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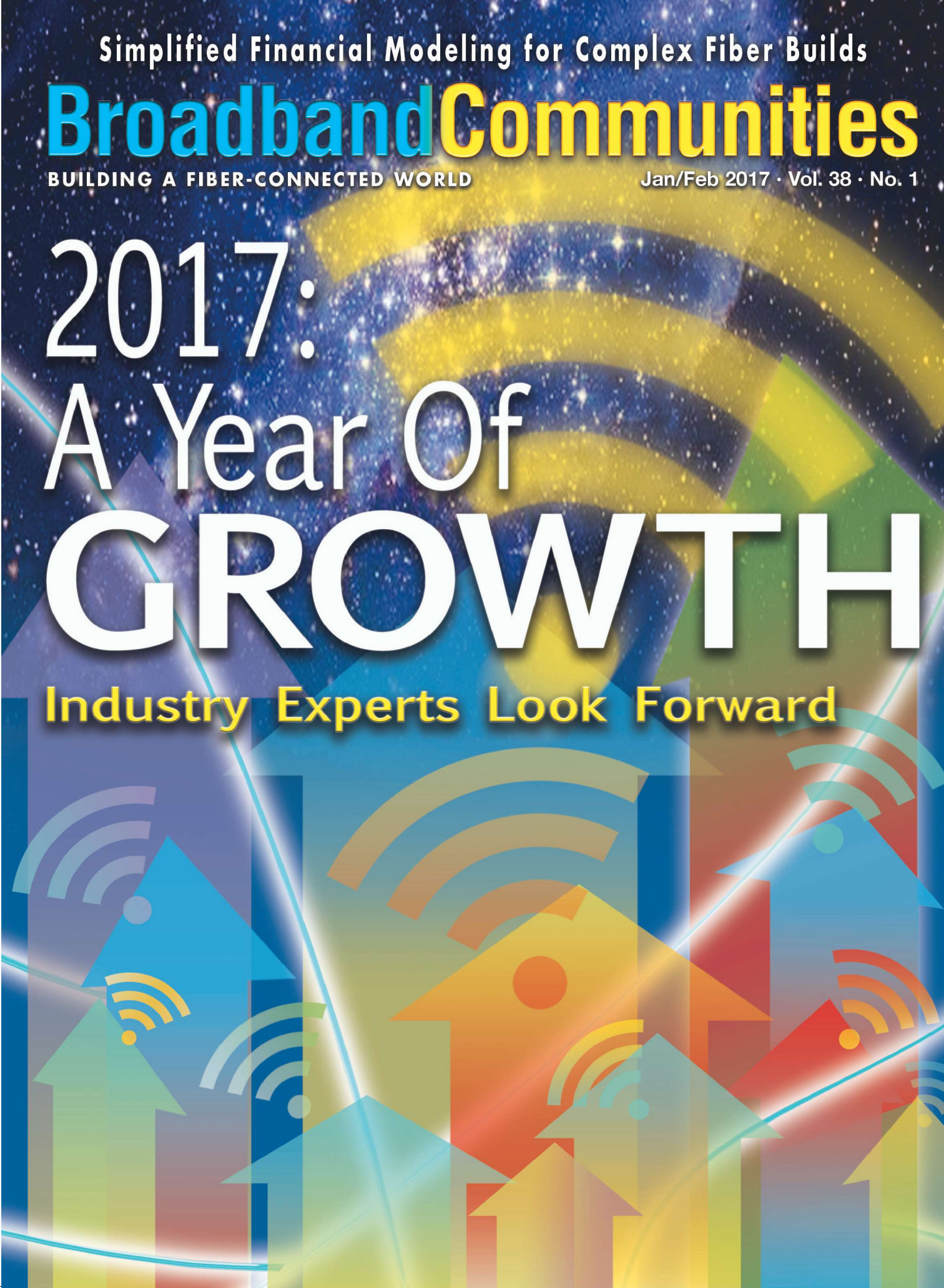
BroadbandCommunities
BUILDING A FIBER-CONNECTED WORLD
Jan/Feb 2017 · Vol. 38 · No. 1

2017: A Year Of GROWTH

Industry Experts Look Forward



Broadband Communities 2017 • SUMMIT

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I identify the Broadband Summit as the crown jewel of conferences I attend each year and strive to push our Canadian conferences to raise the bar and standard.

– Bob Dyrda, Broadband Projects
Alberta SouthWest Regional Economic Alliance

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ily Property Owners and Network Builders

New Success Stories... No One Covers It All Like We Do

e are super happy about this year's
ummit. We have so much work now
at we would need at least 48 hours
er day.
– Isak Finer, Chief Marketing Officer
COS Systems

The conference was excellent. I've suggested to several people that they attend the next one.
– Dennis Nichols, Administrator
Village of Batavia, OH

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REGISTER NOW!

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Offer expires March 10, 2017.

The Summit was a great opportunity for newcomers [like] us. We hope next year to bring even more employees to the event.
– Oliver Pilco, CEO
Access Infrastructure Partners

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you for a great conference, a terrific financial primer
ools), and an outstanding networking opportunity. I
there hoping to get through 101, and though I know
ell is deep and will require a great deal more work, I feel
was introduced and immersed into upper-level and grad
es (if you'll put up with my metaphor) simultaneously.
avid Post, City Councilman
ty of Salisbury, NC

I am a firm believer that, to be successful, you must lead and not follow! This is why Asset Essentials stays ahead of the telecom trends and the up-and-coming technology that affect the multifamily industry, and the annual Broadband Communities Summit is a great opportunity to do that. In an industry with so many conferences, this is one that my team and I truly look forward to each year.

– Gurpaul Singh, CEO
Asset Essentials

s my third year at the Broadband Communities
mit and Henkels & McCoy's first year exhibiting.
attending last year's show, I put the Summit
he communications trade show budget for
and I am really pleased with the results. The
et is growing, and it shows in the attendance
articipation at the Summit. Already looking
rd to next year.
ob Dundon, Market Director, Communications
enkels & McCoy, Inc.

Here's what attendees are saying about the 2016 Summit!

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AGENDA AT

MULTIFAMILY TRACK | EDITOR'S CHOICE TRACK | ECONOMIC DEVELOPMENT TRACK

RURAL BROADBAND TRACK | EXHIBIT HOURS | FOOD/SOCIAL FUNCTIONS

WORKSHOPS | CLIC PROGRAM | CFHP CERTIFICATION

MONDAY, MAY 1

7:00 am – 1:00 pm	**Contractor Move-In** *(Lone Star Ballroom B)*
1:00 pm – 7:00 pm	**Exhibitor Move-In** *(Lone Star Ballroom B)*
7:30 am – 5:00 pm	**Registration Open** *(Lone Star Ballroom Foyer)*
8:00 am – 5:00 pm	LIGHT BRIGADE **CERTIFICATION Day One:** Certified Fiber-to-the-Home Professional (CFHP) – Hosted by **The Light Brigade** *(additional fee required)* *(4th Floor / City View 6)*
1:00 pm – 5:00 pm	CLIC coalition for local internet choice **CLIC Preconference Sessions** *(Ballroom A-1)*
10:00 am – 12:00 pm	**WORKSHOP** *(Lone Star Ballroom A-2)* **Key Legal Issues for Economic Development** Our experts provide a foundation in the core legal concepts that can have a huge impact on your project – the ones that underlie issues being addressed throughout the Summit.
12:00 pm – 2:00 pm	**WORKSHOP** *(Lone Star Ballroom A-2)* **Hands-On Financial Modeling**
2:00 pm – 4:00 pm	**WORKSHOP** *(Lone Star Ballroom A-2)* Sponsored by **Calix**
4:00 pm – 6:00 pm	**WORKSHOP** *(Lone Star Ballroom A-2)* **Best Broadband Infrastructure for Each Building Type** – Richard Holtz
	No added charge for registered Summit attendees
12:00 pm – 2:00 pm	**WORKSHOP** *(Lone Star Ballroom A-3)* **Co-op Partners on the Road to Rural Broadband – Part 1**
2:00 pm – 4:00 pm	**WORKSHOP** *(Lone Star Ballroom A-3)* **Co-op Partners on the Road to Rural Broadband – Part 2**
4:00 pm – 6:00 pm	**WORKSHOP** *(Lone Star Ballroom A-3)* **DIY Fiber Mapping and Estimating**

TUESDAY, MAY 2

7:00 am – 6:00 pm	**Registration Open** *(Lone Star Ballroom Foyer)*
7:00 am – 1:00 pm	**Exhibitor Move-In** *(Lone Star Ballroom B)*
7:30 am – 8:30 am	**Continental Breakfast** *(Lone Star Ballroom Foyer)* Sponsored by **SMB Dynamics**
8:00 am – 4:00 pm	LIGHT BRIGADE **CERTIFICATION Day Two:** Certified Fiber-to-the-Home Professional (CFHP) – Hosted by The **Light Brigade** *(additional fee required)* *(4th Floor / City View 6)*
7:50 am – 8:00 am	**Official Welcome and Introduction** *(Lone Star Ballroom A-3, 4)*

-A-GLANCE

8:00 am – 9:00 am	**GENERAL SESSION –** Sponsored by **SMB Dynamics** **Technology Game Changers: What to Expect and How to Prepare for Living and Working in a Time of Rapid Change** Future of work expert Gary Bolles kicks off the Summit speaking on new strategies to help communities and the individuals who live, work, and learn in them adapt and thrive in a world of constant change. He'll be joined by leaders in the MDU, Economic Development, and Rural Broadband fields to add their perspectives. *(Lone Star Ballroom A-3, 4)* **Presenters:** Gary Bolles – Co-founder, eParachute Jim Baller – President, Baller, Stokes & Lide, PC Bryan Rader – President, Access Media 3 Hilda Legg – Vice Chairman, Broadband Communities Magazine
9:10 am – 10:20 am	**GENERAL SESSION** **On the March: A Conversation with the Big Providers on Where They're Going** Come and hear what the large service providers are offering today, what's up next and what it all means for the consumers they're trying to satisfy *(Lone Star Ballroom A-3, 4)* Sponsored by **iPhotonix** **Presenters:** Ed Balcerzak – Sr. VP, AT&T Entertainment Group & Services Eric Schaefer – Sr. VP, Data & Mobility Services, Xfinity Communities Chris Curtin – Director of Sales & Marketing, Mid-Atlantic Region, Verizon Enhanced Communities Adam Ray – GVP, Direct Sales, Spectrum Community Solutions
10:30 am – 12:30 pm	**GENERAL SESSION** *(Lone Star Ballroom A-3, 4)* **Great Communities** Sponsored by **Google Fiber**
12:40 pm – 1:40 pm	**GENERAL SESSION / WORKING LUNCH** **What to Expect With The New Administration** *(Lone Star Ballroom A-3, 4)* **Moderator:** Tom Cohen – Partner, Washington, D.C., Kelley Drye
1:50 pm – 2:50 pm	**GENERAL SESSION** *(Lone Star Ballroom A-3, 4)*

	MULTIFAMILY TRACK *(Lone Star Ballroom A-3, 4)*	**ECONOMIC DEVELOPMENT TRACK** *(Lone Star Ballroom A-2)*	**RURAL BROADBAND TRACK** *(Lone Star Ballroom A-1)*
3:00 pm – 4:00 pm	In-Building Cellular Reception: Is 5G (or anything else) the Silver Bullet?	Blue Ribbon Panel Our broadband leaders tackle the tough issues	A VOICE FROM WASHINGTON How the Universal Service Fund Reforms Are Rolling Out
4:10 pm – 5:00 pm	Old Buildings, New Technologies	Broadband and Economic Development: What the Numbers Tell Us	BUILDING BETTER BROADBAND Case Studies in Rural Deployment: New York State's Broadband Buildout

5:00 pm – 6:30 pm	**Exhibit Hall Opens – Refreshments** *(Lone Star Ballroom B)*
6:30 pm – 9:00 pm	**Opening Night Cocktail Reception** – Sponsored by **AT&T** **"Let's Fiesta!" Come Celebrate at our Pre-Cinco de Mayo Party** *(Lone Star Ballroom C-1, 2)*

WEDNESDAY, MAY 3

7:00 am – 6:00 pm	**Registration Open** *(Lone Star Ballroom Foyer)*
7:30 am – 8:50 am	**Breakfast and Program:** *(Lone Star Ballroom A-2)* **Next Century Cities Special Session** **Civic Engagement and Digital Inclusion: Showcasing Innovation** Local government leaders are leading the way to implement exciting digital inclusion and civic engagement strategies. This panel will feature three winners of Next Century Cities' Benton Next Generation Engagement Awards. Austin, Raleigh, and Louisville will share their award-winning stories and lessons learned.

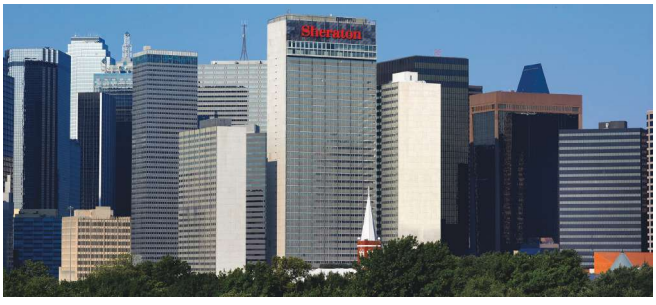
AGENDA AT-A-GLANCE

8:00 am – 8:50 am	**MULTIFAMILY TRACK** Owner / Legal Roundtable *Closed forum for owners and owner lawyers only.* *(4th Floor, City View 6)*	**MULTIFAMILY TRACK** Providers Roundtable *(Lone Star Ballroom A-3, 4)*	
	MULTIFAMILY TRACK *(Lone Star Ballroom A-3, 4)*	**ECONOMIC DEVELOPMENT TRACK** *(Lone Star Ballroom A-2)*	**RURAL BROADBAND TRACK** *(Lone Star Ballroom A-1)*
9:00 am – 9:50 am	New Twist in MDU Open Access for Providers	Working With Economic Development Professionals	BUILDING BETTER BROADBAND Broadband is the New Coal: How Appalachia is Tackling Broadband
10:00 am – 10:50 am	10:00 am – 11:20 am MDU Legal Leaders	How Adaptive Communities Are Creating Future Work	USING BETTER BROADBAND Smart Rural Communities (Presented with NTCA)
10:45 am – 12:45 pm	**Exhibit Hall Open / Refreshment Break** *(Lone Star Ballroom B)*		
12:45 pm – 2:05 pm	**Cornerstone Awards Luncheon** *(Lone Star Ballroom C-1, 2)* Sponsored by **Verizon**		verizon
	MULTIFAMILY TRACK *(Lone Star Ballroom A-3, 4)*	**ECONOMIC DEVELOPMENT & RURAL BROADBAND JOINT TRACK SESSION** *(Lone Star Ballroom A-2)*	**EDITOR'S CHOICE TRACK** *(Lone Star Ballroom A-1)*
2:30 pm – 3:30 pm	Property LAN Part 1: Infrastructure Super Session	Fiber-Based Incubators and Tech Hives	Open Access
3:30 pm – 4:00 pm	**Networking Break** – Refreshments		
4:00 pm– 5:00 pm	Property LAN Part 2: IoT Devices and Their Implementations	New Developments in Public-Private Partnerships	BETTER BROADBAND POLICY Paying for the Last Mile
5:00 pm – 7:30 pm	**Exhibit Hall Cocktail Reception** Sponsored by **XFINITY** *(Lone Star Ballroom B)*		XFINITY Communities™
7:30 pm – 9:00 pm	**Networking Dinners** – *Privately Arranged*		
THURSDAY, MAY 4			
7:00 am – 2:00 pm	**Registration Open** *(Lone Star Ballroom Foyer)*		
7:30 am – 8:30 am	**Continental Breakfast** *(Lone Star Ballroom Foyer)*		
	MULTIFAMILY TRACK *(Lone Star Ballroom A-3, 4)*	**EDITOR'S CHOICE TRACK** *(Lone Star Ballroom A-2)*	**RURAL BROADBAND TRACK** *(Lone Star Ballroom A-1)*
8:00 am – 9:00 am	Student Housing	History and Future of Open Access Networks in Michigan	
9:10 am – 10:00 am	Owner Roundtable *(Closed forum for property owners and managers only)*	Local Government Financing of Broadband: The ECFiber Story	USING BETTER BROADBAND Using Open Access as a Tool for Rural Areas
10:10 am – 11:00 am	Get Savvy about Social Media	Federal Funding	USING BETTER BROADBAND Rural Broadband Adoption: It's Better Than You Think
11:10 am – 12:00 pm	Hot New Growth Opportunity: Serving the Active Adult	Creative Projects That Foster Economic Development	BETTER BROADBAND POLICY Revising the Telecom Act to Meet the Needs of Rural America
11:00 am – 2:00 pm	**Exhibit Hall Open** *(Lone Star Ballroom B)*		
12:00 pm – 1:00 pm	**Exhibit Hall Luncheon and "Must be Present to Win" Drawings** *(Lone Star Ballroom B)*		
1:10 pm – 2:10 pm	**GENERAL SESSION** **Smart Cities** *(Lone Star Ballroom A-2)*		
2:20 pm – 3:20 pm	**GENERAL SESSION** **Pulling It All Together: What We Have Learned About Advanced Broadband Networks and the Future of Work, and Where Do We Go From Here** *(Lone Star Ballroom A-2)*		
3:30 pm – 5:00 pm	**SPECIAL SESSION** *(Lone Star Ballroom A-2)*		

FIBER: Get in the Game of GIGS

Change Is the Thing at the 2017 Summit

We've got a future-of-work guru… a panel of large service providers clueing us in on where they're going … an inside look on what to expect from the new administration…. And that's just between breakfast and lunch on the opening day of the Summit!



Economic Development – Facts, Not Platitudes

Take a deep dive into the latest data, the latest case studies, and the latest strategies for using ultra-broadband to create jobs, attract business, and keep the businesses you have. PLUS this year's Economic Development Track has an added emphasis on living and working in a time of rapid technological change.

Rural Broadband – No Communities Left Behind Is Front and Center

Presented with our Rural Telecommunications Congress partner, the Rural Track highlights the importance of broadband deployment to the vitality and very survival of America's rural communities. Local, state and federal leaders – passionately committed to the belief that Rural America cannot be left behind – provide information on how to obtain and use advanced telecommunications services and technology for social and economic development.

Gigabit Development Is Heating Up

AT&T gigabit service is now in 46 metro areas and plans to reach 21 more. Verizon Fios, already available to about half the company's footprint, has expanded to Boston. Google Fiber is now in eight metro areas and planning others. Comcast, CenturyLink, Cox, and Altice have all gotten in the game of gigs. For four years, we've seen steady growth in new homes passed with fiber, but now the serious fun is heating up.

4.1 million homes were newly passed with fiber in 2016. That's 1.4 million more than in 2015

More than 1,000 network builders now deploy fiber to end-users and more are being created at a record rate

Returns on investment may double, **time to initial revenue may be halved** as exciting new technology has enhanced business cases for fiber

All-New Program for Building Owners, Managers, Developers

The Summit puts the latest shiny new technology into sharp business perspective with an agenda developed by industry leaders in a way that building owners, managers, and real estate developers can understand. Special presentations include dynamic sessions on the provisioning of multifamily properties such as apartments, universities, senior housing, and master-planned communities. What hasn't changed this year: Most speakers are from YOUR industry, not from the technical vendor community. They are coming to share their experiences and expertise – and to answer your questions.

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2017 Program Highlights

SNEAK PREVIEW: Just a few of the exciting sessions planned for Summit 2017

Heads Up! There's a New Legal Twist in MDU Broadband Open Access

There's a shakeup in access that favors upstart broadband service providers. About 20 states allow franchised cable operators to access MDU customers over the property owners' objection. But San Francisco's newly enacted Police Code Article 52 goes much further. It gives *mandatory* MDU access rights to broadband service providers, too. It also applies to commercial multi-tenant buildings as well as MDUs and allows the new provider to use existing inside wiring owned by the MDU owner, with compensation. Rumor has it that the San Francisco ordinance will be a template for access reform nationwide. Will such initiatives encourage or discourage competition? Come to the Summit and join the debate, moderated by former FCC attorney Carl Kandutsch.

Making It Work: Effective Strategies Adaptive Communities Employ to Create the Jobs of the Future

What are the new rules of work and how do they affect communities? Are we really becoming a Gig economy? Learn about some of the proven approaches that communities have adapted to provide access to work opportunities for those who live in them.

Is a P3 the Answer to Your Problems Building an Advanced Broadband Network?

For many communities, public-private partnerships may be the best – and possibly the only – strategy for obtaining an advanced broadband network. The best P3s strive to overcome political, financial and other barriers. Each of our panelists has been intimately involved in some of the leading broadband P3s. They will discuss various P3 models and some of the features communities should look for in their potential business partners.

Opening the Door to Competition

Community leaders want citizens to be able to choose among fiber-to-the-home providers – but in most towns, no one is building any fiber networks at all. The solution: an open-access community network. Find out how to bring the benefits of competition to your community while avoiding the pitfalls that some early open-access networks encountered.

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THE GAME OF GIGS

Standing out from the Crowd: Vermont's ECFiber Parlays Local Control, Local Investment and Lots of Grit into a Powerful FTTP Network

ECFiber, the 24-town fiber network in Vermont, has been featured in past Summits as an example of do-it-yourself crowd financing, a method the organization turned to after its original financing plan fell victim to the 2008 recession. After five years of crowd financing, the organization was successful enough and strong enough to return to the capital markets and raise funding to double the size of its network. This is an inspiring story of local control and local investment in a powerful FTTP network. The participants will offer advice to local governments on the opportunities and challenges of broadband financing.

Carriers to MDU Owners and Managers: We're Stampeding to Get Your Business

Welcome to the largest one-year strategy shift by broadband carriers since fiber-to-the-home builds began ramping up in 2004. The past year has seen astounding consolidation among the biggest satellite, cable and broadband carriers, balanced somewhat by astounding resilience among smaller carriers and astounding willingness of all carriers to serve MDUs and single-family developments outside traditional footprints. It's all because there's been a seismic shift on both the technology and the content sides in the past year. Technology now allows near-seamless consumer switching between cellular, Wi-Fi and hard-wired Ethernet and coax cable. The content side – major carriers have bought a lot of content, from Yahoo to entire TV networks – has enabled more new business propositions. Come and hear what the large service providers are offering today, what's up next and what it all means for the consumers they're trying to satisfy. We'll help you make sense of it, in language you don't have to be a network engineer to understand.

Great Communities

Foresighted property owners and developers know broadband is a key factor in making a community great. Learn from these case studies how owners are setting high standards and overcoming challenges to distinguish their properties.

Learn the Latest On In-Building Cellular Reception

If you are thinking about skimping on your building's broadband systems, cellular reception isn't the place to do it. There's no silver bullet but lots of options to ending residents' complaints about poor reception. True, the cellular carriers' "fifth generation" systems will help... but not this year and never completely. So what's the right use of today's 4G LTE cellular? Distributed antenna systems? Are Wi-Fi calling, 4G picocells or other solutions enough? Perhaps most importantly, how do you buy wisely now, so that you don't have to throw everything away and start over in just a few years? Learn from the experts, in clear non-geek language, about which solutions work in which situations, and how to justify costs and evaluate the performance and amortization trade-offs among them.

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Exciting New Essential Service Approach Can Help You Pay for the Last Mile

The current business case approach is not addressing the needs of many, many unserved and underserved areas. Recent SNG research reveals that rural broadband subscribers receive half the bandwidth for the same price as their urban counterparts. Furthermore, subscribers with just one provider get less than half the bandwidth of subscribers with two or more providers in their area – again for the same price. By approaching broadband as an essential service, there are proven models (e.g. electrical co-ops, gas utilities) to finance broadband in higher-cost areas. This session examines a new way to fund the last mile by combining Broadband Improvement Districts, cost reduction financing and local economic growth in a manner that is sustainable and low risk.

MDU Networks… and Common Sense

Want great broadband in your building? You think you need Zigbee, Wi-Fi and cellular, but how do you know it will all work together? Cloud services are being pushed by some vendors for Wi-Fi management. For one carrier, it's an all-IP video solution. But shouldn't network security be mainly at the network edge, in your building? At what point do all-wired networks become obsolete, and has that moment already arrived? Getting it right will cost you, says Richard Holtz, CEO of InfiniSys, a multifamily technology consulting firm founded in 1989. But lousy broadband will cost you a lot more in repairs, service calls and tenant dissatisfaction. In a plain-language, hour-long panel discussion, Holtz and panel members will explain it all to MDU owners and managers. (He's also chairing a two-hour, more technically detailed pre-Summit workshop.) Come. Question. Learn.

Working it out: Economic Development and Broadband Pros Find Common Ground

Versus a time when economic development and broadband professionals did not understand each other – and sometimes even worked at cross-purposes – the two professions are increasingly working in harmony. This session examines the strengths of each and in particular, it will emphasize the tools that economic development professionals can bring to broadband projects. You'll also hear numerous examples of what's working well.

Federal Funding for Broadband: Yes, No, Maybe

The federal government has annually spent tens of billions of dollars on E-Rate, Connect America Fund, Rural Health Care, Farm Bill Broadband Loans, Community Connect Grants and many other programs that support broadband deployment, adoption and use. But now what happens under the new administration? Our panel of experts will discuss and debate the prospects for the current programs and the possibility of a major, national infrastructure bill – including the bipartisan support needed to include broadband in any such bill.

What to Expect and How to Prepare for Living and Working in Time of Rapid Change

"The future is already here, it's just distributed unevenly." William Gibson

The pace of technology-fueled change is dramatically accelerating, with no end in sight. This opening-day session explores how to develop new strategies that can help communities and the individuals who live, work and learn in them to adapt and thrive in a world of constant change. And on the final day of the Summit, a town hall session will review the work-related issues that have emerged during the conference, including an active audience discussion about the path forward for broadband-enabled communities that are able to adapt in disruptive times.

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THE GAME OF GIGS

What to Expect from the New Administration

Lots more questions than answers about what's in store for broadband have been swirling around. We look to Washington pros – including an administration voice – to get some insights.

MDU Legal Leaders Face Off

Why pay for an attorney when you can get answers from the nation's top broadband legal experts, absolutely free! At the Summit, the top lawyers representing both MDU owners and providers will engage one another in spirited debate on both sides of key industry issues. Join us in what is always a popular – and lively – session moderated with panache by the irrepressible Chris Acker, director of community technology services at Lennar Multifamily Communities, LLC.

Meet Three Providers Who Are Making the Most of Their Assets

Leveraging middle-mile networks to improve last-mile access was one of the greatest challenges of the broadband stimulus program. Three Michigan providers – a statewide research network, a municipal utility and a cooperative telephone company – will describe how they work together to make the most of their assets and capabilities. Open access is part of the key.

Broadband and Economic Development: What the Numbers Are Telling Us Now

Communities that have developed or partnered for the development of advanced communications networks have almost universally cited economic development as their primary reason for doing so. But what do we *really* know about the relationship between broadband and economic development? This popular session returns with new numbers that clearly demonstrate broadband's ability to drive and support economic development. You'll get real figures on how broadband drives business success, increases home prices and generates economic growth.

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Explore the Buzz about Fiber-based Tech Hives

For most communities that develop or partner for high-speed broadband networks, economic development and job creation are the primary motivations. But some particularly innovative locales are taking the next step: developing incubators that cultivate and support new businesses. Hear how communities have leveraged their connectivity to attract new entrepreneurs and high-tech companies. Each of our panelists in this joint Economic Development and Rural Broadband cross-track session has experience working with fiber-based incubators. They'll reveal the positive outcomes – and lessons learned.

Next Century Cities Special Sessions

Austin, Raleigh, Louisville: Hear the award-winning stories that earned these three communities Next Century Cities' prestigious Benton Next Generation Engagement Award. Local leaders from the three communities share their exciting digital inclusion and civic engagement strategies. And you'll get to meet more winners! At a special Summit presentation, Next Century Cities and Google Fiber will announce the 2017 Digital Inclusion Leadership Awards, which celebrate outstanding leadership and encourage innovative approaches to bridging the digital divide.

Hot New MDU Growth Opportunity: Serving the Active Adult

Communities serving adults 55 and older must now seamlessly accommodate active lifestyles while also providing for inevitable life changes – and broadband is a major part of the deal. This session concentrates on attracting and serving folks who don't yet need assistance, but might require it in the future. Active adult communities need great wireless, ultra-reliable networks, and world-class security – and it all needs to be easily upgradable.

Using Better Broadband: Learn from the Winners

Find out what earned three showcase communications companies the NTCA's Smart Rural Community℠ Showcase Award. These awards are given for promoting rural broadband networks and the broadband-enabled applications that communities can leverage to foster innovative economic development, commerce, education, health care, government services, public safety and security and more efficient energy distribution and use – exactly what the Summit is all about.

Secure your seat today by calling 877-588-1649, or visit our website at www.bbcmag.com

THE GAME OF GIGS

It's a Whole New Ball Game: Our Blue Ribbon Panel of Broadband Leaders Tackles the Tough Issues

We have a new administration, a new Congress, and a new FCC – all needing to focus on new investment strategies, on accelerating high-capacity wireless deployment and on addressing the digital divide. What does it all mean for local communities? Is there common ground? Our experts will offer their answers.

Innovative Apps + Powerful Broadband = Smart Cities: What an Intelligent Equation!

From managing traffic and protecting safety to cleaning and greening public spaces; from monitoring air quality to improving public transit. A new generation of applications and devices is making cities more livable, more functional and more efficient. Pioneers from some of the most innovative Smart Cities in America discuss what's worked, what hasn't – and what role broadband is playing in enabling the Smart City of the future.

Old Wiring? New Tricks and New Business Cases

Does your old RG59 and CAT3 make you nervous? Does your small technology budget make you even more nervous? Do carriers' promises and soft SLA language push you over the edge? Here's what to do when your building's infrastructure is outdated and your tenants are demanding the latest bells and whistles. Hint: You do not always have to rip all the old stuff out right away but you do need real upgrade plans, not panic-driven patches. You'll get them from our experts.

Tales from the Trenches: Case Histories of Creative Projects that Worked

We all instinctively believe that high-capacity broadband networks drive economic development and create new work opportunities, but does real-world experience support this belief? In this session, our accomplished speakers, who've been in the trenches creating new projects, share their experiences in the field and what they've learned from them.

Getting Savvy With Social Media

Tweet this. Blog that. Yelp about it. We know property and broadband mentions and ratings on social media matter to the MDU community. Low online ratings for providers can affect a resident's decision to lease at your community. Low online ratings for a management company can affect provider penetration as well. Learn to use social media as an inexpensive consultant that guides you to better performance and to justify the cost versus the benefits of property service and equipment upgrades. Learn how to staff or buy tracking services – and to justify their modest costs. This session aims to help providers and owners/managers work together to improve the residents' overall experience... and enhance their online social media approval rates.

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THE SUMMIT is the leading event for network builders and deployers

WHY ATTEND THE SUMMIT:

The **Broadband Communities Summit** is a must-attend event for network builders, deployers, and large-scale and wholesale buyers and users of broadband technologies, equipment, and services. It is the only annual conference focused on the successful delivery of broadband, video, voice, and other services to multifamily properties and ultra-connected communities. And it is the leading venue for information on digital and broadband technologies for buildings and communities. The last two years have seen more technological, corporate, and regulatory change than any in recent history. And with a new administration, a new Congress, and a new FCC in place, 2017 is shaping up to be even more disruptive. At the 2017 Summit, our 14th annual event, we'll be looking carefully at the changing broadband prospects in rural, urban, and MDU settings. What will higher interest rates expected for 2017 do to deployment economics? What kinds of help will government provide for expanding the country's broadband infrastructure – and will there even be any help? The Summit will provide answers, thanks to its extraordinary program of outstanding speakers and cutting-edge information about building, marketing, managing, and monetizing broadband networks. Come to Dallas on May 1-4 for the 2017 Broadband Communities Summit and you'll learn the latest about the industry – and get to network with your peers at the speed of light.

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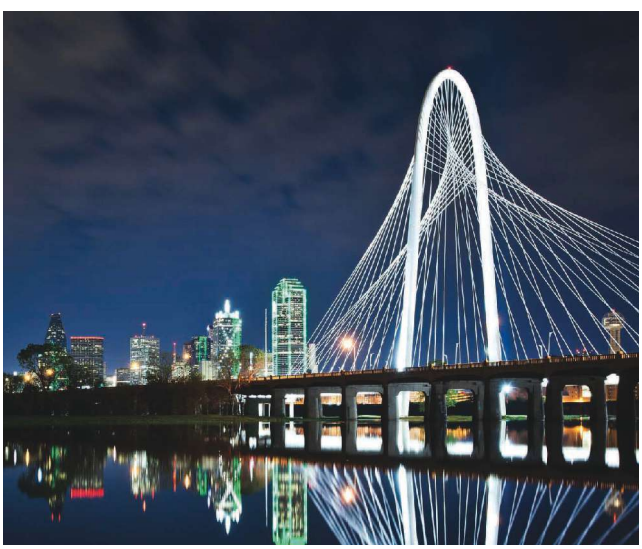

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BPA WORLDWIDE

Looking Forward

Whatever else happens this year, count on progress toward all-fiber networks.

For better or worse, 2017 is shaping up to be a year unlike any in recent memory. As of press time, it's unclear whether Australia is a friend or foe, whether the stock market is soaring or crashing, or even what the new administration's broadband goals are. (The **Broadband Communities** Summit, still three months away, should shed some light on the last of those subjects.)

Nevertheless, I started the year, as I've done for several years, by asking industry experts what they expected to see in the world of broadband, and they gamely ventured some predictions. (See p. 44.) I think you will find them interesting and thought provoking.

One thing that struck me is, barring catastrophe, how little these predictions depend on politics, policies or the economy. The right kind of infrastructure program might speed up the trends experts identified, and the wrong kind of economic policy might slow them down. But the trends are what they are for underlying reasons that aren't easily altered.

DEMAND AND SUPPLY

A generation that grew up with technology is entering the workforce. Even those of us who grew up in the age of rotary phones have become dependent on the internet for life, work, study and play. Researchers at the University of Missouri found that smartphone users think of their phones as extensions of themselves and suffer anxiety when they can't use them. People expect to be connected anywhere, anytime. And by the way, the days of TV broadcasters deciding what people should watch, and when, are over.

That's the demand side. On the supply side, manufacturers are creating paths to the all-fiber future – fiber to every home, business and lamppost. There are multiple paths, and providers follow them at different speeds, but that's because every locality and every network has unique circumstances and requirements. The endgame is the same for everyone.

Our experts envision an integrated, converged network that delivers to homes, businesses and cell sites the services appropriate for each – and that providers can add new services to as easily as smartphone users add new apps. Technologies such as NG-PON2 and software-defined access will make this dream a reality.

Supply and demand aren't simple lines on a graph. Serving millennial office workers in a metropolitan high-rise is different from delivering fiber to a farm. (And if the area you want to serve includes multiple business cases, be sure to read "Financial Modeling for Big Fiber Builds," p. 52.) But these underlying forces are real, and in the end, they are what drive the industry. ❖

Masha Zager

masha@bbcmag.com

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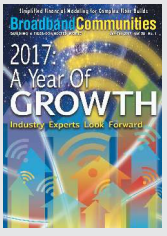

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VOICE

Driving the Digital Highway

The United States needs two regulatory roads – one for urban areas and one for rural.

By Steven S. Ross / *Broadband Communities*

The goal of broadband policy should be to protect consumers while encouraging broadband buildout (perhaps the most important activity of the 21st century) by ensuring that communications carriers can make a business case strong enough to attract investment.

However, communications technology, network ownership patterns and network uses change so fast that regulation is always a step or two behind even if regulatory goals are crystal clear. Imagine highway vehicle traffic doubling every two years. That two-lane road built in 2016 becomes four lanes in 2018, eight lanes in 2020 and 16 lanes in 2022. By 2040, the roadway will be almost 20 miles wide. By 2054, that one roadway will cover the entire country with asphalt, coast to coast and Canada to Mexico.

Hidden inside pencil-thin bundles of fiber, communications traffic volume has doubled every two years for the past half-century. It is small wonder national carriers invest more than $60 billion a year in their networks – more than any other industry on the planet. It is no wonder that fiber is the ultimate solution.

TWO POLICIES

The United States needs two policies, two regulatory regimes – one for urban areas and one for rural. To encourage investment, both should use the lightest touch possible. In urban areas, the goals should be to foster competition, encourage digital literacy and provide usage subsidies. Almost all the wealthiest urban residents are online, and fewer than half the poorest are.

In rural areas, I have shown in three studies that at least a quarter of all rural population loss since 2010, and probably half, is due to lack of broadband access. Yet many states* restrict municipalities from building their own networks even if existing carriers provide little or no broadband service. In the wake of a national election in which rural voters strongly supported the new president, the fact that Virginia and Missouri are seeking to tighten, rather than eliminate, their restrictions on municipal broadband is mind-boggling.

Ajit Pai, after being appointed FCC chairman, wasted no time in saying the two-year-old Open Internet Order (aka net neutrality) will be repealed as soon as a Republican FCC majority is confirmed. That throws into doubt many provisions, including the automatic right of broadband carriers to attach their fiber or copper to utility poles in states that don't have their own pole regulations.

Without the federal order, carriers can still become competitive local exchange carriers to gain federal pole attachment rights, but that requirement is somewhat reminiscent of the old Massachusetts blue laws, which allowed people to harvest oysters on Sundays only if they bought licenses to sell candy bars. Pole rules allow local pole owners to force delay and higher costs on potential deployers.

Net neutrality requires that internet service providers give consumers equal access to all legal content and applications. Should cellular carriers be allowed to "unequally" provide favored (or their own) content without charging it against monthly data caps? Pai says yes and dropped all FCC investigations into the practice.

So-called zero-base content is popular. Verizon users can stream go90 video, and AT&T customers can stream DIRECTV NOW, without data usage limits. These companies gain an advantage over cellular providers that don't have content to stream, and the system encourages network providers to invest in content rather than in their networks. But so far, those downsides seem remote.

The Bureau of Labor Statistics estimates that 500,000 information technology jobs will be created in the next few years. More than 5 million American families – one in 20 – derive some income from online, work-at-home employment (not including ride- or home-sharing services), according to Microsoft Research and Pew Research Center. Economist Michael Curri says three of four new businesses require broadband access. What's the best way to ensure broadband will be available to these homes and businesses? Get some answers at the all-new May 2017 Summit. ❖

* Arkansas, Colorado, Florida, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, North Carolina, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Washington and Wisconsin.

Contact the Hawk at steve@bbcmag.com.

A Technicianless Service Call

Some aspects of customer service just can't be automated.

By Bryan Rader / *Access Media 3*

Ford announced it will offer a self-driving vehicle by 2021. Volkswagen's head of strategy expects its first self-driving car by 2019. GM reported "2020 or sooner." Tesla, Jaguar, Land Rover, BMW – all are making similar announcements.

By 2025, the U.S. Department of Transportation predicts, "driverless cars will be in use all over the world." Uber will begin to phase out its drivers over the next decade, hoping to use only driverless cars by 2030.

In fact, Uber began testing a driverless car in Pittsburgh with a backup driver. The car is a Ford Fusion Hybrid with roof-mounted cameras, GPS receivers and a laser radar (LIDAR) system that collects more than a million data points per second. The system can navigate, accelerate, brake and steer the car.

The strong wind of innovation blowing over the automobile industry today is likely to impact many areas of consumers' lives. Driverless cars take the human element out of driving. There will be fewer accidents, less road rage and no more cutting across three lanes of traffic when the driver almost misses an exit. The driverless car's computer never gets lost, doesn't text and drive and certainly won't stop on the way home for a nightcap that impairs its driving.

A driverless world could become an attractive future reality. It would cut down on one of today's biggest headaches – traffic! But it wouldn't do a thing for another of today's big headaches – in-home service tech visits.

Or would it?

What if cable companies moved to a technicianless world? Maybe they would begin making the same announcements as the car companies: Comcast plans technicianless service calls by 2020. Charter announces it will be technicianless by 2019. AT&T claims it's there in 2021. In fact, the U.S. Department of Cable TV (I mean the FCC) could soon announce that the whole industry will be technicianless by 2025!

Does that sound like a good idea? No more human element in customer installs, service calls, work orders or help tickets. Instead, service providers send driverless cars with technicianless service robots to handle all in-home issues.

A robot will not track in mud during a service call, will not smell like the Taco Bell it inhaled between appointments and will not ask to use the customer's bathroom. It will be programmed to enter the customer's apartment or condo, take internet signal readings throughout the home, test the Wi-Fi devices and replace set-top boxes, all in less than an hour, before it jumps back into its driverless vehicle to go to the next MDU community.

How efficient. A robot won't waste time moving furniture, playing with the customer's dog or answering stupid questions about how to use the new DVR app on a smartphone. Efficient, yes. Customer service focused, no.

A robot can handle the technical items on a work order, but how does it handle unexpected questions or comments such as "I have no idea what a router is" and "I'm not sure where the HDMI cord is located." Work orders and installs are opportunities, more so than ever before.

I was in an Apple store at the mall during the holidays. (I know, a driverless car would probably have told me, "What, are you crazy? You want me to take you to the mall on Christmas Eve?") As I looked around the recently expanded store, I was amazed at how much service and support happen versus sales of new products. Apple stocks its stores with young people in bright red Apple shirts (and tattoos and earrings) to guide customers through myriad issues. Customers hovered around large tables, asking such questions as, "How do I pair my watch with my phone? Where are my old pictures? How do I transfer my contacts?"

No robot answered my questions (I mean, er, the other clueless Apple customers' questions), just patient Apple associates addressing any kind of unexpected issue. No robot could do this as well.

Apple's retail stores get it, and so should broadband service providers. Don't announce a technicianless plan in the next few years. You'll lose an opportunity to be special. And service techs in the industry will be able to breathe a sigh of relief. ❖

Bryan J. Rader is the president of Access Media 3, a broadband provider. He can be reached at brader@accessmedia3.com or by phone at 314-540-1114.

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ADTRAN

Marketing to Millennials

The "me" generation isn't anything like earlier generations – and why don't millennials watch sports on TV, anyway?

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

Marketing an entertainment service to millennials can be a challenge. This is a fresh generation raised with constant digital stimulation. Do millennials really approach most of life's choices in a profoundly new way? The answer is "yes."

Members of the millennial generation (sometimes called Generation Y) were born between 1980 and the mid-1990s. The first of them reached maturity about 2000. This is one of the most researched generations, and its charactistics include optimism, diversity and technical savvy. Because of technological advancements, millennials are accustomed to getting information and entertainment faster than was thought possible just a few years ago.

In the United States, millennials are the first majority nonwhite generation and one of the most diverse generations ever. Millennials are also the most educated generation, as of 2015.

Starting out during economically lean times, many members of this generation find themselves underemployed. In spite of this slow start, they continue to be optimistic about the future and their success.

Millennials are more likely to delay marriage and having children. Women will marry at 27 and men at 29. A Pew Research report predicts that 25 percent of millennials will never marry at all.

The problem of figuring out what appeals to millennials is not limited to the United States. It's a global issue. One example is China, where the government is concerned about losing a digitally savvy younger audience. A recent New York Times article outlines the problem of broadcasting old-school style propaganda to younger Chinese viewers who have become accustomed to the fast pace and strong visuals of digital media.

The government's campaign pops up online in animated videos and TED-style talks. Hip-hop songs pay homage to party history and warn of foreign influence. With the sound turned off, the talks look just like presentations from Silicon Valley.

This generation faces greater economic challenges than previous generations. For example, the New York Times reported in 2016 that although the unemployment rate for recent college graduates was below 5 percent, another 44 percent were underemployed – that is, doing jobs that don't require college degrees. In addition, recent graduates are more than likely swamped with college loan debt and dealing with a high cost of living.

Members of older generations believed that hard work and dedication to an employer would guaranteee them paychecks during their lifetime. Millennials are skeptical that corporate loyalty will result in promotions and continued job security. They have paid attention to the way their older relatives and friends have been treated in the workplace and have shown that they are less apt to tolerate insensitive work environments.

Time magazine reports a co-dependency between millennials and their baby boomer parents. Millennials live at home with their parents longer and accept financial support from them. Despite the TV culture story line of college grads coming back home to live until they find jobs, studies show that parents tend to be very protective and let their children live at home well into adulthood.

This co-dependency was fostered during millennials' time in college. According to NPR, they called, texted or emailed their parents several times a week. In the past, parents had contact with their college-age children about once a week.

MILLENNIALS' NEEDS AND VALUES

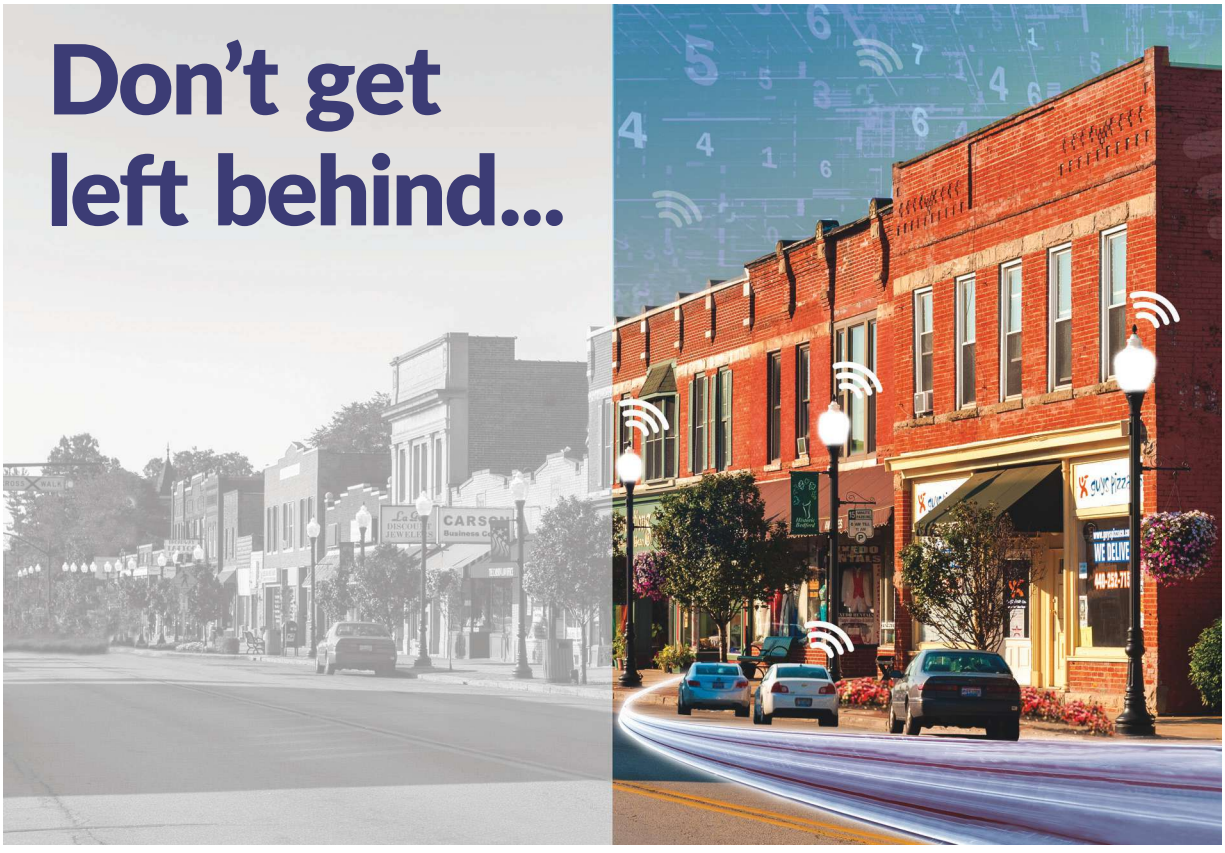
Quality is most important to millennials, but price is a greater factor than it was for earlier generations. Millennials like to see a company that can tackle social issues and let them play a part in developing the brand. Companies need to be transparent, flexible and optimistic about the future, just like millennials themselves.

One facinating development is in how millennials view broadcast sports. Research suggests those in the 18–34 age range don't have as deep a committment to watching sporting events on TV as people of older generations do. Ouch!

Traditional sports viewing can be enhanced with ultrahigh definition, which can make events more visually appealing. Nearly one-third of viewers report streaming sports at home, which is a very different viewing experience that encourages texting, emailing, tweeting and so forth at the same time.

The ramifications of this seismic change affect business models that have been sanctified for generations. ❖

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



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One Fiber, Two Providers: Givens Gerber Park, Asheville, North Carolina

In this issue, **Broadband Communities** showcases Givens Gerber Park, an affordable senior housing community whose residents can choose between two broadband services delivered over the same fiber infrastructure. Thanks to Ricky Foor of Givens Communities and Alan Bertsch of Qypsys for gathering the information for this profile.

By Masha Zager / *Broadband Communities*

Givens Communities is a United Methodist Church–affiliated nonprofit that provides care for seniors in several types of communities – ranging from independent living through skilled nursing – throughout western North Carolina. Its mission of compassionate care emphasizes opportunities for residents to live their lives to the fullest. This requires providing a community atmosphere, a wide variety of activities, and catalysts to participate in as many of those activities as possible.

"That's where technology comes in," says Ricky Foor, technology director for Givens Communities. "Phone, internet and cable are all tools we provide residents to enhance their lives. Wireless access is very important to us because it opens up the door to allow them to interact with the community, the region and the world as a whole." Each community has a website, a community TV channel and, in some cases, a mobile app to keep residents informed about menus and activities and facilitate contact with staff members.

Each community (except one that Givens purchased rather than built) is built with a fiber-to-the-unit network that will enable residents to access any new technology as it develops. "We're planning ahead and thinking about what will happen," Foor says. "Will residents need 3D video? Virtual reality? The medium that gives us most chance of success with these is fiber."

Givens provides triple-play services to residents over its own networks and invests any profits from those services in the communities' technology infrastructures. In addition, it always offers residents a choice of providers, usually through a parallel copper or coaxial network. Foor explains, "I don't believe that forcing residents to subscribe to one service is appropriate."

GERBER PARK

In 2016, Givens developed a new community, Gerber Park, to provide independent living for low- and moderate-income seniors. The community, which includes HUD-subsidized, tax-credit and affordable middle-income apartments, is being built in three phases and includes such amenities as a café, a community room and a fitness room. "It's a home where residents can age in place at a standard of living that we believe everyone deserves," Foor says.

Like earlier Givens properties, Gerber Park was outfitted with a passive optical network that

could support business functions, health monitoring technology and resident internet access. However, in the new community, Givens went a step further: With help from systems integrator Qypsys, it installed a fiber-to-the-unit network that could deliver its own services *and* the services of the local cable company. Residents can choose whichever service bundle they prefer (most choose Givens services), knowing that the services will be delivered over the same robust, reliable infrastructure.

Building a consolidated infrastructure costs about the same as building parallel infrastructures, Foor says, but in the long run, the maintenance costs are lower for a single network, making the total cost of ownership lower. Maintenance isn't the only issue, Foor points out – troubleshooting is easier, too: "There's only one wire to worry about."

VITAL STATISTICS

Property Description: Givens Gerber Park is a vibrant, affordable community located in the South Asheville neighborhood of Asheville. It offers one- and two-bedroom rental apartments to seniors 55 and older. Amenities include a café, a fitness center, elevators, a library/computer room, raised garden beds, a medical clinic, tenant storage areas and access to nearby grocery stores, pharmacies and shopping. Residents enjoy activities and services designed to help them remain healthy, engaged and active. Rent is determined by household income.

Demographics: 55-plus independent living, with a broader income range than is typically found in traditional affordable housing.

Greenfield or retrofit? Greenfield

Number of units: 262

Style: Mid-rise

Date services started: November 2016

Special requirements: Ability to deliver services from two providers over the same network

SERVICES

Services offered on the network: Givens offers residents high-speed internet access with a top speed of 100 Mbps, along with video and digital voice services. The video service is injected into the PON from the cable provider that also serves the community.

Provider choice: Residents may purchase voice, video and internet services from Givens or the incumbent cable company. All services are delivered over the same fiber network.

Point of contact for resident technical support: Givens operates a technology help desk.

BUSINESS

Who owns the network? Givens owns all parts of the network.

What marketing approaches are used? When residents' applications are accepted, Givens asks them to state their communications package options and encourages them to call the technology department or the property manager with questions or concerns before they move in, regardless of the choices they make.

PROPERTY OF THE MONTH HIGHLIGHTS
~ Givens Gerber Park, Asheville, North Carolina ~

- Affordable housing for senior independent living
- Triple-play services are available from two providers – the property owner and the incumbent cable company.
- The two providers share the same fiber infrastructure.
- Vendors include iPhotonix, Dasan Zhone Solutions, Cisco and 3CX.

The communications panel in a resident apartment.

What is the take rate? For Givens services, the take rates average 83 percent for voice, 65 percent for internet and 95 percent for video.

Network benefits:

Ricky Foor: I do not believe that our decision to provide FTTH would have made a difference to residents' decisions to join or stay in the community. However, we believe this decision will improve the quality of communications in their homes and, hopefully, their daily lives overall. This network allows Givens to provide a higher level of service to the residents who choose our system for their cable, internet, and phone.

TECHNOLOGY

Resident Network

Broadband architecture: Fiber to the unit. Givens services are delivered via GPON to an ONT placed in the communications panel in each unit. Cable company services are delivered via RFoG to an ONU in the same communications panel. The fiber in the patch panel is connected to either the GPON ONT or the RFoG ONU depending on which service a resident selects.

Method for running cables between buildings: In-ground conduits installed during construction

Internet connections: The headend for the internet connection for Givens broadband service is at Givens Estates, about a mile from Gerber Park. The OLT at Gerber Park connects to the headend over Givens' MPLS fiber backbone network. For cable broadband service, the connection to the cable network is at a node at Gerber Park.

Business Network

The Givens business network uses the same fiber backbone the resident network uses, but rather than making use of the OLT at Gerber Park, it terminates at a Cisco switch and connects to an office LAN. Givens employees can access the Givens business network wirelessly through wireless access points built into the ONTs in residents' apartments. (The business Wi-Fi network is invisible to residents and separate from the residents' Wi-Fi network even though the same ONTs serve as wireless access points.)

Vendors and Strategic Partners

Qypsys and iPhotonix are responsible for the PON network design, installation and maintenance. Modern Edge Technologies is the fiber and low-voltage cabling partner. Advanced Data & Networks Solutions is the integrator for the multicampus data network. Equipment vendors include Dasan Zhone Solutions (OLT), iPhotonix (ONTs) and Cisco (switch for the business data network). 3CX software is used at the headend as a virtual PBX for the digital voice service for both business and resident networks.

LESSONS LEARNED

Answers by Ricky Foor, Givens

What was the biggest challenge? Fitting an FTTH design into the plans for

Employees from all the Givens Communities campuses tour Gerber Park to view the construction progress.

a building that was not originally designed to support fiber to the home. Standard low-voltage designs include separate lines of service for cable, internet and phone to each home, and the different utilities take care of home runs to the apartments from the utilities' main point of entry. Taking that design out and squeezing in the FTTH design was the largest challenge for us because the contractor, architect and trades were unfamiliar with FTTH. To overcome this challenge for the first phase of the building, we tried to educate trade leaders in weekly meetings.

What was the biggest success?

Implementing converged private and carrier services on a shared infrastructure, which allows us to facilitate preferences for either type of service – and then competing effectively with the carrier. To convince people to leave a marketing giant, our job is to live up to the standards we present. We don't charge any fees, and we don't offer any special promotions. At the end of the day, we offer a great benefit to residents, generate income for the technology infrastructure and still offer lower prices than the carrier, outside of promotions. Our speeds are faster, and our customer service is better. We have a dedicated circuit to the edge of the property, so we have a stronger, more stable solution.

We outfitted every wall outlet with internet, phone and cable jacks. Residents don't have to rent equipment – they can just turn up service and get internet and phone to all outlets, and we manage the Wi-Fi network. Residents can have a wired printer in the bedroom and print from another room. They can plug a phone into any jack. The services are built into the home.

What should other owners consider before they get started on a similar deployment?

- Being heavily involved in the electrical planning process when the drawings are made will reduce cost and frustration.
- Always run fiber through conduit.
- Using a fiber patch panel in the communications panels will save headaches and money in the long run. The fiber ends do break, and this makes repair as easy as a patch fiber rather than a resplice.
- Ensure that all outlets in the apartment have cable, phone and internet jacks. ❖

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

LS Networks Launches Connected Communities Project

A middle-mile network provider in Oregon has a new mission: creating 25 rural gigabit communities.

By Masha Zager / *Broadband Communities*

More than a decade ago, five Oregon electric cooperatives and the economic development arm of the Coquille Indian Tribe joined forces to build a middle-mile fiber network. The original goal of the consortium, LS Networks, was not to deliver broadband services directly but to make it economical for others to do so. The company, whose shareholders are all nonprofit entities, views its mission as providing services before profit and using telecommunications "as a tool to bridge the communities that make the Pacific Northwest great," in the words of Bryan Adams, the director of sales and marketing.

The network serves carriers that include long-distance and local telephone companies, wireless providers and independent cable operators as well as the communications divisions of some member companies.

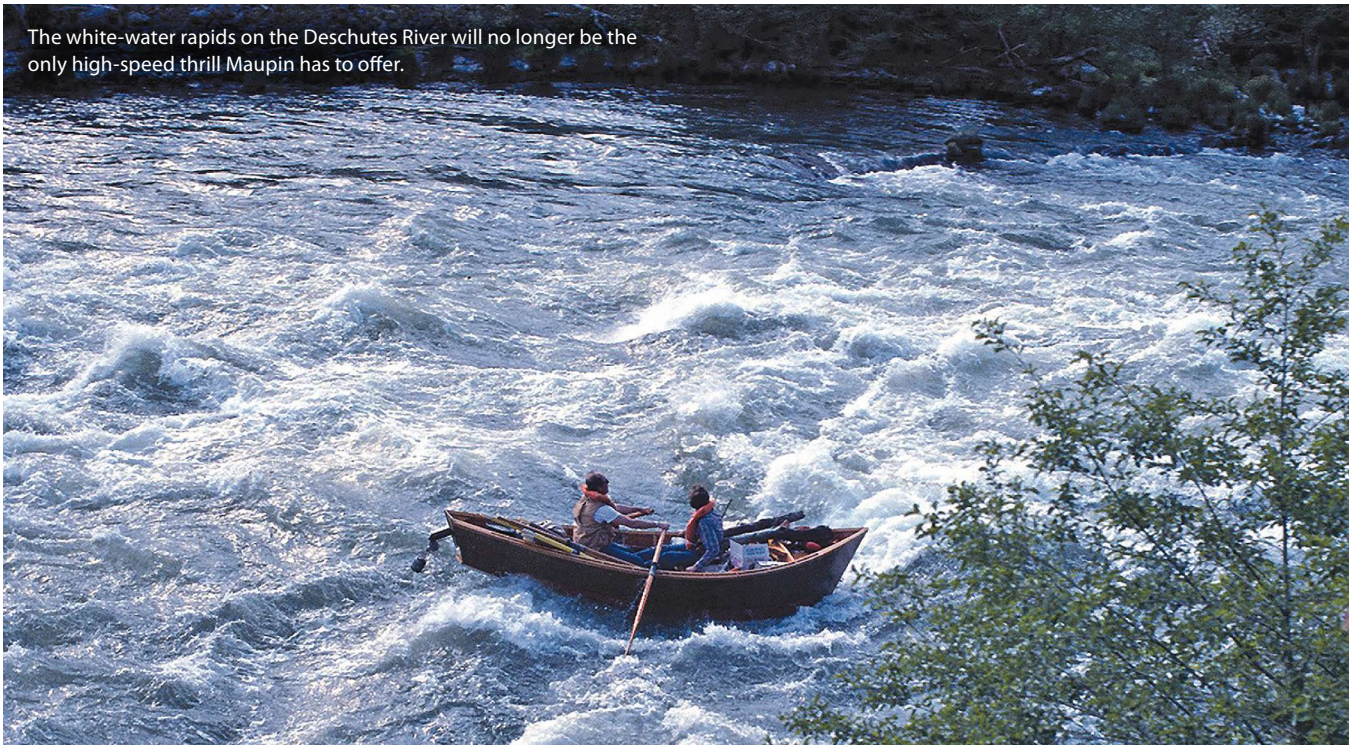
As time went on, the middle-mile network expanded throughout Oregon, rural Washington, Northern California and Idaho (it now has more than 7,500 route miles of fiber). True to the company's mission, the network spurred economic development throughout the area. Though still primarily a wholesaler, LS Networks began to directly serve state and local government agencies, schools, hospitals and some businesses.

In 2012, it started building fiber to cell towers and now reaches more than 500 of them. Because cell towers tend to be located near clusters of residences and small businesses, this opened up yet another opportunity. Adams explains, "The network is now built out to the point where we can, with fairly minimal costs, start building larger local distribution networks in the communities we serve – not just for business customers but for residential customers in underserved communities."

So in October 2016, the company announced an ambitious new goal: deploying gigabit FTTH networks throughout 25 rural communities in Oregon and Washington over a five-year period. Through this "Connected Communities" project, LS Networks will offer 100 Mbps for $40 and and 1 Gbps internet speeds for $70, providing advanced services in communities that desperately need them. The networks will all be open to additional providers.

CONNECTING MAUPIN

By the time the 25-city initiative was announced, the first city build – in Maupin, a city of about 400 in north-central Oregon – was already in progress. The Maupin project came about fortuitously. Mayor Lynn Ewing explains that the city, which was trying to obtain a high-speed network, secured a $410,000 grant from Business Oregon, a state agency, through a partnership with the QualityLife Intergovernmental Agency (QLife). It planned to use the funding, along with a smaller private grant, to build a fiber line from a Bonneville



The white-water rapids on the Deschutes River will no longer be the only high-speed thrill Maupin has to offer.

Power Administration facility several miles out of town and loop it around Maupin's business area.

Maupin's partner, QLife, is a collaboration among public entities in The Dalles, about 40 miles from Maupin, that created a fiber optic loop through that city in the early 2000s. Its goal is to enhance the region's economic development efforts with links to the Bonneville Power Administration's fiber.

When LS Networks, which was getting ready to build fiber to a cell tower in Maupin, learned about the city's plan, it suggested that, rather than duplicate the fiber trunk, the city should connect to LS Networks' fiber and use its grants to build an access network inside the city. The city repurposed the grant money to connect every home and business in Maupin and contracted with QLife to build and manage the access network.

LS Networks invested $690,000 to build the fiber trunk and establish a point of presence in town. Within the POP, it provided half the rack space free of charge to the city so additional service providers can colocate there. "We want to make sure open acccess is real," says Adams.

As of press time, LS Networks was on the verge of connecting Maupin's school and severall cell providers, and it will begin turning up resident and business services in spring 2017. A second provider, which now operates in the area as a wireless ISP (WISP), will also offer services over city fiber and, with fiber backhaul, will improve its wireless offering outside the city. Says Ewing, "Hopefully, the fees paid by the two providers will cover repair costs for the network going down the road."

THE FUTURE OF MAUPIN

Ewing expects the new network to benefit Maupin greatly. "We're essentially dependent on tourism for our economy," he says. "A lot of homes are owned by people who don't live here, several by people in high-tech industries. But because of the lack of internet, they don't live here full time. Some of those have said they plan to be here more, or even full time, and telecommute – that will be huge."

Businesses that depend on the internet to book fly fishing and rafting trips struggle with dropped calls and unreliable connections, so the fiber network will make an enormous difference to them. "A couple of times last summer, the DSL lines went down on weekends, and businesses couldn't take credit cards," Ewing says. "They lost thousands of dollars." The city also hopes to attract other types of businesses – for example, manufacturers of recreation-related equipment – that would not previously have considered Maupin as a location.

The city and the schools have already signed on as customers, says Ewing, a retired schoolteacher. "Today the schools have to limit other network uses when they do state testing, which is all online. Now there should be enough bandwidth for everyone. This will make it more feasible for students to take online classes from community colleges or universities."

The local health clinic, which is operated by a nurse practitioner and a doctor who visits once a week, plans to set up a gigabit connection to a large hospital. "They won't have to send people on a 90-mile trip to see a doctor," the mayor says.

THE NEXT 24 COMMUNITIES

Though LS Networks has not yet announced the other 24 connected communities, it is in discussions with nine of them and hopes to select all 24

within two years. The company doesn't expect to follow the Maupin template everywhere but rather to adapt to local needs and conditions.

"Each community is kind of a custom deployment based on its interest and participation levels," Adams explains. "We're trying to sit down with the communities – city council members, mayors, community members who want better broadband – and figure out what's best for them."

In one city, LS Networks is working with a local cable TV cooperative that just received state funding for an FTTH project. "Rather than competing with the cooperative, we're trying to assist it," Adams says. "We'll provide it with middle-mile access to peering exchanges and support its initiative." In another city, LS Networks plans to serve businesses and schools with fiber and work with WISPs that will provide residential services. He notes, "Because of our success with the cell tower business, we can provide affordable transport service that allows the WISPs to have a successful business model."

In another city that doesn't yet have much demand for FTTH, LS Networks plans to start by improving the wireless infrastructure to boost the quality, reliability and capacity of service and then look for individual neighborhoods where building fiber might make economic sense. "We have a survey that municipalities can send out to residents," Adams says. "It asks whether they're happy with their service provider, whether they're interested in fiber to the home, and what their level of interest is. If there's strong enough interest, we'll do engineering and cost estimates and see if [the city] can help fund it."

In its market studies, LS Networks focuses on communities with populations of less than 15,000 because they are more likely than larger communities to be underserved. Its 25-city buildout may cover as many as 200,000 residents altogether. That doesn't mean it isn't talking to larger communities, too – such as Eugene, Oregon, whose municipal fiber network is ready to expand beyond the pilot-project stage – but in those cases, it is more likely to provide transport and help enable open access.

"It's refreshing to work at LS Networks," Adams adds. "It's a different business model that allows us more flexibility. The focus is on quality of services and not on how much money we can siphon out." ❖

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

THE SOLUTION PUZZLE

The term "solution" has become a popular buzz word throughout the telecom industry. FTTx network architects are frequently approached by manufacturers, touting their latest and greatest, but what does "solution" really mean? To some, it's an answer to the single deployment hurdle in front of them. To others, it answers a series of demanding questions or issues which could comprise an entire system or infrastructure. In many cases, it may be a combination of both.

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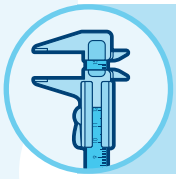

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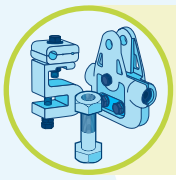

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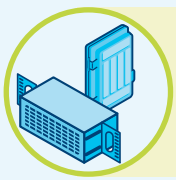

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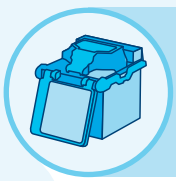

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Partnership for Rural Broadband

Together, electric co-ops and small rural telcos have what it takes to bring advanced broadband to underserved rural areas.

By Hilda Legg / *Broadband Communities*

No "one-size-fits-all" approach will address the needs of rural consumers and businesses yearning for better, more affordable connections. But, as someone who has spent a career focusing on rural infrastructure needs and community development, I want to shine a spotlight on one promising approach that could yield real benefits in terms of connectivity and contribute to the vitality of the rural United States. In rural areas where larger carriers have shown little incentive or ability to deploy robust broadband networks, one of the best solutions available is in partnerships between electric cooperatives and small rural telecom providers – two groups that share a commitment to the rural United States, have complementary strengths and are well positioned to make rural broadband a success.

There are many rural parts of the United States where robust broadband is already available – and these are often served by small, hometown telecom providers. In fact, almost 49 percent of their customers already have access to fiber-to-the-home networks, and nearly three-quarters have access to speeds the Federal Communications Commission considers "table stakes" for broadband.

But the broadband landscape in other rural areas is bleaker. Particularly where larger telecom carriers have not had an incentive to invest, rural broadband access lags far behind what's available in either urban markets or the rural areas that smaller telcos serve.

I look at this problem, and I see opportunities for rural consumers and businesses, for electric cooperatives, for the smaller telcos and for anyone willing to be creative and collaborative in overcoming challenges.

CHALLENGES FOR ELECTRIC COOPERATIVES

Electric cooperatives serve many rural areas that have inadequate broadband access. They have deep experience deploying infrastructure in rural areas, and some are already deploying and managing telecom networks. Many of their members would like to see them take an active role in providing broadband. However, entry into the retail broadband business is hardly easy.

Even where robust broadband doesn't exist, there's often a large incumbent with lots of resources and decades of experience – the kind that, faced with competition, might find a way to

Several rural electric co-ops have already entered into successful broadband partnerships with rural telephone companies.

quickly mobilize and compete. Gaining market share against an incumbent is a challenge for any new entrant in the telecom business, even one that has had a presence in a community for decades. Moreover, although every household uses electricity, not everyone adopts broadband, so in many cases co-ops must educate consumers about why they need broadband in the first place and then win customers over from the competition.

Then there are operating challenges and regulatory issues. Broadband technologies change fast, and regular training is a fact of life in the telecom business. Broadband providers face regulations that address everything from the actual deployment of their network facilities to the manner in which they manage their provision of service to customers. In addition, providers must deal with federal and state regulatory authorities.

Finally, in rural areas in particular, providers face the challenge of transporting increasing amounts of data to and from remote rural locations. Users who stream Netflix or conduct business rely on secure, unfailing connections to carry massive amounts of data from their homes and businesses to servers that may be hundreds or even thousands of miles away. Transporting this data demands specific expertise and includes significant costs even beyond the local network.

THE PROMISE OF PARTNERSHIPS

That's why some electric co-ops have turned to rural telcos for their expertise in providing broadband services. For example, Arrowhead Electric Cooperative in Lutsen, Minnesota, built a fiber-to-the-home network and then contracted with Consolidated Telephone Cooperative to deliver services and provide technical support. And the Johnson County Rural Electric Membership Corporation in Franklin, Indiana, built its FTTH network as a joint venture with NineStar Connect (which is both a telephone co-op and an electric co-op) based on the fiber backbone that Johnson County REMC built to connect its substations.

Indeed, partnerships between small rural telcos and electric cooperatives are uniquely positioned to succeed where others have failed in reaching wide swaths of the rural United States. Electric co-ops are well-known, established and focused on delivering services to rural consumers in many communities that lack broadband.

Small telcos share the same rural roots along with track records of technological innovation and success in rural broadband. Tackling something as complex and challenging as rural broadband calls for an organization that has a proven track record rather than a startup or a company with experience only in settled markets.

Of course, a partnership won't work in every case, and each possible partnership could look different based upon the needs and capabilities of the parties involved – but knowing the electric cooperatives and the rural telcos as well as I do from years of working with both, I see their respective strengths and the significant promise in such opportunities. If these two groups working together and sharing a rural commitment can't get it done, I don't know who can or will! ❖

Hilda Legg, a former administrator of the Rural Utilities Service, is a consultant and an advocate for rural broadband and economic development. She is the vice chairman of ***Broadband Communities****. Reach her at hilda@hildalegg.com.*

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MOBILIZING YOUR WORLD℠

Building Support For Community Broadband

Following are highlights from the 2016 **Broadband Communities** conference on broadband and economic development, held in Minneapolis in October. These excerpts are from sessions about gaining support from state legislators and the impacts of local fiber networks.

A BBC Staff Report

Working With State Legislators

In many states, legislatures have been notoriously unsympathetic to rural communities that suffer from poor broadband. "Most legislators don't know anything about technology," said Tom Sloan, a Kansas state representative who knows (and cares) a great deal about technology, adding that broadband activists and local officials can compete with industry lobbyists for their state legislators' attention.

Sloan said, "Data matters to most legislators. Tell me what you need and why your system is inadequate. Compare your speeds with what the same provider offers in other communities. Survey existing businesses and show the negative impact on them – a cabinetmaker who can't offer products online or a farmer who can't buy and sell commodities and livestock in the national marketplace. Ask the local chamber of commerce to document businesses that left town or didn't move there – even small entities."

Tom Sloan, State Representative, District 45 State of Kansas

Health care providers may also provide valuable examples of the costs of inadequate broadband, Sloan said. Medicare financially punishes hospitals for high readmission rates, but the best way of reducing readmissions is to monitor patients via broadband after release. Such monitoring improves patient health care and saves hospitals and health care providers money. Those savings result in lower insurance premiums or taxes for everyone.

Rural residents should be included in the data compilation. If rural residents leave, they

cannot patronize the community's retail businesses, their children will not attend the schools and the tax value of their property will decline.

Sloan concluded, "Convince me that you are suffering because the incumbent is not providing adequate services. Document the requests you've made. Establish the economic costs of poor broadband. Invite key legislators to your municipality, focus on this subject and present information to them. Be really creative in your thinking. Suggest imposing an 'economic justice tax' – a fee on the provider to offset the penalties your community is suffering – and make sure it can't be passed on to the customers. Lobby for statewide broadband franchising because negotiating with individual communities is frustrating for providers."

Sloan advised talking to legislators when they aren't actually in session – it's easier to get their attention when they aren't overwhelmed with work. In addition, it's a good idea to find out what the broadband and economic situation is in a legislator's district. Those from well-served, thriving districts may respond to different arguments than those from struggling districts.

ELECT THE RIGHT PEOPLE

Josh Byrnes, an Iowa state legislator and general manager of Osage Municipal Utilities, said the first step in dealing with legislators is to elect the right legislators. He advised asking all candidates their views about municipal broadband.

Josh Byrnes, Representative, State of Iowa; General Manager, Osage Municipal Utility (IA)

The next step, Byrnes said, is to form a coalition. After all, broadband affects a wide range of people and organizations. Farmers' organizations, realtors, economic development officials, bankers, educators, unions, and transportation advocates all need better broadband: "It's an odd group, but that's what it takes."

> "Convince me that you are suffering because the incumbent is not providing adequate services. Document the requests you've made. Establish the economic costs of poor broadband."

Though it seems counterintuitive, Byrnes advised, "Avoid the legislators that already support broadband. Why waste your time with them?" Educating those who don't understand the issue is a better use of time, he said. And keep the message simple because "a lot of legislators are not very intelligent." Brochures tend to land in the wastebasket, but if the message can be boiled down to fit onto a business card, the legislator is likely to put the card in his or her pocket and keep it. Data about impact on the economy or jobs is most likely to catch legislators' attention.

Byrne also advised, "Make it personal. Connect it to them. Show the legislators the haves and have-nots. And sell the idea that broadband is infrastructure. We have done a really poor job of taking care of infrastructure of all kinds, so connect the broadband issue to the infrastructure piece."

Above all, Byrne said, don't give up. Convincing legislators can take years of patient work.

FIND THE HOOK

"There has to be a hook – a reason for legislators to care," said Matt Schmit, a Minnesota state senator. "It could be the impact to their constituents, the return on investment, the great economic efficiencies, the environmental benefits, the number of jobs created or the nonstate dollars leveraged." Keep the message simple; just show them how broadband makes life better.

Matt Schmit, Senator, State of Minnesota

One problem, Schmit said, is that legislators often think "the private sector is taking care of it," and they need to be shown that, in some communities, that isn't true. Broadband advocates must be organized and persistent and must talk to legislators who can be persuaded. "Be prepared for a window to open," Schmit said, "and pounce on the opportunity."

Sometimes an opportunity may involve tweaking or modifying legislation originally proposed by incumbent providers. "Good versus evil may not be a useful approach," Schmit pointed out. "Try to suggest approaches that work well for everyone."

Ellen Satterwhite, director of the public affairs firm Glen Echo Group, said, "The first question I ask a legislator is, 'Are the networks you have today OK for the next 10 years?' Everything that will happen in the state for the next 10 years depends on the network." She emphasized that broadband is not an individual choice but a community choice.

Ellen Satterwhite, Director, GlenEcho Group

Satterwhite advised, "Use the power of the internet. Fifty emails may not equal 50 lobbyists, but maybe 5,000 emails do."

Successful Local Fiber Networks

What counts as success in a local fiber network? Communities that build local fiber networks have many different goals – though most involve some form of economic development – and many ways of evaluating their projects' success. Five presenters at the Minneapolis conference, all from the Upper Midwest region, illustrated the variety of ways fiber networks contribute to their communities.

Madison, Wisconsin, is moving forward with a "digital divide project," said Paul Kronberger, the city's chief information officer. The pilot project will wire four underserved neighborhoods with fiber and provide basic internet service there for $10 per month. Because addressing the digital divide takes more than internet availability, the city also contracted with a nonprofit agency to deliver computer literacy training and partnered with corporations to refurbish cast-off computers at no charge.

Paul Kronberger, Chief Information Officer, City of Madison Information Technology

The city has encountered challenges in some areas – for example, landlords who will not or cannot grant the right of entry to their buildings – but is moving ahead quickly in other areas. It expects the pilot project to achieve about 50 percent penetration and to yield valuable insights. "We'll accumulate the lessons learned," Kronberger said. The mayor wants to make fiber broadband available throughout Madison, but Wisconsin law requires a municipality to present a cost-benefit analysis before it builds a broadband network. The results of the digital divide project should help inform the cost-benefit analysis and enable fiber to be built out citywide.

Ultimately, the project's success will depend on its addressing the educational gap – today, schoolchildren without home internet service sit outside schools in the evening to do their homework – and on its ability to retain high-tech employers and facilitate the formation of startup companies.

When the city of **Stratford, Ontario**, bought six local electric utilities, it was required to divest those utilities' fiber assets. Rhyzome Networks, the company formed to administer those assets, originally served only the electric utilities, but soon local manufacturers began leasing spare fiber to connect their facilities, providing a new revenue stream for the network.

Ysni Semsedini, CEO, Festival Hydro and Rhyzome Networks

"Then the province required smart meters," explained Ysni Semsedini, Rhyzome's CEO. "Other utilities built proprietary networks for that – which would have been a waste of money for Stratford. We thought, 'Why don't we step up the Rhyzome network, create an ISP and backhaul the meter data over Wi-Fi – then we'll have ubiquitous Wi-Fi across the whole community!' So we did this in 2010. Today, we offer Wi-Fi to residents and lit fiber for businesses."

The residential Wi-Fi offering of symmetrical 10 Mbps for $30 (no contract required) is popular, and Rhyzome is exploring the possibility of building out fiber to the home, though Semsedini thinks this may not be economically feasible in Stratford's competitive broadband market. Rhyzome offers unique value to the community by acting as a test bed for new products that leverage communitywide connectivity – for example, smart LED streetlights and set-top boxes that act as virtual data centers. "Our latest effort is to become a center for testing autonomous cars," Semsedini added.

Rhyzome Networks' goals are to become a sustainable business that returns cash to the municipality, to enable manufacturing facilities to locate in Stratford and to promote the city through efforts such as the autonomous car initiative. In addition, the network contributes to the community by offering free Wi-Fi in the downtown area and by enabling public-safety communications.

Semsedini noted, "The financials have to work. I don't see slower rollout as a failure – fiber is a long-term rollout. But if I have to take money from the city, that's too slow."

OVERCOMING HURDLES

Michigan has an onerous process for municipalities to build and operate broadband networks, and the only community in the state to succeed in building a residential fiber network is **Sebewaing**, a small village on the coast of Lake Huron. Melanie McCoy, superintendent of Sebewaing Light and Water, explained that the fiber network was originally built to control the municipal electrical grid and later extended to serve businesses. Eventually, "customers were clamoring for broadband because they couldn't get more than poor speeds, and the village council said, 'Let's go for it.'" Other Michigan cities now send delegations to learn how Sebewaing navigated the legal process.

Melanie L. McCoy, P.E., Superintendent, Sebewaing Light and Water

The utility's electric department lent money to its internet department to build out the network, and, with a 50 percent penetration rate (even though most customers subscribe to the entry-level 30 Mbps/30 Mbps tier), the internet department expects to repay the loan in six or seven years.

Sebewaing's criteria for success

include not only positive cash flow but also savings for consumers, economic development (young people are already returning to town, but the impact on businesses is not yet noticeable) and customer satisfaction with the service. McCoy gets a special pleasure from seeing senior citizens make the transition from "Oh, I don't need *that*" to seeing internet access as a must-have when their children visit for the holidays.

Madonna Peltier Yawakie, President, Turtle Island Communications, Inc. (TICOM)

Tribal communities in the Upper Midwest have the most difficulty of any communities in obtaining adequate broadband, said Madonna Peltier Yawakie, president of the Turtle Island Communications consulting firm. A Native American who grew up on the Turtle Mountain reservation, where a telephone call to a family member 14 miles away cost $300, Yawakie went on to work for a large telephone company. Eventually, she realized that price-cap carriers would never invest in infrastructure on the reservations, and that the lack of infrastructure was crippling tribal development. Today, she works to help tribes create broadband plans, form companies that qualify for eligible telecommunications carrier status, obtain universal service funds under rate-of-return regulation and improve their infrastructures by upgrading to fiber.

Yawakie said, "America is upgrading from copper to fiber. Tribes will miss the boat if they don't authorize a provider or do it themselves. The tribes that tried to address their issues with wireless internet service providers have failed – it's only a short-term solution, and there is not enough licensed spectrum. For fiber to the home, we look for a 65 percent penetration rate, and they're getting 85 to 94 percent rates."

For Yawakie, a successful tribal project has more than a high take rate – it also achieves positive cash flow as soon as possible and, most important, puts people to work on the reservations. The economic development boost starts with the construction of the network: "All contractors should hire qualified American Indians. There's a high rate of veterans that work for the businesses we start. They learned communications skills in the military, and we're creating job opportunities for them."

RESPONDING TO BUSINESS NEEDS

Eagan, Minnesota, a suburb of the Twin Cities, began developing a technology plan more than a decade ago. When local business leaders identified a need for more speed, Eagan decided to build a fiber network, Access Eagan, to serve businesses. As a conservative city, it didn't want to be in the broadband business, so the network is open access, with six providers offering services.

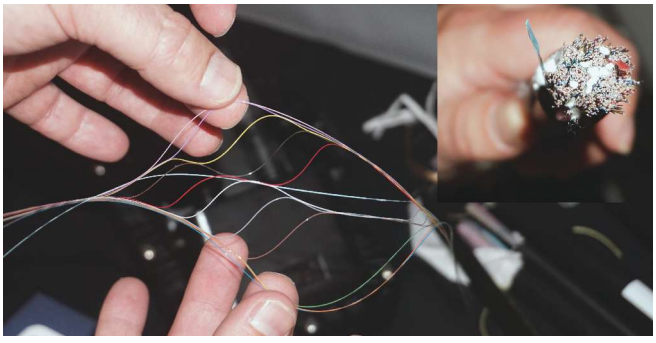
Minnesota's overreliance on a single major carrier hotel was another problem that affected local businesses, and in 2015, Eagan succeeded in attracting a new carrier hotel and data center, in part because of its fiber optic network. The new facility is already 45 percent leased and expands the number of potential service providers to 13. "Now there are multiple carriers with diverse routes and no single point of failure," said Tom Garrison, the city's communications director.

Tom Garrison, Communications Director, City of Eagan, MN

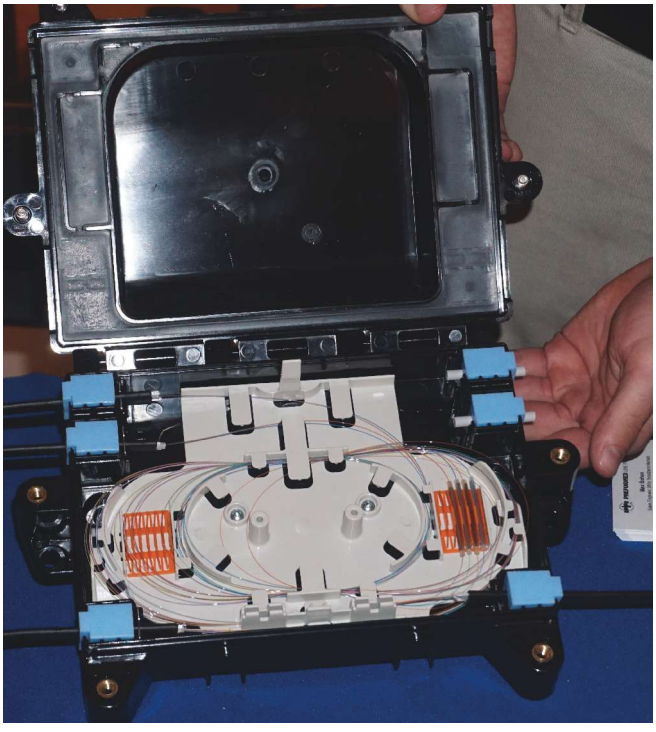
Access Eagan has become known for its responsiveness to business needs. Businesses tend to want "connected buildings, not fiber in the street," according to Garrison, so although the original intention was to build a fiber backbone, the network requested permission from the city council to actually connect buildings. Recently, it extended fiber to a premium outlet mall and to a data center that required a redundant fiber route. Now, a professional sports team is moving its headquarters to Eagan to be sure of having redundant fiber routes. ❖

From the Expo Floor

Exhibitors at the Minneapolis conference showed many new products for networks that support economic development. Here are a few highlights.



AFL's new 1,726-fiber cable is remarkably thin but quite a handful to work with. One innovation to make life easier for technicians: The fiber bundles can be parsed in the field like spiderwebs.



Preformed Line Products high-density boxes have technician-friendly weather sealing and layouts that allow big hands to work comfortably.

Dura-Line offers an almost endless variety of fiber ducting products. This new one is intuitive and rugged.

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Broadband Forecasts for 2017

What's ahead for the broadband industry in 2017? Growth – and preparation for more growth.

By Masha Zager / *Broadband Communities*

Rapid growth and change have marked the broadband industry for several years, and 2017 will be no exception. New technology, rising demand and heightened service expectations continue to drive development. Here are the details, according to industry leaders and analysts.

FTTH DEPLOYMENT: GROWTH WITH OR WITHOUT GOOGLE FIBER

Fiber-to-the-home deployment, which slowed between 2008 and 2011, has risen continually since that year. "We'll continue to see growth again this year, from all indications," says Michael Render, president of the market research firm RVA LLC. "And it's not just from big providers. Obviously, AT&T is doing a lot, but there's a lot more mass from smaller providers, mostly Tier 2s and Tier 3s." Even though Google Fiber hit the pause button on fiber deployment and thus discouraged some potential new entrants to the FTTH market, Render says, "I don't see that slowing the growth rate."

Not all new entrants have been discouraged, Render adds. Telcos, new competitive providers, municipalities – a wide range of companies are getting ready to deploy fiber to the home. Like earlier deployers, most of these organizations already have some experience in communications (for example, as wireless providers).

In rural areas, smart electric grids, which require bandwidth and reliability, are being built out with fiber, and this will drive additional fiber-to-the-home deployments by electric co-ops, among others. Despite the fact that low population density in rural areas makes deployment costs high, Render says, "I don't think everyone has fully figured out that take rates are very high in rural areas." Increasing awareness of rural demand for bandwidth will illuminate real opportunities for rural FTTH deployers, he says.

Many rural areas are about to lose whatever fixed broadband they have, predicts Doug Dawson, president of CCG Consulting. He believes that, in 2017, "Verizon and AT&T are going to leap on the opportunity of a weakened FCC and will be tearing down rural copper as fast as they can. … Both companies will offer much more expensive wireless options to replace the copper." That will only open more opportunities in rural areas for those who can build fiber networks to meet the growing bandwidth demand.

Michael Render: Opportunities for FTTH in rural areas remain unexploited because "I don't think everyone has fully figured out that take rates there are very high."

LIMITS TO GROWTH

Still, not every company that wants to deploy fiber broadband will be able to do so. Render points out that resource constraints may put the brakes on deployment. Fiber optic cable, directional drills, engineering and construction

expertise, and many other resources are limited in the short term, and their supply may not grow quickly enough to meet rising demand. In the long run, however, supply can expand, and new technology can compensate for scarce resources. For example, Render says, engineering is becoming more automated, and the use of drones and LIDAR could reduce the need for construction labor.

Another limiting factor for 2017 is the difficulty of financing fiber builds, especially for deployers that don't have much of a track record. Dawson sees private investment in FTTH already beginning to dry up because of Google's pause, confusion about alternative technologies that may or may not materialize, and general economic uncertainty. "It's going to be hard to borrow money for fiber unless you are a telco or a solvent municipality," he comments.

CABLE STILL HAS LEGS

The resurgence of FTTH five years ago inspired cable companies to get into the "game of gigs" by upgrading their residential network infrastructures and transitioning to new DOCSIS standards that support more bandwidth. Mark Alrutz, senior director of service provider solutions at CommScope, says, "Hybrid fiber-coax (HFC) still has the capability and legs to provide very competitive services while networks are being infused with fiber, even all the way to FTTH." In addition to boosting wired broadband speeds, he adds, cable companies are trying to improve customer experiences and taking responsibility for making Wi-Fi operate smoothly in homes and public spaces.

In 2017, Alrutz says, cable companies will continue to focus on improving their residential service. In some cases, this will involve building fiber all the way to homes. (Interestingly, FTTH can be less expensive than HFC in rural areas, so we may see more instances of rural cable companies building fiber.) For the most part, however, despite the buzz around FTTH, cable companies will continue to leverage their HFC networks and transition to DOCSIS 3.1.

FTTH AND WIRELESS INTEGRATION

Venturing a long-term prediction in addition to his 2017 forecast, Render says that, short of a physics breakthrough (neutrino power, anyone?), "I don't see anything for the next 50 years to overtake fiber." The ongoing wireless revolution will just make fiber more necessary than ever, he says. In fact, returning to 2017, he expects to see the deployment of FTTH and advanced wireless networks become closely integrated: "To make advanced wireless work, you have to run fiber down every street and put an antenna on every third light pole, so it makes sense to do it in conjunction with FTTH. … The very best way would be to build them at the same time to make the most efficient use of all resources; second best would be to design as much as possible for both kinds of networks."

Kurt Raaflaub, head of strategic solutions marketing at ADTRAN, elaborates on the technical details behind wired and wireless integration: "NG-PON2 [the most advanced fiber

access standard, which can deliver up to 80 Gbps per fiber] is the first technology that has the robustness, redundancy and scalability to provide backhaul for service level agreement–based services for businesses *and* the cost structure for mass-market residential services. … Now, if I've got a piece of fiber going to someone's home, that same fiber can connect to a lamppost small cell site with no other changes required." By deploying NG-PON2, operators can converge as many as 20 different wired and wireless network platforms that provide different services today, Raaflaub says. NG-PON2 is being field-tested now, and Raaflaub expects some providers to deploy it to customers before the end of 2017.

The transition from GPON to NG-PON2, Raaflaub adds, will be much smoother than the transition from BPON to GPON. New customer-premises equipment can be self-installed, and outside plant doesn't require any changes. All a service

WATCHWORDS FOR 2017: FLEXIBILITY AND CHOICE

By Cheri Beranek, Clearfield

My son, age 18, wears a size 13 wide shoe. He loves shoes. He owns a half dozen pairs of tennis shoes, multiple pairs of boat shoes, a different pair of boots for every job and different color dress shoes. He's willing to pay a little extra for comfort and a premium if they're stylin'.

My daughter, age 22, is a size 7 narrow. I think she has four pair of shoes to her name, including her winter boots. She hates to spend money on shoes.

Despite the fact they have the same genetic background (other than gender, of course), their physical requirements and personal preferences for footwear couldn't be more different.

The same can be said for the deployment of optical fiber. Every provider has unique physical requirements and numerous personal preferences. Though a sandal-like deployment might work for those that aim for a minimalist approach, others may want the protection of a steel-toed boot. Each service provider has its justification.

In fiber rollouts, I see wireline and wireless methodologies, active versus passive, mixed media and complete overhaul. Regardless of need and preference, enclosures and drop cable options must simplify fiber deployment, reduce initial capex and minimize long-term opex.

MANUFACTURERS DON'T DECIDE

In today's market, we manufacturers no longer have the option of mandating how a service provider is to deploy; rather, we must offer flexibility in our product designs to support all physical requirements and all personal preferences.

The fairy tale of the three bears suggests that, although some like it cold and some like it hot, others think perfection is porridge heated "just right." At Clearfield, we suggest the trend in the marketplace isn't perfection but rather choice.

For instance, some projects require the absolute lowest up-front material cost. The trade-off for such a design may be a lack of restoration or flexibility and, in most cases, a higher total cost of ownership (TCO) over the lifetime of the network. This doesn't mean it is the wrong choice – it simply is an option. As a supplier, we support options for designs driven by lowest first-cost installations.

Because of prevailing wage requirements or a lack of skilled labor, other projects seek to optimize total construction cost – establishing a combined cost for labor and material. In this situation, the network build will be optimized, but there may be compromises in TCO due to a less flexible restoration environment.

A third, holistic approach seeks to minimize long-term TCO. However, this solution may present a slightly higher up-front equipment cost, which can generate cash-flow challenges during the initial build. These up-front challenges can be minimized by deploying first in neighborhoods, subdivisions or communities likely to have high subscription rates. In addition, some modular architectures provide a method to scale capital equipment expenditures as subscriber take rates grow.

In all these scenarios, the common thread is the competitive advantage afforded by deploying optical fiber, whether the network design calls for taking fiber to the curb or cabinet, deeper into a hybrid environment, to cell sites for wireless backhaul, or all the way to homes or businesses. Consumers demand networks that are gigabit capable, and consumers will reward those service providers and communities that provide it.

The next time you go shopping for shoes, remember that your buying criteria will be based upon physical requirements as well as personal preferences. But going barefoot, or sustaining a competitive broadband network environment and community without fiber, is not an option.

Cheri Beranek is the CEO of Clearfield.

provider needs to do is switch out the aggregation units in the central office.

THE MDU BULL MARKET

"There's kind of a fervor to go after the multiple-dwelling-unit (MDU) market," Render says. "Some see it as low-hanging fruit because of its high density." Incumbents, integrators, private cable operators and other types of deployers will all deploy fiber in MDUs this year, according to Render.

Bryan Rader, president of Access Media 3, a multifamily broadband provider, expects the "MDU bull market" to continue in 2017. Millenials are graduating from college and moving into rental apartments, and market research indicates that members of this generation may live in apartments for years until the suburban dream takes hold. The increasing supply of MDU housing may depress rent levels, but opportunities for service providers are still good, Rader says.

> The increasing supply of MDU housing may eventually depress rent levels, but it offers plenty of opportunities for multifamily broadband providers.

Rader anticipates increased use of millimeter-wave wireless technology to serve MDUs, including those in Tier-2 and Tier-3 markets. With this architecture, a provider typically runs fiber to a hub – potentially one building in an apartment community – and transmits signals wirelessly to each of the other buildings. Inside a building, signals travel over existing wiring.

Rader forecasts that stand-alone bulk internet service will become more common in MDUs. "Owners have been pushing for it, and providers wouldn't agree for a long time," he explains. "But then independents started offering it" – because many new independent providers offer only internet service – "and now incumbents are forced to offer it as well. We're going to see that trend continue more aggressively in 2017."

Alrutz sees MDU buildings as prime candidates for cable companies to build fiber to the building or fiber to the floor – or even fiber to the unit in greenfield buildings. "The density is

Software-defined access will make adding new broadband services – both customer-facing and back-office applications – almost as easy as adding an app to a mobile phone.

very attractive," he says. Providers can even hedge their bets; CommScope offers an indoor cable that has both fiber and coaxial elements, allowing deployers a great deal of flexibility.

Addressing the nagging problem of in-building cellular service, Ian Langley, vice president and general manager of Cobham Wireless, predicts that the neutral hosting model will become key for in-building coverage. He explains, "Operators no longer have the revenue to invest heavily in in-building coverage solutions. This is in part due to their resources being drained on other ventures such as the advancement of 5G and the development of their public LTE networks. They cannot provision wireless communications into all the buildings that demand mobile connectivity. Subsequently, in 2017, venues have to install mobile coverage themselves … to provide the connectivity that is demanded of them.

"Operators will turn to a 'neutral hosted model' [in which] they can design and deploy a network for their needs and charge operators for delivering connectivity, generating new revenue. The model suits the operators too, as they do not need to shoulder the responsibility of funding and maintaining a network. The neutral host model has already proven popular in the U.S., and the trend is likely to take off in other parts of the world."

OVER-THE-TOP VIDEO – AND MORE

According to Rader, service providers will increasingly market over-the-top (OTT) products, as AT&T is doing with DIRECTV NOW, to apartment residents. "These products are geared toward high-churn, mobile customers, typically 20-somethings who live in apartments," he says. "They're great deals for customers who are not attracted to two-year terms. They go with you where you go." However, OTT subscriptions depress traditional pay-TV penetration rates, and this in turn affects property owners' ancillary revenues. Eventually – probably not in 2017, Rader says – property owners may try to restructure their deals with service providers and seek a share of OTT revenues.

Raaflaub agrees that multiple carriers will join AT&T in the OTT video space during the coming year. He points out that service providers see broadband revenues plateauing, voice revenues plummeting and video revenues eroded by OTT providers such as Hulu. "They recognize that the OTT guys are eating their lunch," he says. "Everyone's trying to be a content vendor." He speculates that earlier (largely unsuccessful) service provider forays into OTT video were trial runs and that their new efforts will be stronger and more successful.

However, Dawson, noting the many new OTT services offered or planned by service providers, broadcasters and independents, sounds a cautionary note: "This is going to turn into a crazy year for online programming, and it's impossible to believe this many entrants can succeed."

OTT video won't be the only new service that carriers introduce this year, Raaflaub says, adding, "They'll look to monetize the connected-home opportunity with gaming, virtual reality and entertainment." This proliferation of new services, he explains, will be enabled by agile, next-generation networks whose central offices are built on data-center principles and whose customer-premises equipment is controlled by cloud-based software.

This new type of architecture – known as software-defined access network – is beginning to be deployed now and will make adding new broadband services almost as easy as adding apps to a mobile phone. "It needs to take two weeks, not two years, to put up a new service," Raaflaub says. He expects these open, programmable, scalable access networks to enable easy addition of back-office applications (network analytics, performance management and so forth) in addition to consumer applications.

FIBER TO THE BUSINESS

Competition is heating up in the provision of business services, says Alrutz. He explains that historically, telephone carriers have somewhat underserved business markets, in part because cable hybrid fiber-coax networks, which do not easily support service-level agreements, never appealed to most business customers and thus did not offer strong competition.

Fiber serves business needs better than either copper or coax does, so for the last few years, as cable companies pushed fiber deeper into their networks, they led the way in delivering fiber to businesses.

Because these fiber-based business services are tremendously profitable, Alrutz expects to see cable companies forge ahead with them in 2017, bolstering their business networks and expanding their business services. With the cable companies posing more of a competitive threat, Alrutz says, "the telephone companies will certainly answer" by increasing their fiber buildouts to businesses. "Whoever gets the fiber connectivity in there will offer the best and most robust speeds," he says. "We see that on both sides." ❖

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

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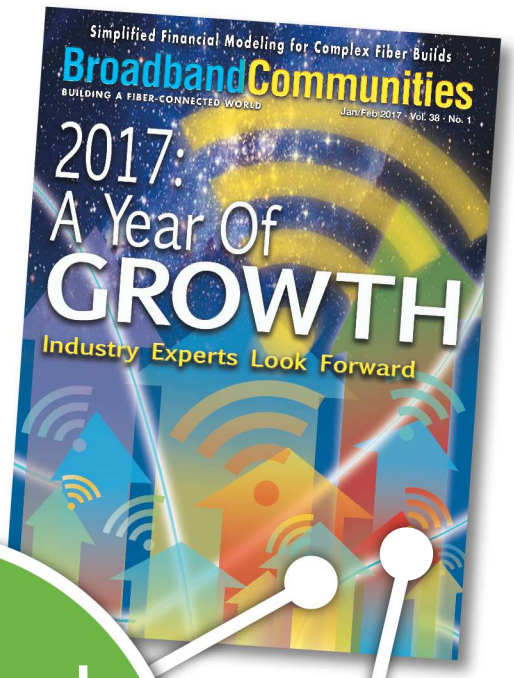

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Cost Reduction Financing For FTTH Networks

Communities can finance fiber-to-the-home networks by applying the cost reductions that the networks make possible.

By Rollie Cole / *Sagamore Institute for Policy Research*

Most readers of this magazine know about tax increment financing, in which a taxing entity, such as a city, county, state or special district, makes a loan or issues bonds to pay for all or part of a project. The taxing entity promises to repay the debt with a fraction of the increased tax revenues expected from the results of the project. The tax revenues usually come from property taxes, which rise because the properties around or served by the project go up in value. As data shows a positive impact of FTTH networks on real estate values, several communities in the last few years have used tax increment financing for FTTH networks.

Tax increment financing may also involve sales taxes and other transaction-based sources when a project is forecast to increase the volume and value of transactions. Work by Strategic Networks Group suggests that an increase in transactions may flow from an FTTH network.

As such transactions are not limited to private buyers and sellers, the revenue pledged to finance a network will not necessarily come from a sales tax. Increased transactions may also include fee-based government services that a network makes faster, better and cheaper. Examples might include building permits, fishing and hunting licenses and admissions to government recreation or parking facilities.

Cost reduction financing is similar in concept: A government entity that uses an FTTH network to reduce costs promises to repay debt from a fraction of those savings. The most obvious savings, often cited as arguments for building FTTH networks, are direct reductions in spending for voice, video and data services.

ACCOUNTING FOR COST REDUCTIONS

In addition to reducing telecom spending, an FTTH network can make many other governmental activities faster, better and cheaper. Citizens often pay to achieve faster service; think of all the rush fees for expediting government processes. "Better" is often a harder sell, in part because the economic value of better service often shows up later or in another context. Better schools, for instance, might result years or decades later in lower unemployment, less

crime and better health. However, being able to get to a fire or crime scene faster (because there are more sensors throughout an area) and with more information may yield immediate economic benefit or loss avoidance.

"Cheaper" is the easiest sell. An FTTH network may allow government agencies to move service delivery from "in line" to "online," saving time, money and trouble for the agencies and their clients. For example, when Illinois migrated from a paper-based system of establishing welfare availability to a digital system, the cost of creating, distributing, receiving and analyzing the required forms dropped by a significant amount. A fraction of that cost reduction could have been made available to repay network construction debt and other costs of converting to a digital system, such as computers and software.

Telemedicine offers opportunities for all three: Service delivery is faster because medical records and images can be transmitted electronically, better because the time of rare specialists can be leveraged across more patients, and cheaper because patients and health workers can spend less time moving to each other.

> With a fiber network, government can deliver services faster, better or cheaper – and sometimes all three.

New and better systems aren't always cheaper. Governments often use networks to improve quality or quantity of services rather than cut costs to deliver existing services. In that case, they fail to see any cost reductions and free up no cash for loan repayment.

Still, cost reduction financing can be helpful even if a borrower never adopts a formal scheme. Trying to account for costs focuses a potential borrower on what it and the citizens it serves will do with the network and how they will benefit. Those benefits become reasons for the entity and its citizens to finance the network, whether based on calculated cost reductions or not. ❖

Rollie Cole is a senior fellow at the Sagamore Institute for Policy Research. You can reach him at rolliecole@gmail.com.

Financial Modeling For Big Fiber Builds

Broadband Communities' latest modeling tool enables easy calculation of costs and benefits for network builds that use multiple technologies or will be completed in multiple phases.

By Steven S. Ross / *Broadband Communities*

Broadband Communities' one-page models for calculating investment returns on ultrabroadband builds have become the industry standard. They're free, they've been checked by hundreds of users since they were first introduced in 2011 and they are easy to modify.

The biggest shortcoming of the earlier modeling tools is that they require building a new model for each section of a network build. The latest tool solves that problem by combining multiple network sections – each on its own tab, or worksheet – into one seamless package. Each section can have its own start and finish time, financing and revenue profile. Each part of the build can use a different technology – FTTH, wireless, cable or others. Mixing multiple technologies and multiple construction phases in the same model is now easy.

Adding tabs is simple, and most spreadsheet software imposes no practical limitations on the number of tabs in a workbook. The top sheet automatically summarizes all the other sheets, but all sheets are visible by default to all users. The model is open to public inspection and tinkering by anyone who has rudimentary knowledge of spreadsheet programming.

For those who would like a hands-on demonstration (and didn't see my Minneapolis presentation), I will present the new modeling tool in a workshop at the 2017 **Broadband Communities** Summit and in a webinar. I also provide limited free help to get users started. **Broadband Communities**' goal is to help communities and small operators find out, without a large investment, whether an ultrabroadband network is within their reach. If the model shows that a network looks financially feasible, a potential network builder can more easily justify the next step: hiring a consultant to hone a design with community input and help find the financing.

Using these models (with or without help from a consultant to start) can cut the cost of exploring the financial issues to well under

$10,000, rather than the $70,000 or more normally necessary.

OVERVIEW

The model is available at www.FTTHanalyzer.com. It comes with three tabs for different network sections and a summary top sheet. Unlike the original spreadsheet, upon which the new tool is based, the model now covers five years rather than four.

Adding new tabs, each representing a unique section of the network build, is possible at any time as long as the new tabs are placed *between* existing tabs that represent sections of the build. Any network section except the first or last in the stack can be omitted by deleting its tab or by setting to zero the number of premises passed and the money raised to fund the passings. Any worksheet except the summary sheet can be modified without breaking the model – an important factor for ease of use – though modifications require some care. Read on for details about all these processes.

GENERAL ADVICE

Users new to the practice of business modeling often attempt to add too much detail in the early stages. Trying to pin down in advance the exact prices for, say, Wi-Fi routers in customer homes is almost never worth the effort. Other costs are far, far higher, and an extra $10 or $20 per unit should not be the make-or-break point in any decision. Polling residents to see how many would use the proposed network and to find out what services they want and will pay for is far more important.

Once a network is operating, such items as that Wi-Fi router become more important. As operating experience increases, financial models become progressively more detailed. **Broadband Communities** offers two monthly cash flow tools for that purpose.

However, when considering a new broadband network, carefully testing key leverage points is most important. These leverage points include technology (fiber, coax, wireless), expected number of customers, expected average revenue per customer, cost of using existing utility poles, cost of linking to national and state broadband trunk (middle mile) networks and so forth.

In a modeling exercise, make sure the uncertainties don't all point in the same direction! Network proponents can easily lowball cost estimates and be overoptimistic about revenues, of course, but those issues are fairly evident. Timing of cash flows is not as easy to understand. A proposed network might indeed meet or exceed its revenue projections but probably not until a few years after operations start.

Modeling is especially important for fiber-to-the-home networks because FTTH is different from copper. FTTH networks usually require higher up-front capital expenses than other types of networks, but because they are generally much easier to maintain, they have lower operating expenses. They use less electric power and are less affected by temperature extremes and flooding. They can often be repaired remotely, without a truck roll. Capital expenses for upgrades are also lower because FTTH networks are almost future-proof. Once fiber is in the ground, it can accommodate vastly higher bandwidth through changes only to the electronics. Finally, fiber networks have *much* higher revenue potential than copper networks.

The economics of broadband networks can vary widely depending on competition, construction and marketing costs, customer uses and the needs of local businesses. Don't rely on rules of thumb. This magazine has reported on network builds with times to cash-flow breakeven that vary from less than one year to seven years.

IS FIBER A POSSIBILITY?

Using this model when first considering a network or network expansion can help a community avoid hiring a consultant to develop detailed financial projections when the numbers can't possibly work. In addition, community residents have more confidence in a model if they fully understand what goes into it.

To estimate costs quickly, visit **Broadband Communities**' Fiberville.com database of more than 1,000 FTTH deployers (including almost 200 communities). Find a deployer nearby or in a similar circumstance, and call for the basic numbers. Other

BROADBAND COMMUNITIES' FINANCIAL MODELING TOOLS

The financial models available to view and download at www.FTTHanalyzer.com include investment calculators for

- Cable companies, telephone companies or municipalities
- Rural providers
- Providers in multifamily housing
- Multiple neighborhoods (introduced in this article)

and the following revenue calculators:

- Customer monthly revenue calculator
- 18-month operational cash flow calculator.

Broadband Communities placed these models into the public domain for anyone to use and modify free of charge. If the models are incorporated into a commercial package, **Broadband Communities** should be credited.

Broadband Communities can provide limited free guidance by telephone to help users get started. More hands-on help and presentations to community or company audiences are available for a small fee.

Call 877-588-1649, or contact us at nancym@bbcmag.com.

TOOL 6: Multi-Neighborhood Financial Analyzer	BroadbandCommunities				Summation
Example: XYZ Project: 20% Equity/80% Debt	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Total homes and businesses passed	4,500	7,500	10,000	11,500	11,500
Total subscribers at year end	1,750	3,550	5,100	5,850	7,100
Average subscribers for year	875	2,650	4,325	4,700	6,475
Total system construction cost	12,250,000	19,250,000	25,250,000	31,250,000	31,250,000
Equity	7,550,000	7,550,000	7,550,000	7,550,000	7,550,000
Debt, principal not including financing fees (see row 33)	30,200,000	30,200,000	30,200,000	30,200,000	30,200,000
Cumulative cost to purchase and install customer premises equipment, using year-end customer total	875,000	1,775,000	2,550,000	2,850,000	3,350,000
Cumulative cost to purchase and install central office equipment, outside plant and fiber cable, excluding CPE	11,375,000	17,475,000	22,700,000	28,400,000	28,400,000
Direct costs per subscriber (color indicates value is picked up by other sheets)	500	500	500	400	400
Cash on hand at year-end, exclusive of investment return	23,215,500	18,897,500	13,152,000	7,215,500	6,979,500
Investment return on cash on hand (color indicates value is picked up by other sheets)	0%	1%	1%	1%	1%
Total cash on hand at year-end	23,215,500	19,086,475	13,283,520	7,287,655	7,049,295
,					
Analysis					
Construction Costs:					
Average cost to pass one home or business	2,722	2,567	2,525	2,717	2,717
Average cost to connect one home or business	500	500	500	400	400
Systemwide Take Rate, Year End, at least one service taken	38.89%	47.33%	51.00%	50.87%	61.74%
Systemwide Take Rate, Midyear Average	19.44%	35.33%	43.25%	40.87%	56.30%
Debt or Capital Cost - 100% Financing					
Term of loan, in years (color indicates value is picked up by other sheets)	15	15	15	15	15
Interest rate (capital cost) (color indicates value is picked up by other sheets)	5.00%	5.00%	5.00%	5.00%	5.00%
Capital Cost Calculations					
Capital cost per subscriber, usung year-end totals	7,500	5,923	5,451	5,742	4,801
Capital cost to be financed (80%)	6,000	4,738	4,361	4,594	3,841
Cost to issue debt (legal fees, commissions, etc.) (color indicates value picked up by other sheets)	8.00%				
Debt per subscriber	6,480	4,738	4,361	4,594	3,841
Debt service per subscriber per year	624.30	456.47	420.13	442.55	370.06
Debt service per subscriber per month	52.02	38.04	35.01	36.88	30.84
Cash Flow Statement					

Cost per month services (revenues for various services are listed at negative)	Cost	% subscribers using	Gross cost/ subscriber	TOTAL	Cost inflation factor
Video	70.00	50%	35.00		
Voice plus data	15.00	100%	15.00		
Security (self monitoring)	3.00	5%	0.15		
Gaming	5.00	15%	0.75		
Wireless backhaul	(1.00)	100%	-1.00		
Smart grid benefits, rents	-	100%	0.00		
Other subscriber services	-	100%	0.00		
Other monthly income, including pro-rata subsidization from business services, fixed IP, etc	-	100%	0.00	49.90	10%

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Average gross monthly revenue per subscriber	150.29	150.00	150.75	152.23	151.27
Total gross monthly revenue, all subscribers	131,500	397,500	652,000	715,500	979,500
Expenses per Subscriber:					
Cost of content or service	49.90	54.89	60.38	66.42	73.06
Payroll (color indicates value picked up by other sheets)	19.81	21.86	21.86	19.40	19.40
Management (color indicates value picked up by other sheets)	6.86	3.00	3.00	2.70	2.70
Debt service	52.02	38.04	35.01	36.88	30.84
Total monthly expenses	128.59	117.79	120.25	125.40	126.00
Monthly cash flow per subscriber	21.69	32.21	30.50	26.84	25.28
Annual cash flow per subscriber	260.29	386.53	366.02	322.06	303.32
Annual cash flow for system	455,508	1,024,298	1,583,043	1,513,668	1,964,020
Annual EBITDA	1,965,508	2,534,298	3,093,043	3,023,668	3,474,020
Investment Considerations:					
Annual EBITDA as percent of debt	6.51%	8.39%	10.24%	10.01%	11.50%
Annual EBITDA as percent of equity	26.03%	33.57%	40.97%	40.05%	46.01%
Annual EBITDA as percent of capital cost	16.04%	13.17%	12.25%	9.68%	11.12%
Debt service coverage ratio	1.80	1.56	1.44	1.17	1.32

Figure 1. The summary Analyzer sheet at the top of the deck aggregates the information entered on the district sheets. Cells in orange are entered on the summary sheet, and the data – for example, interest rates – carries through to all the district sheets as a convenience but can be overwritten on any district sheet with data specific to that part of the build.

TOOL 6: Multi-Neighborhood Financial Analyzer	BroadbandCommunities				Summation
Example: XYZ Project: 20% Equity/80% Debt	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Total homes and businesses passed	4,500	7,500	10,000	11,500	11,500
Total subscribers at year end	1,750	3,550	5,100	5,850	7,100
Average subscribers for year	875	2,650	4,325	4,700	6,475
Total system construction cost	12,250,000	19,250,000	25,250,000	31,250,000	31,250,000
Equity	7,550,000	7,550,000	7,550,000	7,550,000	7,550,000
Debt, principal not including financing fees (see row 33)	30,200,000	30,200,000	30,200,000	30,200,000	30,200,000
Cumulative cost to purchase and install customer premises equipment, using year-end customer total	875,000	1,775,000	2,550,000	2,850,000	3,350,000
Cumulative cost to purchase and install central office equipment, outside plant and fiber cable, excluding CPE	11,375,000	17,475,000	22,700,000	28,400,000	28,400,000
Direct costs per subscriber (color indicates value is picked up by other sheets)	500	500	500	400	400
Cash on hand at year-end, exclusive of investment return	23,215,500	18,897,500	13,152,000	7,215,500	6,979,500
Investment return on cash on hand (color indicates value is picked up by other sheets)	0%	1%	1%	1%	1%
Total cash on hand at year-end	23,215,500	19,086,475	13,283,520	7,287,655	7,049,295

Figure 2: On the summary sheet, this part of the model lays out the size of the proposed network and the anticipated number of subscribers added each year. Cash flow projections require estimates of the *average* number of subscribers in a given period. After year four, for instance, the numbers entered here project a 50 percent take rate, about the average for small, rural providers.

good sources of information include equipment vendors, local telecom engineering and construction firms that supply labor for network builds and some state telecom offices.

For ease of use, the new file as supplied has all formulas unlocked. Thus, you or anyone else can accidentally overwrite them. Use the Format command on the Home menu (in the Excel ribbon menu) to lock specific cells or ranges of cells or to lock entire sheets and unlock only the cells you want to fiddle with.

The formulas are unlocked because users had trouble with earlier tools, which were supplied with formulas locked, and because a multisheet model tends to require more exceptions. It is wise for users to choose a specific color to highlight cells whose formulas have been changed. This promotes transparency and makes for easier auditing. An example of this approach is noted in Figure 4.

MULTIPLE PHASES AND DISTRICTS

The multi-neighborhood worksheet is designed for feasibility modeling of networks that must be built or financed in phases or that will cover districts with different financial dynamics. It is similar to the original model, which is the most frequently used tool, but in addition to spanning five years rather than four, it includes better modeling of service expenses. The published version has three district (or phase) worksheets but, as noted, can be easily expanded to 50 or more. In tests over the past year, I found that most users created models that had between four and 10 worksheets. They often used several worksheets for the same neighborhood if that neighborhood was being built out in phases.

Test users showed their models to citizens, as well as bankers and other sources of capital, to demonstrate the feasibility of the projects they were planning. These projects included builds by incumbent and competitive telephone companies, municipalities and public-private partnerships.

TOOL 6: Multi-Neighborhood Financial Analyzer	BroadbandCommunities				District 1
Example: XYZ Project: 20% Equity/80% Debt	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Total homes and businesses passed	3,000	5,000	7,000	8,000	8,000
Total subscribers at year end	1,200	2,250	3,500	4,000	4,500
Average subscribers for year	600	1,725	2,875	3,125	4,250
Total construction cost, apportioned this section	7,000,000	12,000,000	16,000,000	20,000,000	20,000,000
Equity	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Debt, principal not including financing fees (see row 33)	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
Cumulative cost to purchase and install customer premises equipment, using year-end customer total	600,000	1,125,000	1,750,000	1,950,000	2,150,000
Cumulative cost to purchase and install central office equipment, outside plant and fiber cable, excluding CPE	6,400,000	10,875,000	14,250,000	18,050,000	18,050,000
Direct costs per subscriber	500	500	500	400	400
Cash on hand at year-end, exclusive of investment return, this section	16,496,000	13,276,000	9,460,000	5,500,000	5,480,000
Investment return on cash on hand	0%	1%	1%	1%	1%
Total cash on hand at year-end	16,496,000	13,408,760	9,554,600	5,555,000	5,534,800

Figure 3: The individual sheets for each section of the build require more data to be filled in, as indicated by the green cells. General information that was automatically filled in from the summary sheet (orange cells) can be overwritten on the district worksheets. A cell in the upper-right-hand corner allows identification of an individual district with more detail than its tab name.

Analysis					
Construction Costs:					
Average cost to pass one home or business	2,722	2,567	2,525	2,717	2,717
Average cost to connect one home or business	500	500	500	400	400
Systemwide Take Rate, Year End, at least one service taken	38.89%	47.33%	51.00%	50.87%	61.74%
Systemwide Take Rate, Midyear Average	19.44%	35.33%	43.25%	40.87%	56.30%
Debt or Capital Cost - 100% Financing					
Term of loan, in years (color indicates value is picked up by other sheets)	15	15	15	5	5
Interest rate (capital cost) (color indicates value is picked up by other sheets)	5.00%	5.00%	5.00%	4.00%	4.00%
Capital Cost Calculations					
Capital cost per subscriber, usung year-end totals	7,500	5,923	5,451	5,742	4,801
Capital cost to be financed (80%)	6,000	4,738	4,361	4,594	3,841
Cost to issue debt (legal fees, commissions, etc.) (color indicates value picked up by other sheets)	8.00%				
Debt per subscriber	6,480	4,738	4,361	4,594	3,841
Debt service per subscriber per year	624.30	456.47	420.13	442.55	370.06
Debt service per subscriber per month	52.02	38.04	35.01	36.88	30.84

Figure 4: The model handles almost all of the analysis. Users need to enter only the loan or lease terms – interest rate or imputed interest, term of the lease or loan and the cost of getting the funds into the door. If all the money is raised at once, use the orange cells on the summary worksheet to enter the terms on all sheets at once. If any districts use different financial terms, overwrite the terms on those districts. Testers told us they warned users that some terms were changed by using a dull red shade for those cells on the worksheet in which they were changed and on the summary sheet.

SECTIONS OF THE MODEL

As with earlier feasibility tools, each worksheet has four sections (Figure 1):

- Basics
- Analysis
- Cash Flow
- Investment considerations, ending with coverage ratios for amortization expenses.

A user provides new values on the summary sheet for the green and orange boxes; the software calculates the rest from data entered on district or neighborhood sheets below the summary sheet. Values entered in the orange boxes are copied automatically onto all sheets but can be overwritten on any neighborhood sheet without breaking the model.

The model is supplied with four worksheets. The tab labeled Analyzer summarizes all the information on other sheets. It aggregates all data on all sheets, starting with one named Dist1 (for "District 1") and ending on Dist2. To insert a new worksheet, add a new tab anyplace between Dist1 and Dist2, and copy any existing sheet (in this case, Dist1, Dist2, or Wireless) to the new tab. It is possible to delete or rename any sheets except for Dist1 and Dist2 and the top summary sheet. To avoid using the names Dist1 and Dist2, just leave the Dist1 and Dist2 worksheets empty. After setting the initial values for build size and money needed to zero, hiding the Dist1 and Dist2 tabs is an option in many spreadsheet programs.

Here is the easiest way to copy a worksheet:

- Set cursor outside model area in the worksheet
- Ctrl-A, Ctrl-C
- Right click on a tab to right of Dist1, insert new worksheet
- Go to blank sheet, set cursor on cell A1, hit Ctrl-V to copy model sheet.

In some spreadsheet software, column widths and sometimes row heights will have to be adjusted manually on the new tab.

Analysis		
Construction Costs:		
Cost to pass one home or business	1,683	Total system construction cost/total homes passed
Cost to connect one home or business	823	Picked up from "direct cost per subscriber"
Systemwide Take Rate, Year End, at least one service taken	25.00%	Subscribers at year-end/homes passed
Systemwide Take Rate, Midyear Average	12.50%	Average subs for year/homes passed
Debt or Capital Cost - 100% Financing		
Term of loan, in years	15	
Interest rate (capital cost)	12.00%	
Capital Cost Calculations		
Capital cost per subscriber, usung year-end totals	7,555	Cost to pass a premises, divided by year-end take rate, plus cost to connect a customer
Capital cost to be financed (80%)	6,044	80% of the line above, if 80% is being financed
Cost of issuing debt	8.00%	
Debt per subscriber	6,528	The capital cost being financed,, per subscriber, plus the 8% capital acquisition cost
Debt service per subscriber per year	$958.40	What it all costs, using PMT function
Debt service per subscriber per month	$79.87	Previous line divided by 12

Figure 5: The calculation logic behind the analysis section

Cash Flow Statement					
Cost per month services (revenues for various services are listed at negative)	Cost	% subscribers using	Gross cost/ subscriber	TOTAL	Cost inflation factor
Video	70.00	50%	35.00		
Voice plus data	15.00	100%	15.00		
Security (self monitoring)	3.00	5%	0.15		
Gaming	5.00	15%	0.75		
Wireless backhaul	(1.00)	100%	-1.00		
Smart grid benefits, rents	-	100%	0.00		
Other subscriber services	-	100%	0.00		
Other monthly income, including pro-rata subsidization from business services, fixed IP, etc	-	100%	0.00	49.90	10%
	Year 1	Year 2	Year 3	Year 4	Year 5
Average gross monthly revenue per subscriber	150.29	150.00	150.75	152.23	151.27
Total gross monthly revenue, all subscribers	131,500	397,500	652,000	715,500	979,500
Expenses per Subscriber:					
Cost of content or service	49.90	54.89	60.38	66.42	73.06
Payroll (color indicates value picked up by other sheets)	19.81	21.86	21.86	19.40	19.40
Management (color indicates value picked up by other sheets)	6.86	3.00	3.00	2.70	2.70
Debt service	52.02	38.04	35.01	36.88	30.84
Total monthly expenses	128.59	117.79	120.25	125.40	126.00
Monthly cash flow per subscriber	21.69	32.21	30.50	26.84	25.28
Annual cash flow per subscriber	260.29	386.53	366.02	322.06	303.32
Annual cash flow for system	455,508	1,024,298	1,583,043	1,513,668	1,964,020
Annual EBITDA	1,965,508	2,534,298	3,093,043	3,023,668	3,474,020

Figure 6: Use this section as a checklist of all possible revenue sources for the network; this list is hardly exhaustive. **Warning**: Revenue potential is high, but revenues grow slowly.

Warning: Always keep available a sheet with no orange boxes overwritten for copying into a new tab if needed. Copying from the original software on FTTHanalyzer.com will not work reliably if rows have been added or subtracted.

On the Analyzer sheet (the top-sheet summary), most of the data is pulled from the worksheets that represent separate neighborhood builds. Those worksheets automatically pick up per-customer costs for customer-premises equipment and interest earned on deposits (entered here on the summary sheet in the orange rows).

CONNECTION COSTS

In Figure 2, the model assumes that a network builder incurs a cost to connect a home after passing it only when the resident signs up for service.

This is not always the case! In a rural area, for instance, building all the drops at once and including them in the cost to pass a premises may be a cheaper alternative. In a multiple-dwelling-unit building, installing all premises equipment at once, typically wireless gateways, may be financially wise. The rural and MDU models are helpful in deciding between the "delay" or "all at once" alternatives.

CAPITAL COSTS

The model accounts for the cost of capital (including interest and fees paid to brokers, lawyers and so forth) and the timing of capital inflows. In the XYZ project shown in the figures, the network deployer provides 20 percent of the network cost and raises 80 percent, all in one tranche. Entering different capital flows in different years is also possible.

Using one capital input is more typical for municipal builds but not at all typical for private builds. During the recent recession, raising all the capital ahead of time and carrying the debt at 10 or 12 percent interest while getting 0 to 1 percent for the same cash on deposit was a loser's strategy. Even municipalities, which may be forced to raise all their capital at once if they use revenue bond or municipal lease mechanisms, might consider using commercial loans despite their higher (but, as of now, still reasonable) rates because they offer more flexibility on receipt of funds. As this is written, network operators are financing builds at 5 or 6 percent, and they can park money in Treasury bills or other instruments at more than 2 percent. However, as interest rates rise, Treasury

Monthly cash flow per subscriber	21.69	32.21	30.50	26.84	25.28	Revenue minus expenses
Annual cash flow per subscriber	260.29	386.53	366.02	322.06	303.32	Row above * 12
Annual cash flow for system	455,508	1,024,298	1,583,043	1,513,668	1,964,020	Based on avg subs in a year
Annual EBITDA	1,965,508	2,534,298	3,093,043	3,023,668	3,474,020	Calculated on each sheet

Figure 7: Cash flow analysis. EBITDA – earnings before interest, taxes, depreciation and amortization – is a comforting number for bankers but not for system operators. Here, it is calculated by backing out the interest cost. Obviously, happiness is positive cash flow. Figure 8 shows why (aside from banker comfort) EBITDA is included in the first place.

Investment Considerations:	Year 1	Year 2	Year 3	Year 4
Annual EBITDA as percent of debt	**8.02%**	**14.03%**	**16.29%**	**18.79%**
Annual EBITDA as percent of equity	32.08%	56.10%	65.14%	75.17%
Annual EBITDA as percent of capital cost	9.53%	12.70%	13.35%	15.41%
Debt service coverage ratio	**0.67**	**0.89**	**0.93**	**1.04**

Investment Considerations:		
Annual EBITDA as percent of debt	**8.02%**	EBITDA divided by debt (the $20 million in our example)
Annual EBITDA as percent of equity	32.08%	EBITDA divided by the equity ($5 million in our example)
Annual EBITDA as percent of capital cost	9.53%	EBITDA divided by the cost of building the system
Debt service coverage ratio	**0.67**	EBITDA divided by debt service per subscriber, times number of subscribers.

Figure 8: Investment considerations and the logic behind them

TOOL 6: Multi-Neighborhood Financial Analyzer — BroadbandCommunities — Wireless

Example: XYZ Project: 20% Equity/80% Debt	Year 1	Year 2	Year 3	Year 4	Year 5
Total homes and businesses passed	1,000	1,000	1,000	1,000	1,000
Total subscribers at year end	300	500	600	600	600
Average subscribers for year	150	400	550	600	600
Total system construction cost	250,000	250,000	250,000	250,000	250,000
Equity	50,000	50,000	50,000	50,000	50,000
Debt, principal not including financing fees (see row 33)	200,000	200,000	200,000	200,000	200,000
Cumulative cost to purchase and install customer premises equipment, using year-end customer total	120,000	200,000	240,000	240,000	240,000
Cumulative cost to purchase and install central office equipment, outside plant and fiber cable, excluding CPE	130,000	50,000	10,000	10,000	10,000
Direct costs per subscriber (NOTE: Not linked to front sheet!)	400	400	400	300	300
Cash on hand at year-end, exclusive of investment return	2,000	48,000	66,000	72,000	72,000
Investment return on cash on hand	0%	1%	1%	1%	1%
Total cash on hand at year-end	2,000	48,480	66,660	72,720	72,720
,					
Analysis					
Construction Costs:					
Cost to pass one home or business	250	250	250	250	250
Cost to connect one home or business	400	400	400	300	300
Systemwide Take Rate, Year End, at least one service taken	30.00%	50.00%	60.00%	60.00%	60.00%
Systemwide Take Rate, Midyear Average	15.00%	40.00%	55.00%	60.00%	60.00%
Debt or Capital Cost - 100% Financing					
Term of loan, in years	15	15	15	15	15
Interest rate (capital cost)	5.00%	5.00%	5.00%	5.00%	5.00%
Capital Cost Calculations					
Capital cost per subscriber, using year-end totals	1,233	900	817	717	717
Capital cost to be financed (80%)	987	720	653	573	573
Cost of issuing debt	8.00%				
Debt per subscriber	1,066	720	653	573	573
Debt service per subscriber per year	102.66	69.37	62.94	55.24	55.24
Debt service per subscriber per month	8.56	5.78	5.25	4.60	4.60

Figure 9: Looking at point-to-point wireless as temporary solution for an area in which deploying fiber is tough

Investment Considerations: Dist1					
Annual EBITDA as percent of debt	7.84%	9.83%	13.71%	14.38%	18.41%
Annual EBITDA as percent of equity	31.38%	39.32%	54.82%	57.51%	73.64%
Annual EBITDA as percent of capital cost	22.41%	16.38%	17.13%	14.38%	18.41%
Debt service coverage ratio	2.48	1.94	2.00	1.73	2.19

Investment Considerations: Dist2					
Annual EBITDA as percent of debt	2.74%	5.30%	4.78%	4.64%	7.35%
Annual EBITDA as percent of equity	10.97%	21.18%	19.13%	18.55%	29.42%
Annual EBITDA as percent of capital cost	5.48%	7.56%	5.31%	4.22%	6.69%
Debt service coverage ratio	0.64	0.93	0.65	0.52	0.81

Investment Considerations: Wireless					
Annual EBITDA as percent of debt	67.77%	87.73%	102.40%	101.77%	77.86%
Annual EBITDA as percent of equity	271.10%	350.91%	409.61%	407.07%	311.43%
Annual EBITDA as percent of capital cost	54.22%	70.18%	81.92%	81.41%	62.29%
Debt service coverage ratio	4.40	5.06	5.42	6.14	4.70

Investment Considerations:					
Annual EBITDA as percent of debt	6.51%	8.39%	10.24%	10.01%	11.50%
Annual EBITDA as percent of equity	26.03%	33.57%	40.97%	40.05%	46.01%
Annual EBITDA as percent of capital cost	16.04%	13.17%	12.25%	9.68%	11.12%
Debt service coverage ratio	1.80	1.56	1.44	1.17	1.32

Figure 10: Investment considerations for each of the three districts in the example, separately and rolled up on the summary sheet (bottom table in the figure)

bill values fall. That strategy is not a game for amateurs.

The model allows the up-front cost of equity (the example is 8 percent in legal and brokerage fees) to be entered farther down in the worksheet. This cost could be counted separately (as in this example) or charged against money raised or against initial equity simply by adjusting the amounts in the inputs and making the explicit cost of capital 0 percent. Changing worksheet formulas is not necessary.

For municipal builds, paying the lender interest only (or interest plus a small amortization) until the system gets to cash-flow positive, typically around year four, is common. In this example, payback starts in year one (using the Excel PMT function for a level term mortgage). Lease deals are also popular in some states.

It is possible to override this assumption for the entire build at once on the summary or on individual district sheets. This capability is especially useful when money is raised over many years to build separate sections of a network.

REVENUE

Use the section shown in Figure 6 as a checklist of all possible revenue sources for your network; the example shown here is just a suggestion. Though revenue sources may vary by district, be sure to include all possible sources in all sheets even if many will be zeroed out. Otherwise, the summary sheet will not aggregate the details correctly. However, because the summary sheet sums the final revenue totals on each district sheet, sloppiness will not lead to bad overall projections.

Use the customer monthly revenue calculator as a scratch sheet for the revenue rows in this model. The model assumes content costs will grow annually. Because content costs rise much faster than revenue, especially for video, the model includes an automatic inflation function for content. **Warning**: Revenue potential is high, but it grows slowly as customers sign on to the new system and to new specific services.

The financial dynamics for reusing copper (with G.fast, for instance) or for using wireless differ significantly from laying new fiber or other wired broadband. Revenue starts flowing faster and customer premises costs tend to be lower (in the case of wireless, because there is no physical drop), but the cash outlay, though smaller, is spent faster. Nevertheless, as Figure 10 shows, using wireless to serve a difficult-to-deploy area can turn a disadvantage into a small advantage for the overall build.

A FINAL WORD

Communities and small network builders can typically use these tools without significant input from **Broadband Communities**. However, the magazine needs input from all users. More than 60 users have formally contacted me over the years for quick explanations or to show me what they have been doing. Dozens more have stopped me at conferences to get a quick explanation or clear up a minor misunderstanding. I welcome that input. Rest assured that **Broadband Communities** will keep all users' work and ideas confidential unless users explicitly allow us to share them. ❖

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

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19 – 23
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Los Angeles, CA
855-326-8341
www.ofcconference.org

APRIL

10 – 12
IP Vision Conference & Expo
Marriot St. Louis Grand
St. Louis, MO
703-351-2000
www.ipvisionshow.com

26 – 28
CABA Intelligent Buildings & Digital Home Forum
Intel Corporation Campus
Santa Clara, CA
613-686-1814
www.caba.org/forum

MAY

1 – 4
Broadband Communities Summit
Sheraton Downtown
Dallas, TX
877-588-1649
www.bbcmag.com

6 – 9
American Planning Association
Jacob K. Javits Convention Center
New York, NY
312-431-9100
www.planning.org/conference

31 – June 2
SHLB Coalition Conference
Hyatt Regency Hotel
Crystal City, VA
202-263-4626
www.shlb.org/events/conference

JUNE

12 – 14
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New Year, More Fiber

Exciting new technologies are coming your way, and they all require lots more fiber.

By Heather Burnett Gold / *Fiber to the Home Council Americas*

My family has many holiday traditions that happen like clockwork every November and December. The technology world has its own post-holiday tradition: the annual CES in Las Vegas. It's the largest trade show in the world, and the products and services we'll see in our homes and at work tomorrow are on full display there, today.

Early in the show, I was pleased to participate with a group of FTTH Council members in a panel discussion about connectivity and how fiber empowers this future of innovation. As I walked around the show floor, I saw the emerging tech trends that will dominate 2017. Fiber will be essential to their performance and widespread consumer adoption.

The cloud and the internet of things (IoT). Devices that connect to the internet are becoming smaller and require less power. Many expect 2017 to bring the first batch of low-power, wide-area networks. These advances are expected to extend the reach of the IoT, connecting previously hard-to-reach devices and allowing a much larger assortment of objects to be embedded with chips. This could mean more devices in buildings, more smart sensors throughout cities and even more devices in rural areas for applications such as precision agriculture.

Though no single device will produce a large amount of data, the devices are expected to be deployed at a massive scale. Gartner estimates the average family home will have more than 500 smart devices by 2022, and Ericsson believes 50 billion devices will be connected to the internet by 2020 – 10 devices for every person online. Fiber must be placed deep within and throughout networks to ensure these devices work the way they are intended and stay reliably connected.

IoT will impact manufacturing and supply chains, increasing efficiency by controlling machines remotely, especially in hazardous or dangerous conditions. Where reliability is essential and conditions are too harsh for wireless buildings, in-building fiber is the best way to transmit data among machines.

Optical fibers can be the sensors used in IoT applications, particularly in activities that require sensitivity and high performance, such as monitoring electrical grid activity or providing physical security in pipelines and oil wells.

Artificial intelligence (AI). A wide range of "personal assistants" and other Siri-like "chatbots" were on display at CES. In 2017, AI software will learn better on its own and will appear in even more places. Analysts predict that even complicated tasks will be handed off to powerful machines. These advances depend on compiling and accessing – and learning from – the massive amounts of information that connected devices produce.

Fiber networks will be crucial to handling the coming data deluge: IDC expects annual worldwide data generation to reach 44 zettabytes by 2020.

Virtual, mixed and augmented reality. Oculus Rift, Magic Leap and Pokemon Go have broken out of the world of tech insiders and into the mainstream. At this year's CES, virtual-reality headsets, software and services were on display from more than 70 companies – almost twice as many as last year. It was amazing to see technologies that mix the world's physical and digital aspects. The virtual reality industry is clearly in its infancy and poised to take off. Equally clear is the need for robust fiber networks with abundant bandwidth to deliver full 360-degree video experiences.

5G wireless. 5G is the ultrafast, cutting-edge, underlying technology of many (if not most) technologies discussed and on display at CES. Many big technology players made 5G a centerpiece of their keynotes, talks and displays. Though fiber is not usually people's first thought in connection with wireless, it should be. The performance goals touted for 5G networks – high capacity, low latency, extreme reliability – depend on lots of fiber being in lots of places.

The annual CES left me energized for the FTTH industry. 2017 promises technological delights and leaps that will benefit everyone at home, at play and at work, and fiber will light the path for all of them. We at the FTTH Council look forward to pushing the industry forward in the New Year! ❖

Heather Burnett Gold is president and CEO of the Fiber to the Home Council Americas, a nonprofit association whose mission is to accelerate deployment of all-fiber access networks. You can contact her at heather.b.gold@ftthcouncil.org.

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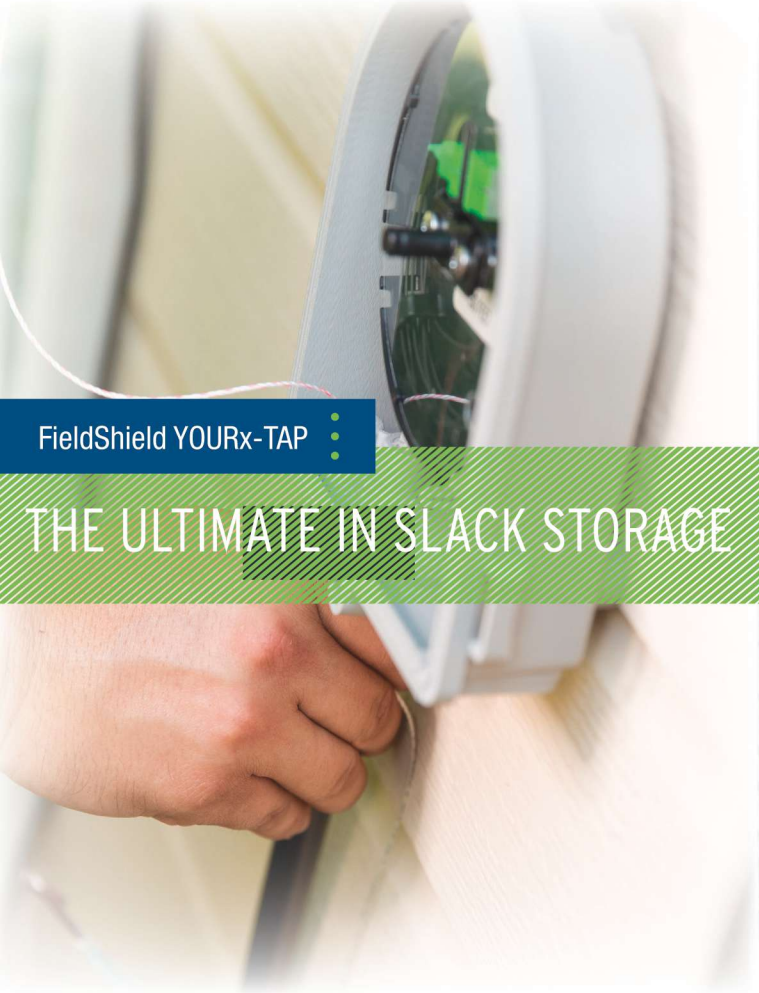

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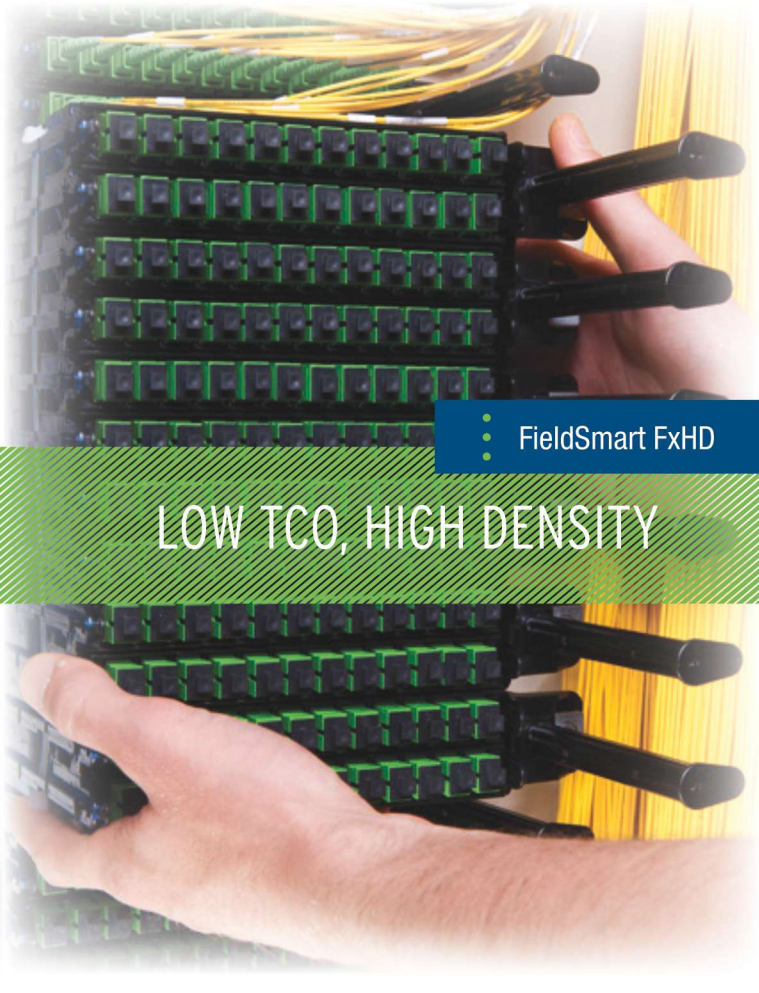

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