowing up to 1 km or more. For short distances it can easily be pushed by hand.

Hexatronic manufactures complete end-to-end passive systems, including microducts and connectivity solutions along with training.

Along with a 20-year system warranty, this makes Hexatronic the ideal partner for your fiber infrastructure needs.

HOT PRODUCTS

IQGEO

1670 Broadway, Suite 2215 Denver, CO 80202-4814 P: 720-577-4732



W: www.ospinsight.com Contact: AJ Hamner E: aj.hamner@iggeo.com

Customers: MDUs/PCOs, Telcos, Municipalities, Electric Co-ops

Products/Services: Passives – Outside Plant; Passives – Inside Plant; Planning, Design or Construction; Customer-Facing Software

Unparalleled Port-to-Port Documentation

Improve the operations of your fiber network by moving from messy spreadsheets and drawings to the intelligence of OSPInsight. With an OSPInsight documented network, you can plan and design new parts of your network, run reports on the relationship between network elements, and explore details of a route from port-to-port with ease.



KGPCO

3305 Highway 60 West Faribault, MN 55021 P: 800-328-5142 W: www.kgpco.com Contact: Kristen Kohler



E: Kristen.kohler@kgpco.com

Customers: Telcos, Cable TV, Municipalities, Electric Co-ops Products/Services: Active Electronics – Wireline; Active Electronics – Wireless; Passives – Outside Plant; Passives – Inside Plant; Customer-Premises Equipment; Structured Wiring; Passive Optical LAN; Test Equipment; Planning, Design or Construction; Optical Fiber and Cable

KGPCo can help build a broadband network that is scalable, flexible, cost-effective and secure. With more than 45 years of telecommunications experience, thousands of OEM partners, \$2,350 million-plus in inventory and a nationwide network of distribution centers, we have the supply chain and installation services to build and maintain your network and connect your customers. Learn more at www.kgpco.com.

MAXCELL

600 Plum Creek Drive Wadsworth, OH 44281 P: 888-387-3828 W: www.maxcell.us Contact: Melissa Hennigan E: mhennigan@maxcell.us



Future Network Flexibility

Customers: MDUs/PCOs, Telcos, Cable TV, Hospitality, Municipalities, Electric Co-ops
 Products/Services: Passives – Outside Plant, Structured Wiring

MaxCell Premise is our latest product innovation for inbuilding and confined-space applications.

MaxCell Premise meets all specifications needed for inbuilding enterprise applications, data centers or confined-space builds, including being UL 2024 (OFCR FT-6) listed, low smoke, zero halogen (LSZH), fire retardant and halogen free.

The newest MaxCell Premise products are made for use in ducts ranging from 1.25 inches to 4 inches in diameter. Configured in one- to three-cell packs, each cell has different-colored pull tapes pre-installed for simplified installation. MaxCell Premise is also available in a self-supporting version, with a strong and flexible pre-installed, integrated, galvanized support wire.

Where the cable pathway is overly dense and space is at a premium, MaxCell Premise allows new cables to be installed easily, eliminating the need for rigid conduit. In cases of short runs, cables often can be pulled into place by hand, saving time and expense.

OFS

2000 Northeast Expressway Norcross, GA 30071 P: 860-678-6522 W: www.ofsoptics.com



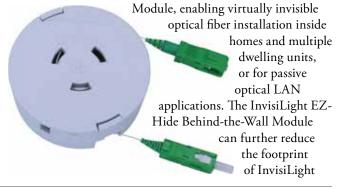


A Furukawa Company

Customers: MDUs/PCOs, Telcos, Cable TV, Hospitality, Municipalities, Electric Co-ops Products/Services: Optical Fiber and Cable

Boost Your Bandwidth Behind the Wall

Introducing the InvisiLight EZ-Hide Behind-the-Wall



ILU installations by up to 50 percent by hiding the spool behind the wall and using the InvisiLight 600 micron fiber. The original InvisiLight ILU Solution offered an innovative yet simple process to reach indoor optical network terminals (ONTs) by adhering a 0.9 mm diameter optical fiber into the crevices along ceilings and walls or moldings and walls. The InvisiLight EZ-Hide Behind-the-Wall Module uses an even smaller 0.6 mm optical fiber and installs with the same simple process and tools as the original. The compact EZ-Hide spool can dispense up to 40 meters of fiber as it is moved along the deployment path to the ONT location yet still fits inside a common behind-the-wall gang box.

POSITRON ACCESS SOLUTIONS

5101 Buchan Street, Suite 220 Montreal, QC H4P 2R9, Canada P: 888-577-5254 W: www.positronaccess.com

E: sales@positronaccess.com

Customers: MDUs/PCOs, Telcos, Cable TV, Hospitality, Municipalities, Electric Co-ops Products/Services: Active Electronics - Wireline, Passives -Outside Plant, Customer-Premises Equipment



Deliver gigabit services at 20 percent of the cost to residents in brownfield buildings in hours.

High-speed bandwidth is an essential need for everyone, especially with telework, remote learning and entertainment needs. High internet speeds increase property values by 3 percent and rents by up to 8 percent. Carriers can deliver bandwidth to these buildings but cannot distribute it to the occupants without costly capex and disruptive construction to install in-building fiber. DOCSIS cannot deliver adequate bandwidth.

Positron's G.hn access multiplexor (GAM) extends fiber or fixed-wireless gigabit services in 90 percent of residential buildings not wired with fiber. G.hn delivers gigabit services over existing in-building wiring of MDUs and MTUs to each



door (up to 800 feet on existing telephone pairs or 2,800 feet on RG6 coaxial cable and splitters). The GAM is a carriergrade, MEF CE 2.0-compliant, fully featured proven product in service at many carriers. It delivers real-time gigabit speeds and has dynamic bandwidth allocation. It is also used for managed business services and can effectively serve mixed-use buildings. Increasingly, the GAM helps counties and owners of subsidized and assisted-living units cost-effectively close the digital divide.

For outdoor deployments, it is used with reverse power feed (eliminating the need for local power) to serve home clusters and for Rural Digital Opportunity Fund deployments using existing outdoor wiring from the curb into the home.

The GAM is scalable and cost-effective even with minimal initial subscriber take rates. It is less complex to deploy and operate than G.fast, GPON or DOCSIS. It is installed and activated in hours and is ideal for telcos, cable companies, ISPs, municipalities and property owners.

Developed, manufactured and supported in North America.

SPECTRUM COMMUNITY SOLUTIONS

400 Atlantic Street Stamford, CT 06901 W: www.spectrumcommunitysolutions.com Contact: Cindy Heitsman E: Cindy.Heitsman@Charter.com

Customers: MDUs/PCOs **Products/Services:** Internet and Video Services/ Programming



THE BEST ENTERTAINMENT FOR YOUR RESIDENTS

Spectrum TV offers the best-in-class entertainment options available to your residents, providing excellent value for your property.



Spectrum Community Solutions is adapting to consumer trends to provide your residents with innovative services. The Spectrum TV app gives residents the latest and greatest entertainment, making your property a hot commodity with 300 Live TV channels and more than 30,000 on-demand TV shows and movies.

The Spectrum TV app is an IP video solution, which removes the need for Spectrum receivers. The app can be downloaded on Apple TV, Samsung Smart TV or iOS Android mobile devices. Residents can also access on SpectrumTV.com. The app or browser recognizes when a customer is connected to the property Wi-Fi, so residents can simply open the app or a browser to instantly watch TV without having to manually sign in.

HOT PRODUCTS

WESCO/ANIXTER

225 West Station Square Drive, Suite 700 Pittsburgh, PA 15219 P: 412-454-2200

W: www.wesco.com Contact: Stephanie Beck E: sbeck@wesco.com

Customers: MDUs/PCOs, Telcos, Cable TV, Hospitality, Municipalities, Electric Co-ops

Products/Services: Active Electronics - Wireline; Active Electronics - Wireless; Video Headends and Related Equipment; Passives - Outside Plant; Passives - Inside Plant; Customer-Premises Equipment; Structured Wiring; Passive Optical LAN; Test Equipment; Planning, Design or Construction; Training; Back-Office Software; Optical Fiber and Cable



WESCO and Anixter can help streamline your project with a variety of end-to-end supply-chain solutions that will save you time and money, including warehouse staging, material staging (both on-site and off-site), product kitting, just-intime delivery, VMI services, project planning/management/ make-ready, cable cutting and customized e-commerce solutions. Our unmatched customer service and account management professionals ensure your fiber build projects stay on budget and on schedule.

If you're establishing a new fiber network or expanding an existing one, our decades of experience will help you get









the job done right. Building on our long-term reputation as a leader in end-to-end solutions for fiber optic networks, WESCO and Anixter have the innovative products and services as well as the expertise to help you meet the exploding demand for bandwidth and capacity.

No matter what your fiber network's size or architecture is, WESCO and Anixter have a vast portfolio of field-proven products to meet your project needs. Our knowledgeable product management team has the experience and problemsolving capabilities to connect you to the right solution for your project. We can assist in technology selection, bill of materials creation, product training, on-site installation and troubleshooting. Visit www.tvcinc.com/c/fiber-simple-fiber-experts.

WIDEOPEN NETWORKS, INC.

2000 Kraft Drive, Suite 2150 Blacksburg, VA 24060 P: 540-552-2150

W: www.wideopennetworks.com

Contact: Dave Sobotta

E: dsobotta@wideopennetworks.us

Customers: Municipalities Products/Services: Other Managed Services; Planning, Design or Construction



WideOpen Networks designs, builds and operates the world's best open-access networks. We can design and build fiber to the home, high-performance fixed-point wireless networks, and fully integrated hybrid fiber/wireless networks. During 2020, we continued to provide our managed networks services 24/7/365 to nine networks in three states without any staff or network downtime.



Our network design services include network technical design, business model development, financial planning, staffing plans, operational expense projections, and full network operations plans.

For communities seeking assistance with the development of open-access networks, we have been the U.S. pioneers in

open access for more than a decade. Some of our municipally owned open-access networks have now been successfully operating for more than 12 years, with multiple providers offering local residents and businesses true choice in providers, services and packages. ❖

TOP TECHNOLOGIES AND SERVICES FROM LEADING BROADBAND INDUSTRY PLAYERS

	CUSTOMERS							PRODUCTS AND SERVICES															
COMPANY	MDUS/PCOS	TELCOS	CABLE TV	HOSPITALITY	MUNICIPALITIES	ELECTRIC CO-OPS		ACTIVE ELECTRONICS – WIRELINE	ACTIVE ELECTRONICS – WIRELESS	VIDEO HEADENDS AND RELATED EQUIPMENT	PASSIVES – OUTSIDE PLANT	PASSIVES – INSIDE PLANT	CUSTOMER-PREMISES EQUIPMENT	STRUCTURED WIRING	PASSIVE OPTICAL LAN	TEST EQUIPMENT	INTERNET AND VIDEO SERVICES / PROGRAMMING	OTHER MANAGED SERVICES	PLANNING, DESIGN OR CONSTRUCTION	TRAINING	BACK-OFFICE SOFTWARE	CUSTOMER-FACING SOFTWARE	OPTICAL FIBER AND CABLE
Calix		1	✓		1	1							✓										
CenturyLink	1																✓						
Charles Industries, LLC — an Amphenol Company		✓	1		1						1		1										
Clearfield, Inc.	1	1	1		1	1		/			1	1	✓										1
Corning Optical Communications		1			1	1					1	1			✓				✓	1			✓
DISH Fiber	1																1						
ESPI		1	1		1	1		1	1				✓					1					
Finley Engineering Company, Inc.		1			1	1												1	✓				
Hexatronic	1	1		1	1																		✓
IQGeo	✓	1			1	1					1	1							✓			✓	
KGPCo		1	1		1	1		✓	✓		1	1	✓	1	1	1			✓				✓
MaxCell	1	1	1	1	1	1					1			1									
OFS	1	1	1	1	1	1																	✓
Positron Access Solutions	✓	1	1	✓	✓	1		✓			1		✓										
Spectrum Community Solutions	1																✓						
WESCO/Anixter	1	1	1	1	1	1		1	1	1	1	1	✓	1	✓	1			1	1	1		✓
WideOpen Networks, Inc.					1													1	✓				

Building Competitive Advantage With Automation

ISPs can use autonomous technologies to help networks grow with companies as their business needs and markets change.

By Sean Robertson / ADTRAN

ince the introduction of the first public switched telephone network, networks have continually evolved. Through the various stages of development – from fixed endpoints in the early days of the internet to today's broadband networks that connect mobile users to massive data centers and bandwidth behemoths such as Netflix, Amazon and Facebook – networks have adjusted to accommodate new demands. The once-static infrastructure is undergoing a more profound transformation than ever before.

The latest incarnation is autonomous networks, a trend that has been building for some time. An autonomous network runs without much human intervention; it can configure, monitor and maintain itself independently. As business and residential subscribers' networks become more complex than ever, internet service providers (ISPs) can harness this evolution of networking by committing to providing networks that can grow with companies as their business needs and markets change.

In addressing the needs of tomorrow, ISPs must understand that today's world is hyperconnected, reliant on complex infrastructures and multicloud environments, connected through a mesh of networks. But modern network demands create new challenges for ISPs. To advance, teams need to start moving away from manual efforts and start harnessing

the power of artificial intelligence (AI) and machine learning (ML) to drive automation and self-healing networks.

To succeed with AI and ML, companies must have full network visibility. The networking community hungers for disruptive ideas to address the unsustainable economics of present-day networks. Today, operational complexity is increasing exponentially as traffic continues to explode and new devices proliferate. Meanwhile, rising operational costs and slower time to revenue squeeze margins for traditional service providers.

The answer to this problem is taking shape in the form of AI-driven networks, a new approach model that will eliminate operational complexity regardless of the type and volume of network traffic. ISPs must act quickly to incorporate disruptive technology that advances AI and ML concepts to transform static networks into dynamic, programmable environments that are predictive, proactive and automated.

The reality is that to be successful, companies cannot build a new future on old technologies. The days of closed, proprietary networks and vendor lock-in are over; the market demands new solutions that are open, intelligent, agile and secure. The investment companies make into any new technology also requires that they leverage their resources to quickly learn and understand the power of automating workflows. Fortunately, the ability

for ISPs to automate and optimize operations on the fly and build sustainably within a standards-based approach is becoming the new norm, which is exactly what data-driven ISPs need today.

MOVING BEYOND PREDICTIVE **ANALYTICS**

AI-driven networks will take the tedious job of data mining out of the equation, focusing on proactive problem resolutions. As ISPs get into more complex things in which people don't really understand all the correlations or how they correlate, AI can help draw the correlation - in a fraction of the time it would take network operations teams. The future network will self-configure, monitor, manage, correct, defend and analyze with little human intervention, providing more time for service providers to innovate their businesses.

Traffic spikes on today's networks can cause goliath challenges in determining the problem, ranging from a new video game release to widespread streaming of national events to distributed denial of service (DDoS) attacks. Luckily, ML algorithms are becoming more intelligent, interpreting vast amounts of network traffic behavior data to predict performance issues before subscribers are affected. The reality of networking software today is that ISPs need tools that intelligently analyze and adapt, providing immediate security during DDoS attacks and increased bandwidth to support traffic surges.

THE JOURNEY TO PROACTIVE PROBLEM RESOLUTION

AI-driven networks powered by ML algorithms will be the end state of a progressive journey beginning with data collection and visualization, leading to automated event correlation and programmability and allowing networks to run autonomously.

The ability for ISPs to leverage their software investments to automatically intervene and correct issues that they identify before they become noticeable to subscribers will be The days of closed, proprietary networks and vendor lock-in are over; the market demands new solutions that are open, intelligent, agile and secure.

key to addressing the digital customer experience revolution.

DEFINING THE FUTURE NETWORK WORKFORCE

Advancements in automation and AI technologies often invoke fears of job displacement. Conversely, the introduction of AI will free network staff from repetitive manual tasks, meaning customer support personnel will spend less time troubleshooting performance issues and running networks and more time working strategically and developing innovation that secures businesses and drives them forward.

As the internet of things (IoT) gathers steam, these emerging software tools will be in high demand to make sense of the deluge of incoming data. For ISPs and technology vendors, it will be imperative to implement ML algorithms that filter out the normal and allow service providers to focus on the anomalous, the unexpected and the dangerous.

Companies considering choosing a vendor with AI and ML claims to their technology should be sure to investigate the company's longevity in the market, along with its strategic software partners, to evaluate whether a long-term customer relationship offers an easy ability to scale over time. Those that make the early investment in AI capabilities need to understand that in the not-so-distant future, applications and hardware technology will become less artificial and more intelligent. When selecting a partner to define a future network, companies should consider three critical components:

Open: Unlock new innovations for your unique software environment

- and business. If you can imagine it, you can build it.
- **Programmable:** Combine the full telemetry of the network on a single platform, retaining unique data to power applications that can provide exclusive insights or integrate with an organization's key processes making teams more effective.
- **Scalable:** Understand what's happening in increasingly complex and interdependent systems so engineers can find and fix issues fast and know where to drill in further and investigate root causes of trouble.

Where ML shows its real value is in the ability to rely less on vast amounts of data and more on top-down reasoning that more closely mimics how humans approach problems and tasks. ML products will have more efficient reasoning, ready expertise and common sense.

As technology vendors continue to substantially invest in AI and ML development to set the foundation for autonomous networks, the feedback from early adopters will form the basis of AI-driven tools for the next five years. Transforming networks into dynamic, programmable environments that are predictive, proactive and automated will be key for service providers of the future. &

Sean Robertson is a product marketing manager at ADTRAN. He is a seasoned SaaS marketer focused on building artificial intelligence and machine learning products.

The Key to Boosting Network Resilience? It's in the Data.

Data-driven insights reduce network downtime and repair costs.

By Gordon Smith / Sagent

f enterprises didn't fully appreciate the importance of their networks at the beginning of 2020, they do now. The emergence of COVID-19 and the shutdowns that followed led to traffic spikes of up to 70 percent and put large network operators front and center in the eyes of businesses and consumers.

Today, companies of all sizes remain dependent on collaboration technologies, cloud services, remote access and other solutions - all of which rely on the network.

Unfortunately, 2020's myriad challenges followed a period of reduced investment in network infrastructure. According to a Global Network Insights Report from NTT, by 2019, almost half (47.9 percent) of businesses' network assets were aging or obsolete, up from 13.1 percent in 2017.

Enterprises are, in many cases, reaping the network failures they've sown through inattention. Opengear reports that nearly onethird (31 percent) of companies lost at least \$1 million to network outages in the past 12 months. Network engineers and IT teams are becoming more and more concerned about network resilience as downtime increases in both frequency and cost.

It must be said, there's no problem with incorporating older networking equipment, assuming appropriate maintenance and life cycle assessments are in place. To the contrary, rushing to upgrade to the latest hardware such as hurrying to adopt network automation and other advanced systems - threatens to

bypass the most effective and affordable means of boosting network reliability to meet the moment. The best results come when organizations first reduce avoidable repairs.

AVOIDABLE OUTAGES PLAGUE NETWORK OPERATORS

I'll share the bad news first: Approximately one-third of network repairs performed are completely avoidable. I have seen this across numerous clients and industries. Trucks roll, field technicians diagnose equipment as faulty, the hardware is removed, and we receive it for repair. Repeatedly, we find that there is nothing physically wrong.

This has a huge impact on downtime. In the best-case scenario, a spare is immediately installed when the purportedly failed hardware is removed. In the worst case, network gaps remain while a replacement is obtained, and a technician returns to make the fix. Either way, if a component critical to network function goes down, network reliability probably takes a hit until field services arrive.

A variety of issues contribute to the prevalence of unnecessary repairs. They run the gamut from misconfiguration to inadequate technician training on equipment to ineffective life cycle management strategies. And there can be variation by product manufacturer and model, installation location, the group of technicians serving an area, and even the weather in a particular region. Think Minnesota's cold winters or Arizona's hot summers and the impacts on product life span.

With the large array of factors, hardware failure patterns can be lost in the noise, leaving network operators to resolve issues on a case-by-case basis. This is less efficient than systemic interventions and doesn't empower the organization to steadily improve resilience.

Greater leverage can be achieved with appropriate hardware failure data analysis, but the necessary information collection and business intelligence tools are surprisingly rare. These features are not part of traditional network analytics solutions. There are, however, options available in the third-party maintenance market, or systems can be built by a network operator determined to be more resilient than the competition. Here are the outlines of such a solution.

ADDRESSING HARDWARE FAILURE

To get a better understanding of network performance and stay ahead of potential issues, service providers should focus on three key areas when analyzing and responding to hardware failures:

collect data. The first necessity is information about network equipment failures. A large proportion of network operators do not catalog basic data on hardware sent in for repair, such as part number, installed location, technician responsible for onsite triage, failure reported by the originating technician, and diagnosis and root cause analysis by the repair facility. By tracking as many data points as possible, network operators increase their ability to identify patterns.

A key barrier to such data collection is typically maintenance vendor relationships. Field support partners frequently avoid sharing such information, as it could reveal shortcomings in their own technicians, reduce the perceived value of their maintenance service, or increase their own data management burdens.

For these and other reasons, most hardware maintenance providers purposefully obscure the diagnoses technicians arrive at in their repair facilities, and original equipment manufacturers (OEMs) can be similarly closed-mouthed about the results of warranty returns. The best response is for network operators to select vendor partners with full transparency policies in place or work to negotiate desired reporting mechanisms as part of the next contract renewal with existing providers.

Analyze across multiple
 variables. With data in hand –
 preferably within a powerful
 business analytics tool – it's time
 to dig in. A purpose-built analytics
 system will provide a wealth of
 reporting features designed to
 highlight common causes of
 avoidable downtime.

If you're building from scratch, on the other hand, a good starting place is to look at repair facility diagnoses to identify cases in which no physical repair was necessary. Then evaluate those incidents by part number, region, technician group and so on. This will tend to point to problems in configuration, on-site troubleshooting and patch application, which have potentially systemic remedies.

Another fertile investigation is relationships between the OEM, product, age and location specifics and particular failures. This can help drive efficient life cycle management and maintenance strategies, enabling the organization to upgrade or maintain equipment often enough to reduce predictable downtime but not so frequently as to waste resources.

• Target top priorities. Avoidable downtime comes in various forms, and addressing all issues at once is impossible. Enterprises and network operators should prioritize their responses to initial findings based on total impact, including downtime and cost considerations. Considering the ease of implementing a solution is also helpful.

As an example, if a spate of configuration problems appears on a particular Cisco switch in a particular region, there may be a training issue with one team. Perhaps the manual is confusing, and word of mouth among these technicians has spread an inaccurate interpretation of a certain step. Once this shortcoming is identified, it is relatively easy to develop a quick configuration guide or offer additional training. As configuration accuracy increases, the organization will gain substantial return on these modest investments.

common and easily resolved causes of network outage are eliminated, network operators can start focusing on more isolated issues and those with longer-range response opportunities, such as shifts in network hardware acquisition choices and life cycle management adjustments.

This is not, however, a linear process. Every new equipment deployment can raise problems in product reliability, warranty recalls, training issues and so on. Most organizations will, therefore, experience a staggered evolution. Impressive front-end savings and resilience improvements will generally be followed by increasingly narrow interventions alongside occasional large-scale troubleshooting when widespread failure patterns again emerge.

The job of hardware failure analysis is never done, but it does get easier with time. Custom-built tools can be improved, people leading the charge become more adept at noticing patterns, and remedies become more effective based on previous experience. With sustained effort, the organization will find itself with far fewer avoidable repairs and associated outages. And with millions of dollars in downtime costs along with brand reputation and customer loyalty at stake, there is good reason to grab for these attainable resilience gains right away. �

Gordon Smith is the CEO of Sagent, which provides advanced business analytics and support services to lower the costs of network ownership and the risks of downtime.

G.hn Is Vital to Gigabit Broadband **Services Rollouts**

G.hn has emerged as competitive to fiber to the home because it now enables service providers to offer higher data rates by leveraging existing copper assets.

By Livia Rosu / HomeGrid Forum

istorically, telecom operators thought that the only way to achieve highspeed broadband services was through the extensive deployment of optical fiber reaching every single home.

Since the early 2000s at least, many people have assumed that existing copper cabling was incapable of delivering the fast data rates required for high-quality fiber-to-the-home (FTTH) services.

Instead, they believed that all copper networks would need to be replaced with newly installed end-to-end optical fiber to enable truly next-generational services.

CHANGING THE CONVERSATION

The theory about FTTH has proven to be a twoedged sword as cost and speed of installation are linked to the requirement of causing minimal disruption to customers and local area networks. The conversation has shifted, and providers now understand that aspects of the traditional FTTH deployment model had to be modified, largely due to two factors: cost and new technologies.

First, installing fiber to every single home was too expensive in terms of labor costs and disruptive to residents. In addition, FTTH rollouts often were delayed because of the slow process of getting permissions from building owners or local authorities.

At the same time, advances in technology meant the industry was able to develop new

telecom and cable standards, which meant higher data rates could be provided through existing copper assets that leverage the infrastructure and are competitive with fiber.

Though some industry players continued to doubt the practicalities of copper, new innovations enabled copper wires to deliver data rates 10 times higher than those previously possible. As such, a trend has now developed with standards such as gigabit home networking (G.hn) technology being continually enhanced. This specific update means broadband can now reach speeds of up to 1-2 Gbps over copper coaxial and twisted pair cables, with even higher rates promised soon.

G.HN TAKES CENTER STAGE

It is now possible for service providers to leverage G.hn technology, along with its corresponding copper assets, to reduce the cost of deploying last-mile infrastructure while supplying gigabit class broadband that is virtually indistinguishable from traditional FTTH.

G.hn is a networking standard initially developed by the International Telecommunications Union (ITU). Its original design goal was to specify a physical layer and a data link layer capable of delivering data rates of 1 Gbps via any type of wiring available in residential environments, such as powerlines, phone lines and coaxial cables.

The original achievement for G.hn was to solve home-networking problems, but the industry soon identified G.hn as a great solution for broadband access. It is especially useful in multiple dwelling units (MDUs), such as office buildings or apartment complexes, where installing optical fiber is just not feasible because of high costs and regulatory requirements.

As such, G.hn proved to be perfect for providing the high-speed broadband services customers now demand. It can work through the legacy wiring often found in MDUs, such as twisted-pair cabling for phone service, keeping installation costs low. For these topologies, individual microdistribution point units (DPUs) can be installed in a central location of an MDU, or multiport DPUs can serve multiple customers.

G.hn has also become a perfect fit for coaxial cable networks, which typically have a point-to-multipoint (P2MP) topology. It is ideal for delivering gigabit services at a fraction of the cost of more traditional DOCSIS solutions that rely on expensive cable modem termination system equipment.

G.hn is also an extremely valuable connectivity solution for isolated or bundled single-family-unit topologies, in which multiple phone wires or coax wires are either isolated in a point-topoint (P2P) connection or converge as multiple P2P connections in the same bundle to reach a single distribution point (DP). For these networks, the micro-DPU installation can be delayed until customers decide to sign up for the connectivity service, which is what network operators call the pay-as-yougrow business model of the installation.

With technical aspects common for power lines, coaxial and twisted-pair cabling, silicon vendors can develop a single chip that can implement all three, ensuring scale and interoperability through adherence to ITU standards and HomeGrid Forum certification. Today, G.hn chipsets support all three media, enabling system vendors to build products that can adapt to any available wiring by just changing a simple software setting in the device.

Broadband can now reach speeds of up to 1 to 2 Gbps over copper coaxial and twisted pair cables, with even higher speeds promised soon.

This flexibility is a key reason service providers rely on G.hn technology to provide gigabit broadband services to millions of users worldwide, with many already utilizing it as a solution.

IMPROVING THE BUSINESS CASE

In addition to the technical parameters that must be considered to reduce the cost of FTTx deployment, such as reliability, robustness, latency, security and data rate, there are several nontechnical aspects to consider. To ensure the broadband industry remains successful and competitive, it is critical that service providers work with a high number of system vendors that rival each other. However, multivendor availability is crucial at both the silicon and system levels to guarantee a competitive ecosystem. For service providers, it is important to choose from a wide portfolio of system vendors working with multiple chipset vendors

Going a step further, multivendor interoperability is also essential. If a carrier has a large installed base of products from vendor A, it will never be able to adopt a lower-cost product from vendor B or mix with a higherend device from vendor C if they are not able to work together. Though products A, B and C may be based on the same broadband technology or implement the same standard, there often are technical differences in that interoperability can be guaranteed only by a compliance-certification laboratory authorized to test for certification purposes. The connectivity history of GPON and xDSL technologies taught us that several compatibility problems can be avoided by ensuring interoperability certification prior to deployments.

Though vendors have a huge incentive to push service providers to start paying for and deploying new technology as soon as it is available, early adopters often face the risk of finding bugs associated with early implementation. For large carriers, it can often be better to wait until manufacturers have had time to iron out any issues in their hardware and software – being the first customer for any new chip is not without risk. It is important to allow technology to mature.

The last consideration is critical mass. When a given technology is not in wide circulation, it will not generate enough revenue to allow vendors to invest resources in supporting it properly. This means when volumes are reduced, manufacturers are forced to keep prices high to recoup their initial investment in the product's development. Only when a technology is shipping millions of units per year can vendors achieve desired economies of scale.

MAKING G.HN HIT THE SPOT

G.hn hits all the performance markers perfectly. Currently, dozens of Tier-1 and Tier-2 system vendors offer a range of G.hn products. These address a range of form factors, from G.hn access multiplexers (GAM) to G.hn network terminals, from micro-DPUs to multiport DPUs, from fiber extenders to home-networking products - all of which rely on chipsets sold by multiple manufacturers.

To ensure interoperability, certification programs, such as the HomeGrid Forum program, guarantee that products work with others on the market. For products that pass all the tests, certification guarantees that they meet international standards. This

TECHNOLOGY

helps improve the entire ecosystem by making complete interoperability an industry-level standard all vendors aspire to meet.

G.hn technology has had plenty of time to mature since the release of the first standard in 2009, with multiple updates and improvements made since then. As such, silicon manufacturers have had time to release multiple generations of G.hn products, and millions of broadband users rely on them. G.hn has also achieved critical mass with vendors shipping millions of chips every year at competitive prices. As a result, companies have been able to invest millions of dollars into research and development, ensuring the continual development of G.hn technology as it evolves to meet demands for 10 Gbps networks and other applications in areas such as smart cities, smart grids and industrial IoT.

LOOKING AHEAD

As demand grows for faster and more reliable connectivity, service providers worldwide experience higher levels of users online now more than ever. To meet demand, technology must be capable of delivering the internet services required. G.hn is vital in enabling this, and it is imperative that innovation continues freely, along with the certification and deployment efforts of industry alliances.

G.hn technology offers a reliable, secure backbone for connectivity, along with multi-gigabit data rates and incomparable interoperability between devices and bidirectional travel. Bandwidth management is ensured with dynamic bandwidth allocation mechanisms for downstream/upstream slit per frame adaptation, and crosstalk mitigation techniques applied to network traffic are designed to ensure the best user experience at all levels.

This makes G.hn a powerful tool for service providers committed to meeting subscriber demands. As part of this, HomeGrid Forum will continue to support technology vendors submitting their products for certification to ensure the ecosystem continues developing, and work with members on the continual innovation of G.hn technology.

With further development, it will be possible for the technology to reach even higher data rates. The role of G.hn, and the broadband services it can provide, will play a critical role in the success of innovative technologies, such as the smart home, that have the potential to transform lives and enhance lifestyles. �

Livia Rosu is marketing work group chair and a member of the board of directors at HomeGrid Forum, an industry alliance that supports the development and deployment of G.hn.

The Leading Broadband Event for Multi-Housing, Commercial Properties, and Communities

Broadband Communities Magazine Congratulates



For becoming the Cornerstone Awards Luncheon Sponsor at the 2021 Broadband Communities Summit

For more information on Verizon, visit www.verizon.com. You are cordially invited to come see Verizon at the upcoming



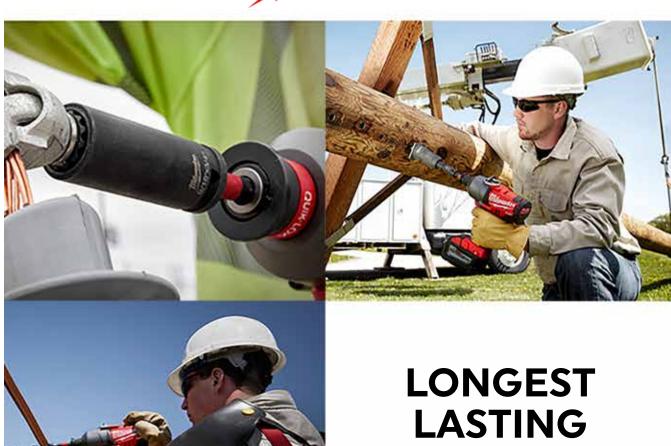
September 27 - 30, 2021 HOUSTON, TX **Marriott Marquis Houston**

To Exhibit or Sponsor contact: Irene G. Prescott irene@bbcmag.com | 505-867-3299

For other inquiries: 877-588-1649 | www.bbcmag.com







LONGEST LASTING HEAVY DUTY ACCESSORIES.



Available from



(800) 755-1950 www.kgpco.com

LEO Satellites: A Path to Nowhere?

Low-Earth-orbit satellites face various challenges meeting Rural Digital Opportunity Fund requirements.

By Deborah Kish / Fiber Broadband Association

he FCC recently awarded more than 180 bidders funding to build broadband access in unserved and underserved rural areas of the U.S. This is great for rural areas as the increase in remote workers and online schooling the pandemic caused means broadband no longer is a nice-to-have but a necessity.

The exciting news is that 85 percent of the Rural Digital Opportunity Fund (RDOF) awards were for gigabit services. Unfortunately, however, 85 percent of the non-gigabit locations were awarded to Starlink, a division of SpaceX. That means nearly \$900 million of RDOF money is going to SpaceX to deliver broadband service using its Starlink low-Earth-orbit (LEO) satellite fleet with a commitment to deliver 100 Mbps/20 Mbps rural broadband to 642,000 locations in 35 states.

The Fiber Broadband Association (FBA) and NTCA—The Rural Broadband Association commissioned strategy and analyst firm Cartesian to build a model the FCC can use to better evaluate Starlink's ability to meet RDOF performance criteria. The parameters and variables of this model were set to the most favorable assumptions for Starlink, assuming it can launch 12,000 satellites on schedule and align its constellations in a perfect optimal formation. The model also assumed each satellite could deliver its theorical performance of 20 Gbps. After running the model, the FBA and NTCA determined the LEO satellites will experience challenges meeting the RDOF requirements.

RDOF REQUIREMENTS AND GROWTH **EXPECTATIONS**

To meet its RDOF obligations, Starlink must design its network to deliver service at the bitrates of 100 Mbps downstream and 20 Mbps upstream for "above baseline" service (50 Mbps downstream and 5 upstream) with a bandwidth allowance of \geq 250 GB or the U.S. median, whichever is higher. This means that any subscriber should be able to receive 100 Mbps during peak hours. However, the growing bandwidth needs of the average household mean that even under the best circumstances, bandwidth needs likely will not be met.

In addition, winners of RDOF funding must begin to offer at least one voice and one broadband service to the service area in question, which might also prove challenging for satellites. Figure 1 indicates a model with two rates of growth for the required capacity: a high case and a conservative low case.

Factors to consider when thinking about current and future bandwidth needs include:

- An increase in the number of online users. RDOF areas likely will have higher usage of online streaming applications because cable TV is generally not available.
- A continuing rise in the number of networked devices through 2030, particularly with the expected increase in video traffic over 4K/UHD, which requires 30-40 percent more bandwidth than HD. This is a clear indicator of the need for increased broadband speeds.

Figure 2 shows the output of the model measuring the capacity of LEO satellites. It

Capacity Required per Subscriber

We model two rates of growth for the required capacity - a high case and a conservative low case.

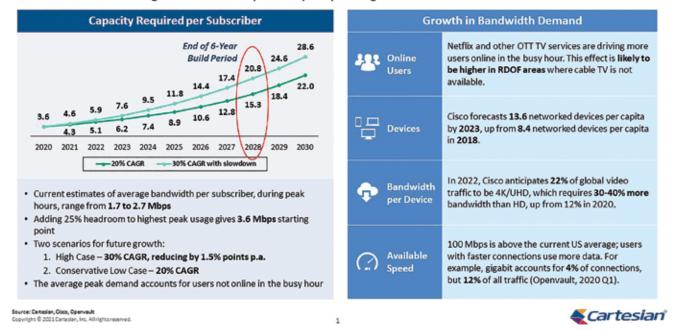


Figure 1. Note: Current estimates of average bandwidth per subscriber, during peak hours, range from 1.7 to 2.7 Mbps.

indicates that more than half of Starlink RDOF subscribers may experience service degradation as early as 2028 in both low-case and high-case capacity requirements of 15.3 and 20.8 Mbps. At least 56 percent of subscribers in the low case and 57 percent of subscribers in the high case will experience service degradation during peak times.

RDOF Model Outputs

The model shows that more than half of Starlink subscribers may experience service degradation in 2028.

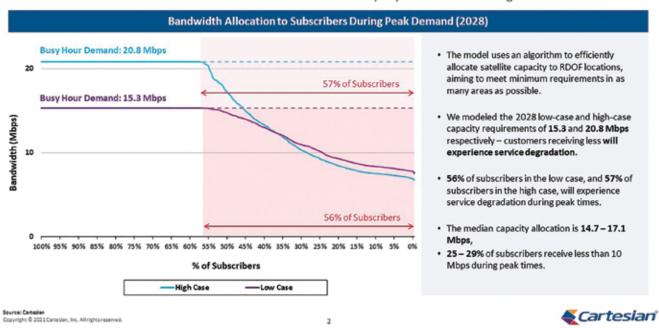
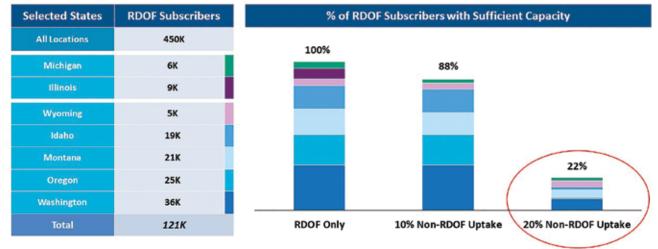


Figure 2.

Impact from Non-RDOF Commercial Broadband

In the high-demand scenario, there is insufficient capacity to support non-RDOF customers in rural areas alongside the RDOF commitment.



RDOF subscribers in these states receive the required 20.8 Mbps allocation in the RDOF-only scenario but lose out when non-RDOF subscribers are added to the network

ource: Camesian, FCC v rasian, Inc. All rights resen hr @ 2021 Cv

Cartesian

Figure 3.

Furthermore, RDOF service could be significantly worse if Starlink allocates capacity to non-RDOF use cases. Figure 3 shows the outcome from the model using an algorithm to efficiently allocate satellite capacity to RDOF locations, aiming to meet minimum requirements in as many areas as possible. The 2028 model low-case and high-case capacity requirements were set at 15.3 and 20.8 Mbps respectively.

Customers receiving less will experience service degradation. With just 20 percent of its capacity allocated to commercial (non-RDOF) subscribers, only 22 percent of RDOF subscribers will have sufficient broadband capacity (15.3 Mbps to 20.8 Mbps). Given the capacity constraints and the speculation that capacity will be used to serve non-RDOF areas, LEO satellite for broadband services will not be able to meet the future bandwidth needs, nor the RDOF requirements of 100 Mbps downstream and 20 Mbps upstream.

OVERLY OPTIMISTIC ASSUMPTIONS

After the FBA and NTCA filed the LEO satellite assessment and model with the FCC in February, feedback from industry experts suggested that FBA and NTCA assumptions are overly optimistic in favor of Starlink. For example, we modeled a base case of 12,000 Starlink satellites, including 4,408 satellites authorized to operate in the Ku and Ka bands and 7,518 satellites authorized to operate in the V band.

SpaceX found that the V band downlink spectrum was not usable for this application, so only 4,408 satellites should be considered in the Starlink RDOF capacity assessment. This results in our model overestimating Starlink's capacity by 270 percent.

Further, SpaceX indicated to the FCC in a December 2020 ex parte meeting that 250 MHz of its 2 GHz of the Ku band, from the satellite to the user, is unusable. That reduces the effective capacity of each Starlink satellite by 12.5 percent. In addition, Starlink's claim of 20 Gbps per

satellite applies only to enterprise class terminals, not residential. The maximum designed data rate for residential terminals is about 13 Gbps.

When considering only these areas of overly optimistic assumptions, the model reduces the assessment of Starlink's broadband capacity by nearly 80 percent. Although we knowingly were generous to Starlink with our assumptions, the intent was to build a model that the FCC can use to scrutinize the Starlink RDOF longform application. The FCC is then able to input the appropriate assumptions in its efforts to determine whether Starlink can deliver a network that meets the performance criteria promised in the RDOF 904 auction.

Though LEO satellites cannot deliver the required performance for the FCC to approve their long-form applications, the bigger issue is that RDOF locations relegated to LEO satellite service will be on the wrong side of the digital divide, and that gap will widen.

A decade ago, the FCC's national broadband plan was based on 1 Mbps as the definition of broadband. We are not arguing whether 100 Mbps or 1 Gbps is adequate today, and we expect demand will continue to grow at a 20 to 30 percent CAGR.

FIBER SUPERIOR TECHNOLOGY

It's indisputable that fiber is the goal – nearly every other access technology leverages fiber deployment as deep in its network architecture as is economically feasible. Even the previous CAF-based DSL projects funded middle-mile fiber and fiber to the node, providing a path for subscribers to finally get fiber to the home (FTTH).

Fiber is more than broadband connectivity. It delivers jobs, fuels education and provides billions of dollars in economic development to the communities where it's deployed. For instance, a recent study shows a new fiber network in Chattanooga resulted in 9,516 new jobs and \$2.69 billion in economic impact.

In terms of economic value, fiber improves GDP by increasing per-person productivity by up to 300 hours annually, increases home values by 1.8 percent for single-family homes, has the lowest carbon footprint of all technologies because it uses the least power, does not require rocket launches, and is best for telecommuting.

Fiber also delivers critical infrastructure for smart-grid modernization. In the Chattanooga study, fiber deployment resulted in 2.11 million customer interruptions avoided, an average 43 percent reduction in outage minutes, and \$421 million in benefits during major weather events. It also reduced 1,865 milliwatts of demand and 10,331 milliwatt hours of electricity consumption over the 10-year study period.

In areas where fiber is deployed, service providers received 80 percent fewer trouble calls. Households with FTTH have a better user experience compared with other technologies because fiber is not affected by weather conditions, natural obstacles such as trees, or other signals as alternative technologies.

Fiber also delivers the 5G future. A

5G network requires a high-capacity, low-latency fiber infrastructure.

Technology continuously evolves, and fiber is no stranger to that. It has come a long way in 50 years, enjoying its fair share of innovation that increased speed and reduced cost and deployment time. Fiber

- Is cheaper than fishing line
- Is a future-ready, build-once technology
- Requires no disruptive upgrades, unlike the competing technologies coax, wireless and copper
- Provides 50,000 times the capacity of wireless or coax and 400,000 times more than copper
- Better supports new applications needing higher upstream bandwidth
- Is more reliable and secure compared with other technologies.

Because customer experience is an essential component in reducing churn, service providers must consider fiber the only technology to provide the best service and meet service-level agreements.

LEO SATELLITES CAN'T COMPETE

LEO satellite technology simply can't compete. It has nothing to build on relative to other technologies, such as fixed wireless access, which serves as a foundation for future fiber buildouts. LEO satellites launched into space can't be built on, have no economic impact, and are subject to interference from weather conditions, which can lead to poor customer experience.

LEO satellite technology is ultimately single-purpose. Without attributes that contribute to the economy, environment and the betterment of users, it is essentially on a path to nowhere. ❖

Deborah Kish is vice president of research and marketing for the Fiber Broadband Association.



Pandemic Spurs Broadband Bump

Tier-1 and rural telcos enhanced their broadband speeds and reach to meet the needs of consumers who relied on Zoom conferencing, remote learning, video streaming and the use of multiple internet-connected devices when the COVID-19 pandemic turned their lives upside down.

By Bruce Forey / BroadMax Group

he coronavirus pandemic was a feast or famine for businesses. Many brick-and-mortar retail, restaurant, travel and hospitality industries saw business dip dramatically once lockdown measures were put in place. However, other businesses, such as those connected to the outdoors or home-experience improvements, had record sales.

A necessity for enhancing life at home during the pandemic is fast, reliable internet to handle Zoom conferencing, remote learning, video streaming and the multiple internet-enabled connected devices now essential to people's lives. As a result, the broadband industry – including Tier-1 internet providers, telephone cooperatives and broadband support vendors - by and large benefited significantly from the new shuttered reality.

Annual reports from publicly traded companies will help provide a more complete picture on actual broadband sales in 2020. The reports won't be released in time for this article, so Broadband Communities talked to some industry analysts who shared their findings from 2020 and their thoughts on whether the broadband spike will continue in 2021.

Verizon recorded strong sales in its 2020 fourth-quarter report and posted a 5.1 percent increase in Fios internet subscribers over 2019. Even Verizon's slower DSL offering grew year-over-year by 2.8 percent. Tier-1 operators such as Verizon typically forecast closer to 1 percent growth to accommodate for housing and population increases in service areas, so these bumps are noteworthy.

Fellow Tier-1 operators AT&T and Lumen also saw broadband gains during the fourth quarter. For AT&T, 2020 was the year of fiber; the telco added 1 million fiber broadband subscribers in 2020. As AT&T hits its fiber-to-thehome (FTTH) milestone, the provider has plans to deepen penetration in existing and new markets.

Lumen also enhanced its FTTH reach in 2020, passing an additional 400,000 homes with fiber to reach 2.4 million homes, up from 2 million at the end of 2019. In all, Lumen added 54,000 subscribers who purchased 100 Mbps and higher speed tiers. However, it lost a total of 19,000 broadband subscribers. This was due to a loss of 57,000 subscribers to plans of 20 Mbps and slower and 20-99 Mbps.

TIER-1 BROADBAND GROWTH SURGE

Bruce Leichtman, president of Leichtman Research Group (LRG), believes the pandemic was responsible for the largest overall broadband growth the industry has experienced in many years.

"With the impact of the coronavirus pandemic, there were more net broadband additions in 2020 than in any year since 2008, and this is despite broadband being in more than 80 percent of all households before the pandemic," he said.

Leichtman studied data from 16 of the largest cable and wireline broadband providers, which provide service to about 96 percent of internet subscribers in the United States. He discovered these companies acquired about 4.86 million net additional broadband internet subscribers last year compared with about 2.55 million subscribers in 2019. In addition, Leichtman found overall broadband additions in 2020 were up 190 percent over 2019.

Other key LRG findings include that top cable companies added about 4.82 million subscribers in 2020, compared with about 3.145 million net adds in 2019. The top wireline phone companies added about 40,000 subscribers in 2020, compared with a loss of about 590,000 subscribers in 2019.

"These top broadband providers now account for more than 105 million subscribers, with top cable companies

having close to 73 million broadband subscribers, and top wireline phone companies having 33 million subscribers," said Leichtman.

RURAL TELCOS EXPAND FIBER REACH

Larger broadband providers weren't the only beneficiaries of the pandemic. Many telephone cooperatives and smaller telcos that offer broadband to more rural areas saw a bump in new broadband connections. "Telcos had positive net annual broadband adds for the first year since 2014," said Leichtman.

Many didn't spend any additional marketing dollars to acquire the connections. The increases came from having a network in place, which in essence provided the supply to meet the demand.

Hill Country Telephone Cooperative (HCTC), which serves the Texas Hill Country and some areas in the western part of the state, also experienced higher than projected broadband sales. HCTC added 2,441 broadband-only customers in 2020 for about 10 percent growth. This number was close to evenly split between ILEC and CLEC customers. HCTC reported adding 1,016 members to the cooperative, mostly driven by broadband sales.

The cooperative serves a mostly rural area that doesn't have the same population growth as metro areas; most of HCTC's new customers are residents within its service area who weren't customers prior to the pandemic. Craig Cook, CEO of HCTC, credits the company's recent multimillion-dollar investment, which expanded its fiber broadband network to almost onequarter of its service area. The strategy also included increasing speeds to many existing members.

"When everyone was isolated at home and realized they needed a better broadband connection, we had done the work with our network to serve more of our members with faster speeds or offer a much better alternative than our competitors," said Cook. "Fiber broadband delivers a superior internet

connection and having the best product available in the market was important to provide excellent customer service to our members and to attract new customers when they really needed fast and reliable broadband."

FTTH, DOCSIS SALES RISE

Another indicator of broadband growth during 2020 comes from hardware and equipment sales.

Dell'Oro Group reported significant increases in sales of optical line terminals (OLT) and optical network terminals (ONTs). According to the research firm, 2020 spending on OLT/ ONT hardware was \$414 million, which was a \$68 million, or a 19 percent increase, over 2019 spending.

Fiber broadband wasn't the only network technology in demand to deliver faster internet speeds. DOCSIS 3.1 technology is used to greatly increase broadband speeds from coaxial networks.

Dell'Oro found 20.3 million units of DOCSIS 3.1 equipment shipped in 2020, which was an additional 4.5 million units, and a 28 percent increase over the 15.8 million DOCSIS units shipped in 2019.

"The numbers would be even higher if the supply chains were in order and there weren't shortages with materials needed for fiber buildout," says Jeff Heynen, vice president of broadband access and home networking for Dell'Oro. "These shortages were due in part to factory shutdowns in China because of the coronavirus. Once a factory shuts down, it takes time to ramp production back up, and this further contributed to the supply chain challenges to meet demand in 2020."

SPEED DESIRE TO DRIVE NEW **INVESTMENTS**

As vaccines roll out across the nation, many people are planning a return to pre-pandemic life. Offices will begin to slowly reopen, and more schools are welcoming students back to classrooms.

Will broadband sales growth and its industry trickle-down effects continue in 2021 and beyond? Some industry analysts predict many internet

providers will continue to invest in their networks, particularly with FTTH, because customers are now accustomed to faster, more reliable internet speeds.

Mike Render, president of the consulting firm RVA LLC, says the lifestyle shift forced by the coronavirus is probably here to stay.

"I think to some degree, we're not going back to the pre-pandemic age," he says. "I certainly see more of a hybrid work-from-home and workfrom-the-office situation as compared to pre-pandemic. So, there's going to be continuing pressure for good broadband in the home."

The pressure to deliver lies with broadband service providers. Already in a highly competitive industry, many will have to continue to invest in their broadband product to offer the fastest speeds and most reliable service to obtain and retain customers.

"I don't expect spending to decrease in 2021 and into the short-term future," Heynen says. "Especially if you are a telco and want to compete for the needs of today's broadband customer, then you'll need to continue to invest in fiber infrastructure as it provides the most throughput for the customer."

Render agreed and added that consumers have become aware of how high-speed broadband can be a useful tool. "I think a lot of people that have selected a higher speed tier will probably stay with that," he says. "And I think certainly people who haven't found a higher quality alternative are still looking. Maybe the pressure won't be quite as high after the pandemic, but many consumers now realize just how important broadband is." &

Bruce Forey is the founder of the BroadMax Group, a consulting firm offering marketing, communications and product development solutions for businesses at various stages for fiber broadband deployment. He can be reached at bruce@broadmaxgroup.com.

Three Big Telco Predictions for 2021

Chassis-based systems will end, new vendors will enter the market, and access networks will be the focus of innovation.

By Pravin S. Bhandarkar / RtBrick

020 wasn't the sort of year anyone would have predicted. Just as many aspects of people's lives were disrupted by the pandemic, so too was the telecom industry, which has settled into a "new normal."

As social videoconferencing massively increased and businesses dispersed operations to remote workers, internet connectivity reached whole new levels. At the same time, some underlying technology shifts didn't stop. Given these factors, what might be in store for the rest of 2021?

DEATH OF THE CHASSIS-BASED SYSTEM

For a while now, telcos have been clear about their desire to go "cloud-native": to follow the hyperscalers and become more agile and efficient. With more traffic to deliver than ever before - especially during the pandemic and with no expected increase in revenue from subscribers – something has to change.

This is the year the shift toward cloud-native networking will start. We've already seen adoption in the mobile RAN, for example, from players such as Rakuten. In 2021, expect to see it in fixed networks, too.

This year, carriers will start building disaggregated networks, giving them more choice, more programmability and lower costs. Telecom Infra Project (TIP) has called on the telecom industry to develop an open broadband network gateway, which is broadband routing software that runs on open hardware. This is outlined in a paper authored by BT, Deutsche Telekom, Telefonica and Vodafone - quite an impressive lineup of carriers.

The rise of cloud-native networking means that the days of monolithic chassis-based systems, with software and hardware from the same vendor, are over.

TURNING POINT FOR VENDOR CHOICE

In the telco equipment space, only a handful of big players are left standing: Cisco, Ericsson, Huawei, Juniper, Nokia ... it's a pretty short list. The national security concerns Huawei raised have narrowed the field even further. Lack of vendor choice has become a huge issue and has stifled innovation in

telco technology. Very little has changed in infrastructure technology since the arrival of IP, and with higher and higher barriers to entry, it has seemed set to stay that way. But 2021 will be the turning point. Why? In short, because of the rise of software-based solutions and disaggregated networking.

For the first time in decades, providing solutions that compete with established vendors is viable for innovative new software and hardware companies. More than that, traditional vendors often are reluctant to eat into their established business models – with their high margins and long lock-in cycles – by being disruptive themselves. Expect to see some new kids on the block and some big projects going their way.

ACCESS NETWORK PAIN POINT

When internet traffic first hit carrier networks, the biggest pain point was in network cores. Vendors raced to develop ever-faster routers and higher-capacity optical systems to meet demands. Then the congestion flared up in the last mile, when subscribers found their broadband lines creaking under the strain of triple-play services and online TV.

These days, the core is insulated by the arrival of content delivery networks (CDNs), which serve up copies of the most popular content from servers embedded around network edges. Investments in fiber to the cabinet and to the home have alleviated the last-mile challenge, with 5G set to tackle mobile limitations.

This brings us to the biggest unsolved pain point – the access network. This is the part of the network that delivers all traffic from CDN servers to the last mile. All online TV traffic, along with surging traffic from people working at home and new machine-to-machine traffic, must cross the access network to reach the end consumer.

As 2021 progresses, it's becoming increasingly clear that the access network is going to be a focus for new innovation because it will need to keep up with increasing demands. �

Pravin S. Bhandarkar is the CEO at RtBrick, which provides cloud-native routing software for carrier networks.



Outdoor UPS Products Ready for Work

- Eliminate appointments or entering customer's home
- Reduce truck rolls with ONT reset capability
- Mount up to 115ft. from power outlet*
- Operates in extreme climate, rated for -40°F to 161°F

*Titan and Titan-24 UPS units only

TITAN CREW

Can You Trust Your Business Case for Broadband Expansion?

Access to quality data will make or break service providers financially as they work to provide high-performance broadband to communities in the post-pandemic world.

By Raj Singh / VCTI

he past year spotlighted the social, economic and educational impacts of the digital divide. In response, there's been a flurry of activity from all levels of government and an increasingly diverse population of broadband service providers.

The telecom industry can look at the intensity of the FCC's Rural Digital Opportunity Fund (RDOF) bidding, which attracted 386 qualified bidders for \$16 billion in potential funding. In the end, 180 service providers were awarded a total of \$9.2 billion to serve 5.2 million locations in 49 states and the commonwealth of the Northern Mariana Islands. A slew of younger companies with new technology solutions were among the winners, but they received lower subsidy levels than initially anticipated.

Another example is changes to the FCC E-Rate program included in the most recent

The recent COVID-19 relief bill significantly expanded the categories of expenses that can be subsidized, enabling communities to upgrade services to their schools and surrounding households.

COVID-19 relief bill, which significantly expanded the categories of subsidized expenses. The expansion included the ability to provide connectivity off-campus to help bridge the athome digital divide, enabling communities to leverage this program more broadly to upgrade services to schools and surrounding households.

With a passel of government subsidies coming available and the emergence of new competitors, the question becomes: How will service providers optimize their funding to fulfill community needs most quickly for high-performance broadband and drive the highest possible return of investment (ROI) to deliver, and even exceed, their business case expectations?

Providers will need to prioritize their buildout plans quickly with high accuracy, incorporating analytics on eligible locations, comparative costs to deploy, revenue potential and competitive threats. The quality of this data will make or break their financial success.

IS LOCATION DATA TRUSTWORTHY?

The "serviceable location" count from the FCC is notoriously inaccurate. Carriers that participated in RDOF's predecessor, the Connect America Fund (CAF) programs, were required to file broadband deployment data with the Universal Service Administrative Co.'s High-Cost Universal Broadband (HUBB) portal to show where they built out massmarket, high-speed internet services using CAF

support. This information includes latitude and longitude coordinates for every location where service is available.

However, there have been challenges with the HUBB. VCTI found that the FCC's data has an average error rate of 30 percent, and the implications are significant. That error rate can result in either underestimating or overestimating revenue by 30 percent. It also can dramatically impact deployment cost estimates.

Here are suggestions to strengthen confidence in the location data:

- Vet the sources informing location data. Does the data include land-use insight from property tax records? Can it reasonably distinguish physical buildings' differences on a property, recognizing a shed versus a house? Is the process manual, or does it use artificial intelligence?
- Identify E-Rate-eligible schools in the target market and the number of households they serve. Statistics on school lunch program enrollment rates can provide an indication of a market in which students have insufficient access to broadband at home.
- Undertake manual spot-checking using online satellite tools to inspect samples of data visually.
- Tap into publicly available databases to check for any new construction plans.
- Ensure data distinguishes residential from commercial properties.

CAN CASH FLOW BE MAXIMIZED?

To maximize cash flow, it's imperative that service providers know where to build first for the fastest ROI. Decisions should be made not just on the lowest cost or the highest potential for revenue but also on the holistic ROI in which cost and revenue are assessed together. Only when algorithms are capable of modeling data for every option is it possible to plan network deployment well.

Analyze the cost to extend the existing network or build a new network for each target market

To maximize cash flow, it's imperative that service providers decide where to build first based on an ROI in which cost and revenue are assessed together.

based on potential revenue. These comparative analytics will identify the most immediately profitable opportunities. Analysis should include several factors: cost per household, cost per node, first cost to build and average revenue per household.

In addition, analysis should include the ability to leverage the RDOF or other subsidy deployment into tangential areas to expand the addressable market. For example, a tangential market may have only one or two houses with higher service while the remaining underserved houses are eager for better broadband but were excluded from the earlier FCC programs.

Understand your competition, including inroads by program winners in their own markets and the surrounding areas.

CAN CAPITAL SPEND BE OPTIMIZED?

It's necessary to model and compare deployment options, including identification of minute but material cost drivers, so that deployment is as cost-effective as possible.

- Ask where and how you can expand your service footprint to the most houses at the least cost. Analyze upload speed and download speed. Households now routinely need to be able to support multiple videoconference sessions simultaneously in addition to online gaming and shared video streaming.
- Identify capital cost and performance of the viable options for the last mile. Determine potential technologies to deploy. An all fixed wireless or an all fiber

build may not give the optimized result. An integration of multiple technologies for best performance at the least capital cost is critical in the post-COVID-19 environment. Terrain and subscriber density are the most important filters to apply first when determining what technologies can realistically be considered. Point-to-point or point-to-multipoint architectures ensure the highest symmetrical bandwidth in fiber builds, but recent bandwidth innovations in the Citizens Broadband Radio Service and millimeter OEM module demand attention.

Ask whether pockets where fiber is an economical alternative can be identified to better futureproof the investment, even if the bid or standard architecture is fixed wireless.

More people working and learning from home means the broadband customer landscape and requirements have dramatically changed. Service providers need to adapt their traditional broadband expansion plans to enable a data-driven approach to market buildout planning and ensure they can achieve their financial goals. �

Raj Singh serves as CEO of VCTI, which delivers automated intelligence products and services to grow and serve the broadband market.

BROADBAND COMMUNITIES MARKETPLACE

To reserve space in this section and LEVERAGE the power of your advertising via print, digital, and multimedia exposure in the global market, contact Irene G. Prescott at 505-867-3299 or email irene@bbcmag.com.













BROADBAND COMMUNITIES MARKETPLAGE

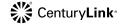
To reserve space in this section and LEVERAGE the power of your advertising via print, digital, and multimedia exposure in the global market, contact Irene G. Prescott at 505-867-3299 or email irene@bbcmag.com.











Services not available everywhere. Restrictions apply. © 2020 CenturyLink. All Rights Reserved.



ADVERTISER INDEX / CALENDAR

ADVERTISER	PAGE	WEBSITE
3HV Innovations	83	www.3hv.com
AT&T	29, 82	www.att.com/fiberproperties
Calix	21, 56	www.calix.com/munis
BROADBAND COMMUNITIES Magazir	ne 83	www.bbcmag.com
BROADBAND COMMUNITIES		
Summit 2021	Inside Front Cover – 9, 20, 34, 70, 75, 82, 8	
CenturyLink	13, 56, 83	www.centurylink.com/ connectedcommunities
Charles Industries	47, 56	www.charlesindustries.com
Clearfield, Inc.	57, 82, Back Cover	www.SeeClearfield.com
Comcast (Xfinity)	51	www.xfinity.com/ xfinitycommunities
Corning	58, 82, Inside Back Co	ver www.corning.com/ community-broadband
DISH Fiber	43, 58	www.dish.com/fiber
ESPi NA, Inc.	58, 79	www.espicorp.com
Fiberdyne Labs, Inc	83	www.fiberdyne.com
Finley Engineering	39, 59	www.finleyusa.com
Hexatronic	3, 59	www.hexatronic.com
IQGeo (OSPInsight)	60	www.ospinsight.com
KGPCo	60, 71	www.kgpco.com
Maxcell	60	www.maxcell.us
NiSC	82	www.nisc.coop
OFS	7, 60	www.ofsoptics.com
Positron Access Solutions	61	www.positronaccess.com
Spectrum Community Solutions (Charter Communications)	5, 61, 82	www.SpectrumCommunity Solutions.com
Tyson Ventures	57	www.tysonventures.org
Walker and Associates	55 V	http://communication. walkerfirst.com/bbcmagazine march2021
WESCO/Anixter	25, 62	www.wesco.com
Wide Open Networks	24, 62	www.wideopennetworks.us

Broadband Communities (ISSN 0745-8711) (USPS 679-050) (Publication Mail Agreement #1271091) is published 7 times a year at a rate of \$24 per year by Broadband Properties LLC, 1909 Avenue G, Rosenberg, TX 77471. Periodical postage paid at Rosenberg, TX, and additional mailing offices.

POSTMASTER: Please send address changes to Broadband Communities, PO Box 303, Congers, NY 10920-9852. CANADA POST: Publications Mail Agreement #40612608. Canada Returns to be sent to Bleuchip International, PO Box 25542, London, ON N6C 6B2.

Copyright © 2021 Broadband Properties LLC. All rights reserved.

JULY

25 – 28

Fiber Connect Conference

Gaylord Opryland Resort Nashville, TN 312-673-5389 www.fiberconnect.org

SEPTEMBER

19 - 22

NTCA Fall Conference

Gaylord Opryland Resort & Convention Center Nashville, TN 703-351-2000 www.ntca.org

21 - 23

NATOA Annual Conference

Virtual Conference 703-519-8035 www.natoa.org

27 - 30

Broadband Communities Summit 2021

Marriott Marquis Houston, Texas 877-588-1649 www.bbcmag.com

OCTOBER

18 - 21

WISPAPALOOZA 2021

Caesars Las Vegas, NV 866-317-2851 www.wispa.org

25 - 27

The INCOMPAS Show

The Cosmopolitan Las Vegas, NV 202-296-6650 www.incompas.org

NOVEMBER

8 - 10

OPTECH Conference & Exposition

Gaylord National Resort & Convention Center National Harbor, MD 202-974-2300 www.nmhc.org



Big ideas don't just come from big cities. Set your community's potential free.

With affordable, reliable broadband, you'll connect your neighbors to a world of possibilities, and bring their best to the world. We'll be right there with you, for them, every step of the way.

Whether you're an experienced network operator or tackling broadband for the first time, we'll meet you where you are to create a high-quality, cost-effective, fiber-to-the-home solution that's right for you today and scalable for tomorrow. Discover how we can help at www.corning.com/community-broadband.



Splice or preconnectorized, lashed or ADSS – our broad portfolio meets your network needs.

Enabling the Lifestyle that Better Broadband Provides

Speeding 288 Connections for Any Environment

Working from anywhere is expanding the need for fiber broadband connections. That means providers are encountering deployments in every type of scenario. Whether you need point-to-point or point-to-multipoint fiber, our products support user-defined feeder-to-distribution fiber ratios. Clearfield® has you covered for any environment. Which 288 Fiber Distribution Hub works best for YOUR working-from-anywhere deployments?



FieldSmart® 288 Indoor FDP Wall Box



FieldSmart 288
Outdoor
FDH Cabinet



FieldSmart 288 Below Grade Makwa



StreetSmart[™] 288 Aerial FDH



StreetSmart 288
Pre-Assigned Outdoor
FDH Cabinet



Removing Barriers to Fiber Deployment

Learn how you can simplify your deployments at www.SeeClearfield.com or call 800-422-2537

